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Kesha A. Patel March 25, 2025

Refining the $M_{\rm BH} - \sigma_*$ Relation: Improving on R_e Measurements and σ_* Estimates for a Sample of Early-Type Galaxies using GALFIT and SAURON IFS Data

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An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of Bachelors of Science with Honors

Department of Physics

2025

Abstract

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In this project, we develop 2-D computational models, using the software GALFIT, to fit the luminosity profiles for a set of five galaxies from the quiescent galaxy sample of Batiste et al. (2017b) in order to improve measurements of the bulge effective radius, R_e. The galaxies investigated include NGC 3384, NGC 3945, NGC 3998, NGC 4382, and NGC 4472. We develop multi-component fits to model the light distributions of these galaxies, using Hubble Space Telescope imaging data from the ACS/WFC and WFC3/IR cameras. With these improved models, we are able to identify the dominant structural components within each galaxy, and examine how each structure emits light according to various surface brightness profiles. This allows us to isolate the bulge component for each galaxy and better constrain its effective radius, R_e, which is the location at which half the luminosity is contained for this structure. Comparing our measurement to previous work in determining R_e for this sample, we find that the previous values for the radii are significantly overestimated, by as much as $11\times$. Finally, we use publicly available stellar kinematic data from the SAURON Integral Field Unit to make an updated estimate of the stellar velocity dispersion, σ_* within R_e for each galaxy. These data are then used to make a preliminary assessment of the impact of these improvements on the $M_{\rm BH} - \sigma_*$ relation, which correlates the mass of a central supermassive black hole ($M_{\rm BH}$) and the stellar velocity dispersion in the bulge of the host galaxy.

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Acknowledgments

First, I want to begin by thanking Dr. Merida Batiste for supporting me ever since I first joined her research group two and a half years ago. Dr. Batiste was one of my first instructors here at Emory, and her enthusiasm for astronomy was what inspired me to switch to this major and develop my own interests. Working under her mentorship throughout the entirety of this project was an honor and a pleasure, and I'll miss our weekly meetings. Additionally, I want to thank the rest of my committee: Dr. Alissa Bans, Dr. Erin Bonning, and Dr. Jennifer Rieser. All three of you have helped develop my passion for different branches of astronomy and physics, and I have learned several valuable skills from each one of you. Finally, I want to thank my family and friends for the endless kindness and love I have received. You all have supported and encouraged me every step of the way. Thank you to everyone for helping me reach this point in my life.

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Chapter 1

Introduction

At the center of every large galaxy, a supermassive black hole (SMBH) can be found, distinguished by masses $\geq 10^5$ $M_\odot$. Galaxy nuclei can be classified as active or quiescent based on the activity of its SMBH. Some galaxies have an active galactic nucleus (AGN), referring to the environment in which the SMBH is gaining mass by actively accreting gas from a surrounding accretion disk. As gas and material falls into the SMBH from the accretion disk, the matter loses angular momentum and potential energy as it falls to lower orbits (Urry & Padovani (1995)). In turn, this results in the release of a large amount of radiation. In particular, there is a class of AGNs known as quasars, in which the nucleus is incredibly luminous, even compared to other AGNs (Urry & Padovani (1995)). We observe these quasars at very large distances and high redshifts towards the early universe, with the number density of quasars peaking at redshift $z \approx 2.5$ (Shaver et al. (1996)). However, we find that most galaxies in the local universe classify as quiescent galaxies, in which the SMBHs do not accrete gas, and only a small percentage of the galaxies in the local universe host an AGN (Mishra & Dai (2020)). As there are only a small number of AGN-host galaxies in the local universe and no quasars, it is thought that the quiescent galaxies, with inactive SMBHs, in the nearby universe are remnants of the large number of AGN-host

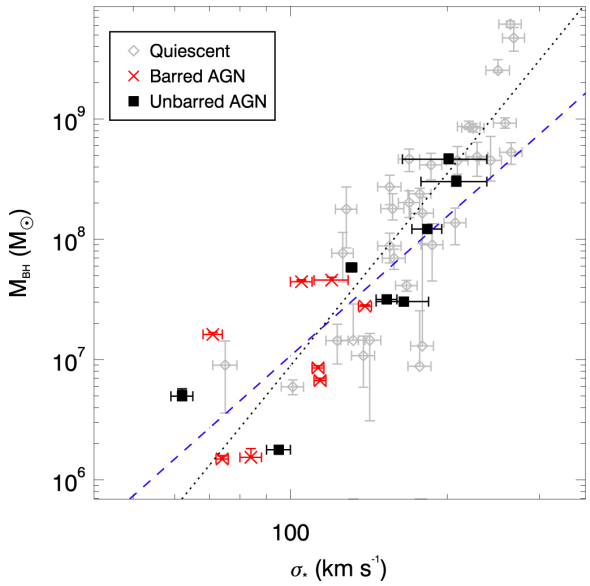

Figure 1.1: The $M_{\rm BH} - \sigma_*$ relation from Batiste et al. (2017b) for quiescent galaxies, represented by the dotted grey line, and AGN-host galaxies, represented by the dashed blue line. The difference in slopes between the two lines is not statistically significant.

galaxies from the early universe. This points to a connection or co-evolution between galaxies and their SMBHs (Kormendy & Ho (2013)) which is further supported by the many scaling relationships that exist between the SMBH and large-scale components in the host galaxy.

Much work has been done to investigate these relationships, such as the one between the mass of the SMBH and the mass of the bulge (Kormendy & Richstone (1995) and Magorrian et al. (1998)) or the relation between the mass of the SMBH and the luminosity of the bulge (Gültekin et al. (2009)). Among these relations that have been found, one of the tightest correlations is the one between σ_*, the stellar velocity dispersion of the bulge, and $M_{\rm BH}$, the mass of the central SMBH (Gebhardt et al. (2000) and Ferrarese & Merritt (2000)). This is known as the $M_{\rm BH} - \sigma_*$ relation, as shown in Figure 1.1. The stellar velocity dispersion is the amount of variability around the mean velocity of stars in a given radius; in this correlation, σ_* is measured within the radius of the bulge.

The underlying physics of these different relationships, including $M_{\rm BH} - \sigma_*$, is still

not well understood. It has been shown that a SMBH's mass, or gravitational force, only impacts a small radius of the galaxy, and not the entire galaxy (Valluri et al. (2004)). Specifically, the sphere of influence (SOI) of a SMBH, which describes the region in which the gravitational potential of the SMBH dominates, is incredibly small (for nearby galaxies, the SOI is approximately $0.1'' - 1''$) relative to the large extent of a galaxy (Kormendy & Ho (2013)) as the SMBH is very compact. The stars in the bulge fall outside the SOI of the SMBH, meaning they are not orbiting the SMBH and their motion is not dominated by the black hole's gravitational influence. Yet, there is a correlation between them, implying that there must be another process that is connecting $M_{\rm BH}$ and σ_*.

It is crucial to tightly constrain the relation to understand the connection between the two values, but previous literature has indicated that there is a scatter to the $M_{\rm BH} - \sigma_*$ relation (Batiste et al. (2017b), Pacucci et al. (2018), and Valluri et al. (2004)). With further investigation, it was determined that the scatter cannot be explained fully by measurement error. There is an intrinsic scatter that suggests that we do not completely understand the relationship (Gültekin et al. (2009)). However, the measurement and systemic error obscure the true fit, making it difficult to reveal and understand the intrinsic scatter. Therefore, there have been efforts to reduce the measurement error. Previously, the measurement of $M_{\rm BH}$ was thought to be the source of error as it was difficult to obtain a tight constrain on the mass measurement and it required a large amount of observational resources (Bellovary et al. (2014)). However, with the significant improvement of $M_{\rm BH}$, this component is unlikely to be the source of error.

The mass of a galaxy's SMBH can be determined using two independent methods, Stellar Dynamical Modeling (SDM) and Reverberation Mapping (RM). The former of the two is done by modeling the stars or gas kinematics that fall within the sphere of influence of the SMBH (van der Marel et al. (1998)). However, this method requires

spatial resolution of the SOI as it is based off how the SMBH impacts the stellar kinematics in this region. This resolution can only be achieved for galaxies in the local universe. Additionally, due to the high luminosity of AGNs, the sphere of influence of the SBMH is often obscured for active galaxies. Thus, SDM primarily works for nearby quiescent galaxies. The other method, RM, depends on the observed flux variations from the accretion disks of AGN (Blandford & McKee (1982)). Light from the accretion disk of an AGN is variable due to instabilities, and that is observed in the continuum, which has arbitrary increases and decreases in flux. These changes in flux are mimicked in the emission from the broad-line region (BLR), a location of high-density gas clouds outside of the accretion disk but still deep within the gravitational potential well of the SMBH. This occurs as the light from the accretion disk travels outwards in all directions and interacts with clouds in the BLR, which re-emits the light with a time delay. For instance, when there is an increase in flux in the accretion disk, we observe a corresponding increase in flux from the BLR some time later. Thus, RM is a method that works only for broad-line AGNs and spatial resolution is not necessary. Under the assumption that light is traveling at the same speed as it would in a vacuum, we can get a measure of how far the BLR is from the accretion disk based on the time lag. Using the virial theorem, we can constrain $M_{\rm BH}$:

$$M_{BH} = f\left(\frac{\Delta V^2 R_{BLR}}{G}\right) \tag{1.1}$$

Here, f is a scale factor that accounts for the specific geometry and kinematics of the BLR, ΔV is the virial velocity of the BLR, $R_{\rm BLR}$ is the radius of the BLR, and G is the gravitational constant.

$M_{\rm BH}$ can be determined when scaled by the factor f. However, the kinematics and geometry of the BLR are unknown as we have no method of direct measurement for this region. There have been efforts to model the BLR of AGNs (Pancoast et al. (2012)

and Pan et al. (2019)), but the region is not well understood, making it difficult to constrain f. Instead, f is estimated to be the multiplicative factor of order unity that is needed to calibrate $M_{\rm BH}$ such that the intercept for $M_{\rm BH}$ – σ_* will agree for both AGN-host and quiescent galaxies (Onken et al. (2004)). This scaling is done under the assumption that $M_{\rm BH}$ – σ_* is the same for both active and quiescent galaxies (Woo et al. (2013)). To measure an accurate $M_{\rm BH}$ through RM, therefore, it is necessary to improve constraints on the $M_{\rm BH}$ – σ_* relation, particularly for quiescent galaxies, and reduce any error in σ_*, to obtain an accurate estimate for f. It is important to note that it remains an open question whether AGN-host and quiescent galaxies do follow the same $M_{\rm BH}$ – σ_* relation, emphasizing the importance of more tightly constraining this relation.

To refine the $M_{\rm BH}$ – σ_* relation, we need to reduce the error in σ_*, which is dependent on the radius of the bulge. We define the radius of the bulge through the effective radius, R_e, which is taken as the radius containing half of the bulge's luminosity. We can obtain this measurement by modeling the galaxy's light distribution or luminosity function through its separate structural components, including the bulge. Measuring an accurate R_e will provide a better constraint for σ_*, which is essential in improving $M_{\rm BH}$ – σ_*. Work done in Batiste et al. (2017b) included a recalibration of the $M_{\rm BH}$ – σ_* relation for a sample of AGN-host galaxies and a sample of quiescent galaxies, shown in Figure 1.1. Each quiescent galaxy has well-constrained dynamical masses obtained from Kormendy & Ho (2013) and both the AGN-host and quiescent galaxies have stellar kinematic data from Cappellari et al. (2011). The AGN-host galaxies had accurate R_e measurements determined from multi-component image decompositions using the software, GALFIT, leading to a better constraint for the corresponding $M_{\rm BH}$ – σ_* relation, but the quiescent sample did not. The quiescent sample and their corresponding R_e values had been pulled from a larger sample in the ATLAS$^{\rm 3D}$ survey (Cappellari et al. (2011) and Cappellari et al. (2013)) as these

galaxies had consistent stellar kinematics with the AGN-host galaxies. The smaller subsample of quiescent galaxies in Batiste et al. (2017a) was chosen as they had well-constrained SDM masses for $M_{\rm BH}$.

The ATLAS$^{\rm 3D}$ survey is a compilation of 260 nearby early-type galaxies (Discussion in Chapter 3). The main objective of the ATLAS$^{\rm 3D}$ was to model the stellar kinematics, but they additionally used previous Two Micron All-Sky Survey (2MASS) photometric observations to obtain R_e, which was defined as the whole galaxy's half light radius in their work. While the stellar kinematic data were relatively accurate, the R_e values are less reliable. The photometric observations were ground-based, allowing potential problems such as atmospheric distortion or visibility to impact the data. Furthermore, the reported R_e values encompass half of the entire galaxy's light, rather than just the bulge's. One-component fits do not work well with galaxies that have more complex morphologies (Peng et al. (2002) and Meert et al. (2013)), which these quiescent galaxies have. The morphology of a galaxy refers to the various structural properties and shapes that can classify a galaxy. Discussion on the various morphology types and structures of galaxies can be found in Chapter 2.

In fact, Batiste et al. (2017b) found that the one-component fit performed by Cappellari et al. (2011) for NGC 5373 overestimated R_e by 5$\times$ that of the bulge-disk decomposition in Bentz et al. (2014). This bias is likely to be present in each galaxy as the sample has complex structures. For example, in the case of barred-lenticular galaxies, which make up most of the sample in this work, it is essential to account for the additional component of bars (Laurikainen et al. (2004)). In a follow-up paper (Laurikainen et al. (2006)), it was found that accounting for bars reduced the mean B/T (bulge to total light) ratio from 0.55 to 0.30 and the mean Sérsic index, n, from 2.6 to 2.1. As the Sérsic index relates to the size and luminosity of a galaxy, a change in this parameter can impact the estimate of R_e.

This uncertainty in R_e requires an improvement in bulge radii measurements to

minimize the error in σ_*. It is particularly problematic as a large overestimation can significantly change the region in which we are measuring σ_*. We aim to constrain R_e by modeling a subsample of five early-type galaxies with Hubble Space Telescope data using the software GALFIT, a 2-D fitting algorithm that can model light profiles from galaxy images (Peng et al. (2002) and Peng et al. (2010)). By refining the fits, we measure the radius of the bulge and then use available stellar kinematic data to obtain a value of σ_* within R_e for each galaxy. The stellar kinematic data is drawn from the ATLAS^{3D} Project, which utilized the SAURON integral-field unit (IFU). IFU employs the method of integral-field spectroscopy (IFS) to perform an analysis of stellar kinematics for each galaxy (Cappellari et al. (2011)). Further discussion on Hubble Space Telescope data, GALFIT, the method of IFS, and the ATLAS^{3D} project can be found in Chapter 3. With the stellar kinematics, we find σ_* of the bulge within R_e to examine the relationship between $M_{\rm BH}$ and σ_* for a galaxy. In this work, we investigate NGC 3384, NGC 3945, NGC 4382, NGC 4472, and the AGN-host galaxy, NGC 3998. These five early-type galaxies were originally classified as quiescent galaxies in the ATLAS^{3D} sample, but one of them has a low-luminosity AGN in the center. The work in Batiste et al. (2017b) on the recalibration of the $M_{\rm BH} - \sigma_*$ used a subsample of 32 quiescent galaxies from Cappellari et al. (2011)), which included the five in this project. We explore how improved measurements of R_e affect σ_* values and the broader implications on the $M_{\rm BH} - \sigma_*$ relation.

This paper has been divided into seven chapters. Chapter 2 briefly overviews galaxy morphology types and structures. This is followed up with a discussion on the Hubble Space Telescope, Luminosity Function Fitting, GALFIT, the SAURON Integral-Field Unit, the method of integral-field spectroscopy, and the ATLAS^{3D} project in Chapter 3. Then we introduce the sample in Chapter 4 and continue with the image decomposition in Chapter 5. Chapter 6 discusses the impact of the improved R_e values on σ_* values and the broader implications for the $M_{\rm BH} - \sigma_*$ relation, and

we end with our conclusions and future work in Chapter 7.

Chapter 2

Galaxy Structures and Types

In this overview of galaxy structures and types, we will begin with a brief discussion of different morphological structures that can be found in the galaxies of this work. At the center of most galaxies, there are structural components called bulges and pseudobulges. Bulges are a dense, spheroidal region of stars while pseudobulges are more dominated by rotation and more disk-like than classical bulges (Kormendy & Ho (2013)). Several galaxies also have galactic disks, which are flattened structures, containing objects that are mainly supported by rotation. More complex components include bars, spiral arms, and rings. Bar-like structures are elongated components of gas, dust, and stars. Spiral arms are spiral-shaped locations of high star formation, and we can also find rings, which are ring-shaped patterns in the light distributions of these galaxies (Fernandez et al. (2021)).

Traditionally, the characterization of galaxies has been incredibly subjective. Classifications are determined by a galaxy's apparent morphology as viewed by eye, leading to significant bias and false classifications. However, this visual characterization is common practice, and there are three main morphological types: elliptical, lenticular, and spiral galaxies as depicted by the Hubble Tuning Fork, a classification scheme for galaxies (Hubble (1936)). Elliptical galaxies, denoted by E0 through E7, are

distinguished by minimal structure, lacking, for example, disks, spiral arms, bars, and dust lanes (Sandage (1961) and de Vaucouleurs (1987)). Simple elliptical galaxies can be treated as a large, extended bulge structure, which is why one-component fits using a single Sérsic profile (Sersic (1968)) or de Vaucouleur's law (de Vaucouleurs (1948)) can work well for these galaxies. Despite having a single structural component, it sometimes takes multiple profiles to truly model the light distribution properly. Thus, it is not necessarily true that one galaxy component is equivalent to one component.

Spiral galaxies, such as the Milky Way galaxy, contain spiral arms, a location of high star formation rates (Elmegreen (2009)). This indicates the presence of young stars, but spiral galaxies also have older stellar populations in other regions such as the bulge (Bell & de Jong (2000)). This category of galaxies can be split into two further types based on if there is a bar. Finally, lenticular, or S0, galaxies, are distinguished by a central bulge, a thin disk for the plane of the galaxy, a lack of spiral arms, an older star population, and less star formation (Sandage (1961)). S0 galaxies can have several structural components such as bars, rings, or inner and outer disks (Erwin et al. (2003)), and thus, for lenticular galaxies, this one-component model does not work as well as there are many structures to parametrize. Lenticulars are theorized to be a transition state between elliptical and spiral galaxies due to their history of mergers and gravitation encounters, having properties of both morphology types (Hubble (1936)). Additionally, lenticular and elliptical galaxies are typically referred to as early-type galaxies (ETGs) while spirals are late-types.

Chapter 3

Data and Analysis Methods

3.1 Hubble Space Telescope

Data for this project are drawn from the Hubble Space Telescope (HST) archive.[1] Currently, HST has three operating cameras, two spectrographs, and fine guidance sensors. Its location in space allows for high-resolution imaging of objects, such as galaxies, while avoiding any issues that can be associated with ground-based observations, such as variable distortion from Earth's atmosphere. It also provides the advantage of being able to effectively observe ultraviolet and infrared wavelengths without the effects of Earth's atmosphere. In this work, we utilize data from the Wide Field Camera 3 (WFC3) and Advanced Camera for Surveys/Wide-Field Channel (ACS/WFC) cameras on HST.[2] Specifically, these cameras were chosen for their high spatial resolution and large field-of-view. The WFC3, which was installed in 2009, has two channels: one for ultraviolet and visible wavelengths (referred to as the WFC3/UVIS) and another focused on infrared wavelengths (referred to as WFC3/IR). In this work, we use images from the IR channel. The ACS/WFC camera covers a wavelength range from visible to near IR and has a larger field-of view(FOV), allowing

[1] HST data can be found at this link.

[2] The instrumentation information can be found at this link.

for deep, wide-field imaging.

3.2 Luminosity Function Fitting and GALFIT

3.2.1 Luminosity Function Fitting

Luminosity function fitting is the method by which the light distribution of an object is modeled using parametric functions. One of the first instances of fitting the light distribution of a galaxy to luminosity functions is described in de Vaucouleurs (1948), who found that the luminosity profiles of elliptical galaxies were found to follow a power-law of $e^{-r^{1/4}}$, now known as de Vaucouleurs profile. With the advancement of our knowledge in galaxy structure, Faber et al. (1997) found that some galaxies can be broken down further: a spherical bulge following a de Vaucouleurs light profile, and a disky region following an exponential distribution. As more structures such as bars, rings, and spiral arms came into the picture, different profiles were developed and adjusted to fit these structures. Initially, luminosity functions started as one-dimensional brightness profiles to model galaxy distributions (examples include: Kormendy (1977) and MacArthur et al. (2003)). Now, there are techniques to fit two-dimensional profiles as shown by, for example, Shaw & Gilmore (1989) and Gadotti (2008), allowing for one to take advantage of more spatial information and account for any image-smearing through point-spread functions as described in Section 3.2.2.

3.2.2 GALFIT

GALFIT is a 2D fitting program that models galaxy luminosity profiles by allowing for a complex image decomposition to fit a range of different structural components (Peng et al. (2002) and Peng et al. (2010)). It allows the user to fit any number of different surface brightness profiles (also referred to as model components) that have been show to accurately model structural components in galaxies by utilizing the

Levenberg-Marquardt technique to find the best fit. GALFIT allows for the user to introduce bending modes, Fourier modes, or spiral rotation functions to account for more complexity in shapes such as asymmetry in structures or numerous spiral arms.

As a nonlinear least-squares fitting algorithm, GALFIT iterates by adjusting the inputted parameters at each step until the goodness of fit is not decreasing considerably. The goodness of fit is represented by the normalized χ^2_ν, which accounts for the number of degrees of freedom, the flux and uncertainty at each pixel, and the model components and their parameters. Values closer to $\chi^2_\nu = 1$ indicate that the best-fit model fits the data well. Anything below 1 indicates there is a large amount of oversubtraction while a value well over 1 indicates an undersubtraction. In this work, we take $\chi^2_\nu < 5$ to be a good fit, such that we are accounting for enough of the observed data to constrain R_e of the bulge. Along with parameterizing each fitted structural component, GALFIT provides a statistical measurement error on each quantity. It is important to note that the formal uncertainties calculated are only truly useful in perfect situations such as one where the galaxy is the only object in the FOV. However, stars and galaxies in the field-of-view that are not being fit make this uncertainty measurement less reliable. Despite the uncertainty in this value, having the residual image to inspect areas of under and oversubtraction aid in determining a good fit. Systematic errors are reduced as much as possible by obtaining better fits.

GALFIT takes in the CCD image of the data, σ-image, Point Spread Function (PSF) image, and an optional bad pixel image. The σ-image is an input that provides the uncertainty at each pixel, and GALFIT is able to generate its own if the user does not input it. The GALFIT generated σ-image is developed based on the gain and read-noise found in the header of the data image. In this work, we had GALFIT develop its own σ-image as overall fits are not incredibly sensitive to the inputted σ-image.[3] The PSF image accounts for the smearing that occurs to light from distant

[3]For further discussion on the σ-image, see this link.

sources, which can, for example, be affected by distortions from the optics. The bad pixel mask identifies pixels that should be excluded in the fitting process such as dead pixels on the CCD or a bright foreground star. All of these images are included in the input file, which also details the functions and parameters that GALFIT will use to develop a model. Once it has run, GALFIT will output a FITS image block containing the original CCD image, the model, and the residual. The residual image subtracts the model from the original image, allowing the user to identify regions of over/underfitted data. The overall process is iterative, such that the user examines the residuals to identify places of missing structure to try and add more components to fit them. The user continues to repeat this process until a satisfactory best-fit model is reached.

The following subsections describe the profiles used in this project and the input PSFs developed by HST.

The Radial Profiles

The Sérsic surface brightness profile has seven free parameters, x_0, y_0, $m_{\rm tot}$, R_e, n, q, and $\theta_{\rm P.A.}$, which correspond to the x-position, y-position, integrated magnitude, effective radius, concentration parameter (or Sérsic index), axis ratio, and position angle (P.A.) respectively. The parameter R_e is the effective radius defined as the radius at which half the total flux is contained, and the parameter n describes the steepness of the profile at inner and outer radii. Larger values of n indicate a steeper inner profile and extended outer wing while smaller values imply a shallow inner profile and steep outer wing. In particular, a galactic bulge or simple elliptical galaxy can be fit with this profile; typically, the Sérsic index associated with this structural component is $n > 2$ (Fisher & Drory (2010)). Pseudobulges, which are more disky, have indices $n < 2$ (Fisher & Drory (2010)). We will distinguish bulges from pseudobulges using those limits. Functions with $n = 1$ are a special case of Sérsic profiles, corresponding

to an exponential surface brightness profile, $n = 0.5$ corresponds to a Gaussian surface brightness profile, and $n = 4$ corresponds to de Vaucouleurs law. An index of $n < 0.5$ creates a Sérsic profile similar to the Ferrer function, which is typically used to fit galaxy bars or lenses. Additionally, the general Sérsic profile can also be modified with radial and power functions to truncate and rotate the overall function to fit rings, ansae, or spiral arms. This surface brightness profile is very versatile and can be adapted to fit many different structural components found in galaxies. The exponential disk profile, as a special case of the Sérsic profile for $n = 1$, instead, has six free parameters, x_0, y_0, $m_{\rm tot}$, R_s, q, and $\theta_{\rm P.A.}$. Note that this profile uses R_s, the scale length, unlike the Sérsic profile's R_e. R_s is the location at which the surface brightness of the disk is approximately 2.718× more faint than the brightness at the center. The relationship between the R_s and the half-light radius of the profile, R_e, at $n = 1$ is given by:

$$R_e = 1.678 \times R_s \tag{3.1}$$

The PSF profile is utilized to fit unresolved sources with stellar PSFs. It takes advantage of the user inputted PSF and has three free parameters: x_0, y_0, and $m_{\rm tot}$. In this work, the PSF profile was used in the fitting of NGC 3998 to fit the unresolved AGN in the center. Finally, the background sky is a flat plane that has three parameters: the flux gradient in the x and y directions and the sky background. Typically, when the galaxy occupies majority of the FOV, we can keep the parameters fixed to 0.00, which was done in this work.

HST Point Spread Functions

In this project, we used CCD images from HST to model the galaxies in the sample. To account for any blurring that occurs from any optics in the telescope, it is necessary to input a PSF image into GALFIT. It is important to note that having a perfect PSF model is not essential for this work as we are not working with extremely luminous

AGN-host galaxies. Regardless, a PSF is needed, and developing a PSF model is difficult. It can change based on the position along the field-of view (FOV) due to differences in the optical distortions or variations in the thickness of the detector (Jee et al. (2007)). A PSF can change over time due to changes in the instrumentation focus. Particularly for the WFC3 on HST, PSFs were undersampled by the detector pixels, a trade off to allow for the instrument to cover more of the field (Dauphin et al. (2021)). Another instrument, ACS/WFC, deals with uneven heating of the telescope tube from the Sun, resulting in perturbed PSFs (Bellini et al. (2018)).

To account for the blurring, there are two methods for the PSF that were considered for the GALFIT input. The first is using the software, GALFIT, itself to fit a star in the FOV. This can be done by stacking Gaussians on top of one another and is a method often employed in the literature (Becker et al. (2012) and Miller & van Dokkum (2021)).[4] However, it can be very difficult to capture the distribution of the star well, and furthermore, there is a risk of contamination from galaxy light and issues can arise if the star is overexposed. The second method is using publicly available PSFs developed by HST as they are more likely to capture the variations and perturbations inherent to data from these instruments.[5,6] In order to account for the undersampling in WFC3, HST PSFs utilize dithering to recover lost information (Anderson (2016)). For the uneven heating from the Sun, a large number of ACS/WFC exposures with several bright and unsaturated stars were taken to construct focus-diverse PSFs (Bellini et al. (2018)). After careful consideration, for this project, we chose to make use of the PSFs constructed by HST as they are more likely to capture the variations and perturbations inherent to data from these instruments.

[4]This method is discussed further in the GALFIT FAQ linked here.
[5]More information on PSFs for WFC3 can be found at this link.
[6]The ACS/WFC PSFs were obtained from the ACS/WFC focus-driven, ePSF webtool found here.

3.3 SAURON Integral-Field Spectroscopy

The spectroscopic data from ATLAS^{3D} were taken with the Spectroscopic Areal Unit for Research on Optical Nebulae (SAURON) on the William Herschel Telescope on La Palma. It is an integral-field spectrograph that aims to measure the kinematics of stars and ionized gas through spectroscopy for nearby early-type galaxies (Bacon et al. (2001)). It utilizes the method of integral-field spectroscopy, which provides spatially resolved spectroscopy across a contiguous FOV. The FOV is split into adjacent spatial pixels, or spaxels, and a spectrum is taken for each spaxel. These spectra are then stacked to form a 3-D data cube with coordinates (α, δ, λ), such that α and δ are the sky coordinates and λ is the wavelength coordinate as shown in Figure 3.1. This method is preferred over other spectroscopic methods such as long-slit spectroscopy, which takes a 2-D spectrum at each position along a slit placed on the FOV. This method is limited in spatial coverage by only being able to obtain data along the slits that are placed at a few position angles. On the other hand, IFS allows for complete coverage of the FOV by taking spectra at each spaxel in the field, rather than being confined to the slit. This method makes it possible to create spatially resolved kinematic maps, which can be used to more accurately measure kinematics in different structural components.

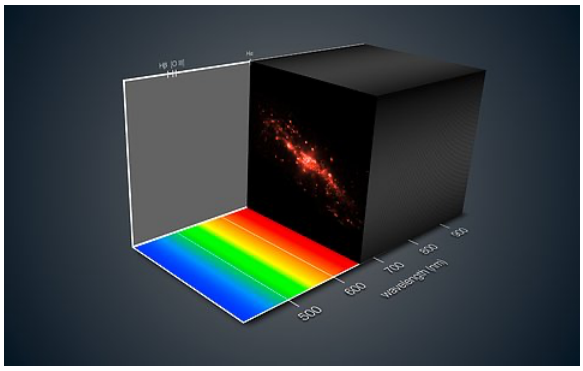

Figure 3.1: An example of the resulting 3-D data cube of integral-field spectroscopy. Credit: ESO/MUSE consortium/R. Bacon/L. Calçada

The SAURON integral-field unit(IFU) is specifically optimized to probe galaxies and the kinematics of gas and stars within them while having a large FOV. The instrument's wavelength range allows for the observations of [O III] and Hβ emission lines to examine gas kinematics and key absorption features for the stellar kinematics. There are two modes, low resolution(LR) and high resolution (HR), on SAURON. The LR mode has a FOV of $33'' \times 44''$ and samples an area of $0.94'' \times 0.94''$. The HR mode has a FOV of $9'' \times 11''$ and samples an area of $0.27'' \times 0.27''$. Observations for the ATLAS^{3D} project were done using the LR mode.

3.4 ATLAS^{3D} Survey

The ATLAS^{3D} project examines 260 lenticular and elliptical type galaxies in a multiwavelength and modeling survey (Cappellari et al. (2011)). These galaxies were taken from a parent sample of 871 galaxies within distances of 42 Mpc, with absolute magnitudes brighter than -21.5 mag, declination satisfying $|\delta - 29°| < 35°$, and galactic latitude $|b| > 15°$ to avoid dust along and near the Milky Way's plane. 22% (192 galaxies) of the sample was characterized as a S0 lenticular galaxy and 8% (86 galaxies) were classified as E types or elliptical galaxies. Lenticular and elliptical galaxies are referred to as early-type galaxies (ETGs) while the remaining 70% of the sample was spiral and irregular types.

The ATLAS^{3D} survey performed a kinematic analysis using SAURON IFS data. The goal was to measure the line-of sight-velocity distribution (LOSVD), of which σ_* is one coefficient. The observations for this survey were done over the course of 38 observation nights to observe 196 of the elliptical and lenticular galaxies. 64 of the galaxies had been observed previous to this survey on the SAURON IFU (de Zeeuw et al. (2002) and Cappellari et al. (2007)). In order to increase the signal-to-noise (S/N) ratio, which is necessary to measure higher order terms in the LOSVD, the

Voronoi binning method was employed (Cappellari & Copin (2003)), which focuses on adaptive binning. Adaptive binning is where a larger number of spaxels that are averaged together will be applied to lower S/N regions and vice versa in the spatial direction to obtain a constant S/N across the FOV. Typically, the S/N across spaxels varies from the inner to outer region of the galaxy, causing some of the spaxels to have a lower amount of S/N to the point where it becomes insufficient. In order to account for this, the spaxels can be averaged together to increase the S/N, resulting in poor spatial resolution. While the Voronoi binning method also has poor spatial resolution, it retains the physical distribution of the data better through obtaining a constant S/N across the FOV. Making the S/N uniform is important as having a low S/N on the outer regions of the CCD can bias the data. For example, a structural component, such as the disk of a galaxy, which is generally lower in flux when compared to the bulge of a galaxy will have low S/N, and if it falls on an outer spaxel, then the S/N may be insufficient. Therefore, it is necessary to ensure that the S/N is consistent throughout the entirety of the detector. In the ATLAS^{3D} survey, they aimed for a S/N = 40 (Cappellari et al. (2011)).

To extract the stellar kinematics from the data, Cappellari et al. (2011) employed the penalized pixel-fitting (pPXF) software (Cappellari & Emsellem (2004)). This approach works well for when the S/N is low or the LOSVD is not well sampled, making it particularly beneficial to IFS analysis. It uses a maximum-likelihood approach to extract the LOSVD for the stars. By describing the LOSVD as a Gauss-Hermite parametrization, of which σ_* is the second coefficient, this pPXF approach can fit the stellar kinematics using a linear combination of template stars from the MILES library (Sanchez-Blazquez et al. (2006)). Using the pPXF method, the ATLAS^{3D} survey was able to obtain the stellar kinematics, including estimates of σ_*, for galaxies in their sample.

To determine R_e, the ATLAS^{3D} project utilized photometric data from the Two

Micron All-Sky Survey (2MASS) and adopted the R_e from the 2MASS X-ray Source Catalog (XSC). The 2MASS observations used a single ellipse that encloses half the entire galaxy's light, performing a one-component fit to determine the semi-major axis that they are defining as R_e. Cappellari et al. (2011) took the median of R_e values from the 2MASS J, H, and K_s bands and scaled the averaged value to get the effective radius of a circle with the same area, rather than the semi-major axis of an ellipse. To further refine R_e, the averaged 2MASS values were compared to the Third Reference Catalogue of Bright Galaxies (RC3), which used growth curves in a circular aperture to determine R_e. The averaged 2MASS R_e values were generally offset by a factor of 1.7 from those in RC3. For galaxies that had data in the RC3 catalog, R_e was determined from the average of the offset-corrected 2MASS and RC3 values. If there were not data for a galaxy in the RC3 catalog, then the 2MASS R_e was used, multiplied by a factor of 1.7. By employing this process to determine R_e, they are essentially fitting the galaxies with one-component fits and not accounting for any complex structure that may be present, emphasizing the need to perform multi-component image decompositions.

Chapter 4

The Sample

In this project, we analyze five galaxies obtained from the quiescent sample in Batiste et al. (2017b), which examined a subsample from Cappellari et al. (2011). However, in the course of this work, one of the galaxies in this subsample, NGC 3998, was found to have been classified as low-level, or weak, AGN in the literature (Wrobel (1991)). The other four, NGC 3384, NGC 3945, NGC 4382, and NGC 4472, are categorized as quiescent as discussed in Chapter 1. Each of the galaxies have previously been fit with a one-component model using data from 2MASS to calculate R_e (Cappellari et al. (2011)). The various published quantities for each galaxy have been summarized in Table 4.1, and the observation data can be found in Table 4.2. Furthermore, we include SDSS snapshots of this sample in Figure 4.1 to visualize the extent of each galaxy. In addition to this primary sample, we have included an additional sample of galaxies for which we performed preliminary image decompositions but found the resulting models to be less reliable. Therefore, the models for these additional galaxies do not have accurate R_e values (discussed further in Chapter 5).

The HST data were taken from one of two instruments: ACS/WFC or WFC3/IR. Each HST image taken on WFC3/IR has a $0.13''$ pixel^{-1} plate scale, and the filter used was F160W with a wavelength range of approximately 1400 to 1700 nanometers (nm).

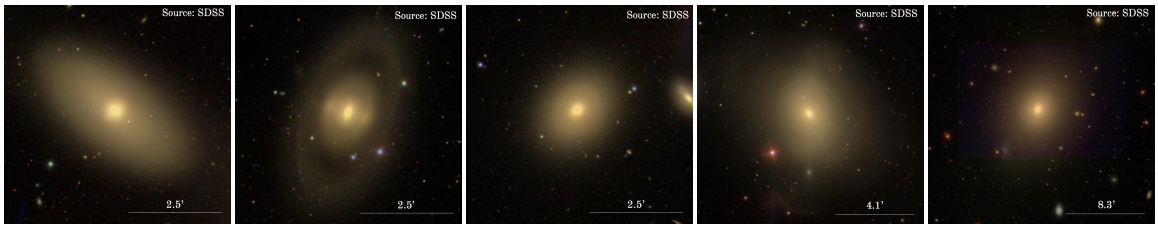

Figure 4.1: SDSS snapshots of the primary sample of galaxies. From left to right: NGC 3384, NGC 3945, NGC 3998, NGC 4382, and NGC 4472. The scale length is shown in the bottom right.

The Sample of Galaxies

ID	**RA**	**Dec.**	**Morphology Classification**	**Redshift**	$M_{\mathbf{BH}}$
	(°)	(°)			(10^7 $M_\odot$)
NGC 0524[b]	21.198938	9.538900	SA(rs)$^+$	0.008016	$86.7^{+9.4}_{-4.6}$
NGC 3384[a]	162.070404	12.629300	SB(s)0$^-$	0.002348	$1.1^{+0.5}_{-0.5}$
NGC 3945[a]	178.306774	60.675646	(R)SB(rs)0$^+$	0.004273	$0.9^{+1.7}_{-0.9}$
NGC 3998[a]	179.483889	55.453589	SA0^0(r)	0.003401	$84.5^{+7.0}_{-6.6}$
NGC 4382[a]	186.350220	18.191080	SA(s)0$^+$pec	0.002432	$1.3^{+21.1}_{-1.3}$
NGC 4472[a]	187.444841	8.000476	E2	0.003272	$254.0^{+58.0}_{-10.0}$
NGC 4596[b]	189.983131	10.176206	SB(r)0$^+$	0.006311	$7.7^{+3.7}_{-3.2}$

Table 4.1: RA, Dec., Morphology Classification, and Redshift were obtained from NASA/IPAC Extragalactic Database (NED). $M_{\rm BH}$ from Kormendy & Ho (2013). Galaxies labeled with (*a*) are part of the main sample that we will be investigating while those with (*b*) are additional decompositions we have unreliable fits for.

For NGC 0524 and NGC 3384, the data were taken on the ACS/WFC instrument with a plate scale of 0.049″ pixel^{-1}. The filters used were F110W with a wavelength range of approximately 900 to 1400 nm and F475W with approximately 400 to 550 nm.

In the following discussion, we provide an overview of work from the literature for each galaxy in the main sample. Despite the extensive work done on these galaxies, it is crucial to refine the fits and improve upon them; in particular, the usage of the software, GALFIT, and data from a space-based telescope will provide a good

HST Data

ID	Instrument	Data Set	Proposal ID	PI	Filter	Image Dimensions
						(pixel × pixel)
NGC 0524[b]	WFC3/IR	ID9202010	14654	Milne	F110W	1100 × 973
NGC 3384[a]	ACS/WFC	JBVU05020	12760	Lehmer	F475W	4220 × 4298
NGC 3945[a]	WFC3/IR	I9ZL79010	11219	Capetti	F160W	1060 × 950
NGC 3998[a]	WFC3/IR	IDLJ02010	15082	Robinson	F160W	1087 × 962
NGC 4382[a]	WFC3/IR	IBBW11050	11360	O'Connell	F160W	1090 × 965
NGC 4472[a]	WFC3/IR	IB1H15030	11712	Blakeslee	F160W	1088 × 962
NGC 4596[b]	WFC3/IR	IDKV49030	15133	Erwin	F160W	1089 × 962

Table 4.2: The observation information for the publicly available HST data obtained from the Barbara A. Mikulski Archive for Space Telescopes (MAST) Portal. Galaxies labeled with (*a*) are part of the main sample that we will be investigating while those with (*b*) are additional decompositions we have unreliable fits for.

foundation in refining these models.

NGC 3384

At a distance of 11.3 Mpc (Tonry et al. (2001); corrected by Mei et al. (2007)), NGC 3384 is defined as a lenticular galaxy that is part of the Leo I galaxy group (de Vaucouleurs (1975)). This early-type galaxy has several morphology features that have been investigated in previous works. NGC 3384 has historically been classified as a single-barred galaxy (Erwin & Sparke (2003) and Sarzi et al. (2006)), with an inner bar identified by a photometric decomposition performed using Spitzer data (Fisher & Drory (2010)). However, it has also been considered a potential S2B (double-barred structure) candidate based on a kinematic analysis in Du et al. (2016). Furthermore, this galaxy has a pseudobulge (Fisher & Drory (2010), Pinkney et al. (2003)), strong isophote twist in the inner and intermediate regions of the galaxy (Barbon et al. (1976)), and outer boxy isophotes (Busarello et al. (1996)). Cortesi et al. (2013) has performed a photometric decomposition of NGC 3384 using GALFIT, where they used two components: an exponential disc and a Sérsic profile spheroid. While this

galaxy has already been analyzed with GALFIT, it is still useful to perform an image decomposition for it to improve the fits to include components not included in Cortesi et al. (2013), and they had used data from the 2MASS, a ground-based telescope. The 2MASS observations have lower spatial resolution compared to the HST data used in our analysis, and thus, we expect our work to be a meaningful and useful improvement.

NGC 3945

NGC 3945 is a complex lenticular galaxy that has been characterized as a low-ionization nuclear emission-line region (LINER) (Dullo et al. (2016) and Ho et al. (1997)). Previously, it had been identified as a triple-barred galaxy candidate (Wozniak et al. (1995)), but Erwin & Sparke (1999) concluded instead that NGC 3945, in fact, hosted 2 concentric bars. Kormendy (1979) and Kormendy (1982) determined that there was also a pseudo-bulge present. A five-component fit from Dullo et al. (2016) (using a combination of HST ACS F814W, ACS F850LP and Wide Field and Planetary Camera 2 (WFPC2) F814W plus Sloan Digital Sky Survey (SDSS) images) and six-component fit on data from the Nordic Optical Telescope in La Palma (Laurikainen et al. (2010)) revealed a lens, inner ring, and outer ring. There were also several two-component fits (Erwin & Sparke (2003), Moiseev et al. (2004) and Krajnović et al. (2013)) and a three-component fit from Erwin et al. (2015)). These models were developed using data from a variety of sources such as HST ACS/WFC, Wisconsin-Indiana-Yale-NOIRLab 3.5m telescope in Arizona, Spanish National Observatory in Mexico, and more.

NGC 3998

An AGN-host galaxy (Wrobel (1991)) and a LINER (Ho et al. (1997)), NGC 3998 is at a distance of 13.7 Mpc (Tonry et al. (2001); corrected by Mei et al. (2007)) in Ursa Major. Its morphology type is identified as Sa (de Vaucouleurs et al. (1991)). This galaxy has S-shaped radio lobes (Frank et al. (2016)), and its nucleus is characterized

as a low-power radio AGN (Wrobel (1991)). Previously, de Francesco et al. (2006) fit elliptical isophotes to the galaxy using HST WFPC2 F547M data and fit the central region of NGC 3998 with a Sérsic profile. Fisher et al. (1996) obtained B- and R-band data at the Lick Observatory in California and fit the bulge region with a de Vaucouleurs profile and the disk with an exponential profile. Similarly, Sánchez-Portal et al. (2004) performed a bulge-disk surface brightness decomposition of the same profiles as Fisher et al. (1996), but they applied a sharp cut-off to the galaxy using images from the Jacobus Kapteyn Telescope in La Palma (SaÂnchez-Portal (2000)).

NGC 4382

NGC 4382 is part of the Virgo cluster at a distance of 17.9 Mpc (Mei et al. (2007)), and it has been classified variously: as an E2 (Kormendy et al. (2009)); S0 due to the surrounding diffuse stellar light (Gültekin et al. (2011)); and Sa based on spiral patterns observed in the inner disk and its bluer color (Sivakoff et al. (2003)). It also has strong evidence for being a wet-merger remnant (Kormendy et al. (2009) and Ko et al. (2018)), meaning that there were significant amounts of gas left from this interaction, inducing star formation. This theory is further supported by the irregular ripples (Schweizer & Seitzer (1988)), a bluer center than what is expected for S0 galaxies (Fisher et al. (1996)), counter-rotating core (McDermid et al. (2004)), a double-peaked nucleus suggesting two nuclei (Lauer et al. (2005)), and a high fine-structure index which can indicate a recent merger (Hibbard & Sansom (2003)). All of these factors indicate that there is remaining evidence of the merger that can be found in the structure of this galaxy such as spiral patterns or a counter-rotating core. Previously, there have been a few image decompositions performed on NGC 4382. For example, Kormendy et al. (2009) performed a one-component fit on HST ACS data using a Sérsic profile on the inner regions on the galaxy. In this work, we similarly utilize HST data but using WFC3/IR data, allowing for better spatial resolution. There was additionally a two-component fit done on data from the Kiso Observatory

in Japan, separating the galaxy into the bulge, modeled with the de Vaucouleurs surface brightness function, and the disk, which was represented by an exponential function (Baggett et al. (1998)).

NGC 4472

NGC 4472, also known as M49, is classified as an elliptical galaxy, and it is the most massive and optically bright galaxy in the Virgo cluster. It has a double-lobed radio emission and extended radio tails (Spasic et al. (2024) and Edler et al. (2023)). Capaccioli et al. (2015) used data obtained from VLT Survey Telescope's OmegaCAM in Chile to fit the light profile of this galaxy with one component, a de Vaucouleurs profile. Spavone et al. (2017) modeled the surface brightness of NGC 4472 with a two-component fit using a Sérsic and exponential profile on data from the same telescope. Kim et al. (2000) used data from the Kitt Peak National Observatory 4-meter telescope in Arizona, fitting the inner and outer (the bulge and disk) regions of the galaxy separately with two King profiles, which is typically used to fit globular cluster light. They additionally find that the outer regions of the galaxy could also be approximated with a different profile, the de Vaucouleurs law. Overall, there is no evidence of additional structural components in this galaxy.

Chapter 5

Results and Discussion

5.1 Image Decomposition

Using GALFIT, we performed a two-dimensional image decomposition on each galaxy in the sample. For each input file, we included the necessary time-dependent photometric Vega zeropoint for the WFC3/IR F160W filter, which was 24.470 mags for each galaxy[1], and for NGC 3384, taken using ACS/WFC F475W, the Vega zeropoint magnitude was 26.155 mags and 22.400 mags NGC0524 taken with F110W.[2] We used a convolution box size of 1000×1000 pixels^2. For each galaxy, we developed and included a bad pixel mask to account for dead pixels on the CCD, or to mask out foreground stars, such as the one in the FOV of NGC 4472 as shown in Figure 5.10. Table 5.1 lists the components and parameters for the best-fitting image decompositions and the following sections discuss the individual cases for the main sample.

NGC 3384

NGC 3384's HST image, best-fit model, and residual can be seen in Figure 5.1. The best-fit model resulted in $\chi^2_\nu = 0.289$, and the parameters for each component can be

[1]The information on how to calculate the time-dependent zeropoint magnitudes for WFC3/IR can be found in the notebook here.

[2]The ACS/WFC time-dependent zeropoint magnitudes can be determined using the ACS Zeropoints Calculator at this link.

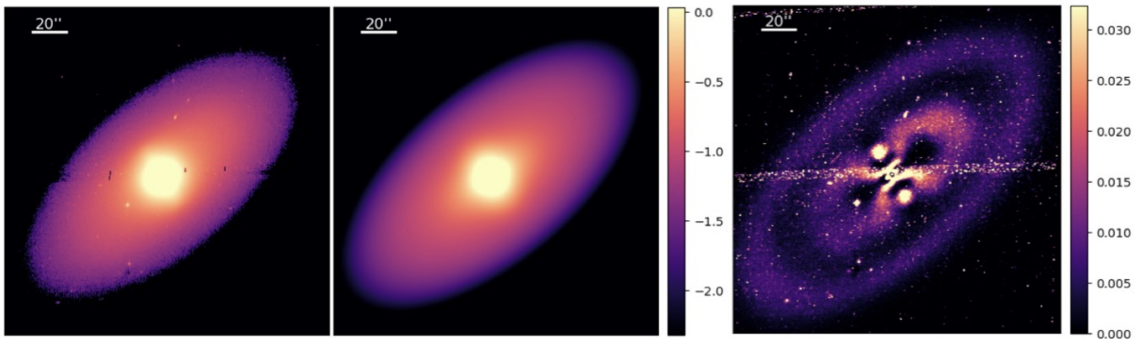

Figure 5.1: NGC 3384's final image decomposition with the F475W image(left), best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD and to encompass more of the galaxy for visualization purposes. The F475W and best-fit model are on a logarithmic stretch and the scaling is indicated by the bar to the right of the best-fit model. The residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

found in Table 5.1. Aside from the sky background, we used four profiles to model the galaxy, and the breakdown of the best-fit model can be found in Figure 5.2. Component No. 1, a Sérsic function with index $n = 1.35$ suggests a pseudobulge in the center as the index is less than 2, similar to what has been seen in literature (Fisher & Drory (2010)). However, it is evident from the residuals that there is still structure remaining in the center of NGC 3384 that might require an additional component to model the bulge well. Furthermore, we included a disk, component No. 2, and a bar, component No. 3, at PA = 29.72°, a structure that has been noted in past work (Fisher & Drory (2010), Sarzi et al. (2006), and Erwin & Sparke (2003)). However based on the residual, we see that there are parts that have been undersubtracted and oversubtracted along the bar which may be due to component No. 4. This last component is a Sérsic profile with a large effective radius, $R_e = 59.52''$, and an index of $n = 0.22$, values we would expect to see for a large-scale bar structure. It is inclined nearly 80° to the true bar structure, component No. 3, and it seems to be overfitting regions of the bar at their intersection. Perhaps, due to this, the small-scale bar is not being fit properly, which

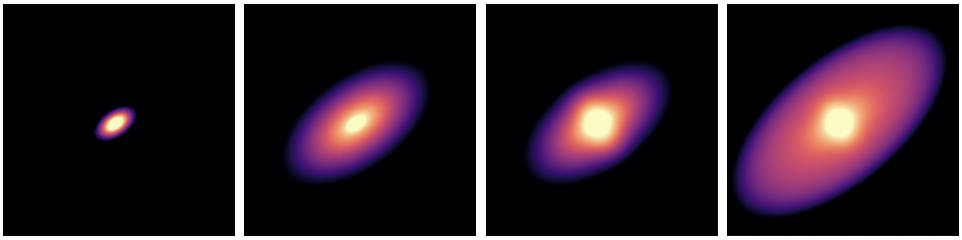

Figure 5.2: The image decomposition process for NGC 3384, showing each component stacked upon each other. From left to right: Image (1) is component No. 1; Image (2) is component No. 1 + component No. 2; Image (3) is component No. 1 + component No. 2 + component No. 3; Image (4) is component No. 1 + component No. 2 + component No. 3 + component No. 4. Image (4) is the final best-fit model.

is observed in the residuals where there is an undersubtraction at the ends of the bar. Furthermore, the radius of component No. 4 exceeds that of the exponential disk component. The parameters for this component indicate a large-scale bar, but there is no indication in the literature about this additional structure. Evidently, there is a need to improve on this best-fit model to better understand this structure or what it is trying to model.

Additionally, we considered another exponential function, as component No. 4 might be possibly trying to account for the large-scale disk. However, this addition showed a similar residual and did not affect component No. 4 significantly, which still retained the large-scale bar-like structure. The relative radii for all the other components also remained similar to the values for the final fit of Figure 5.1, with the pseudobulge only increasing in radius by .08″. Thus, our final fit did not include this extra exponential profile, but it still effectively captured most of the light.

NGC 3945

To model NGC 3945, we used 5 surface brightness profiles and one truncation function, and the step-by-step of the addition of each profile can be seen in Figure 5.4. The values for the parameters can be found in Table 5.1, and the decomposition shown in Figure 5.3 resulted in $\chi^2_\nu = 2.007$. The bulge of NGC 3945 was modeled with two functions, one Sérsic (component No. 1) and one exponential disk (component No. 2).

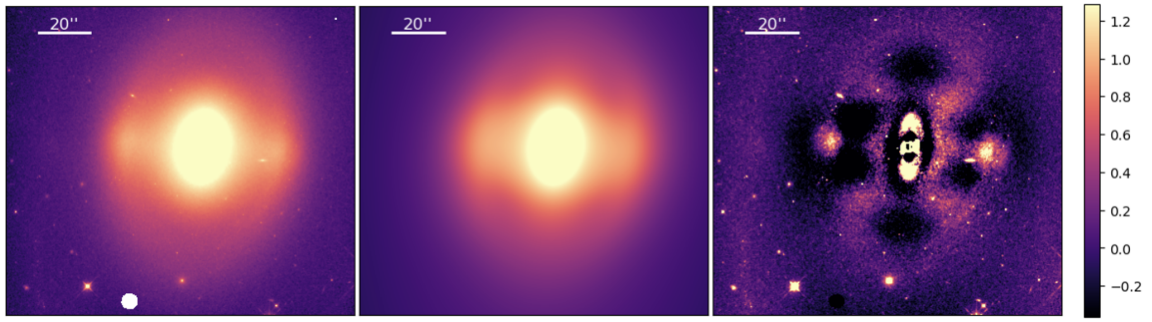

Figure 5.3: NGC 3945's final image decomposition with the F160W image(left), best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F160W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

The former of the two, has an index of $n = 0.85$ and the exponential disk function has similar characteristics to component No. 1, such as P.A. and axis ratio. This indicates that the bulge has a more disky nature to it, as an index less than 2 typically indicates a pseudobulge, and there is a exponential disk function added to this region. This pseudobulge has been noted in the literature (Kormendy (1979)). It is important to note that it is evident in the residual that the luminosity from the central region has not been captured completely. Component No. 3 represents the large disk structure in this galaxy. At $R_s = 239.96''$, this component extends beyond the size of the HST image, which is true of the physical size of this galaxy as shown in Figure 4.1. NGC 3945's profile is larger than the FOV of this HST image, and we are seeing evidence of this with the extent of the exponential function.

In addition to these structures, we included Sérsic profiles to model the obvious bar and ring. The bar, component No. 4, is causing an oversubtraction as see in the residual, with the width of the component being too large. The last Sérsic, component No. 5, additionally had a truncation function added to it in order to depict the ring structure. The Sérsic and truncation function position angles were not aligned, causing the ring's luminosity to be more concentrated along the ansae at the end of the central

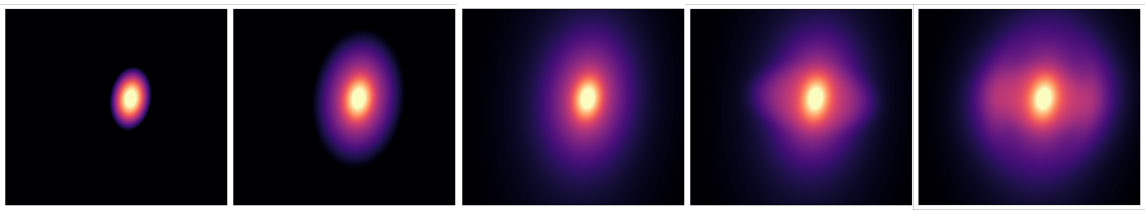

Figure 5.4: The image decomposition process for NGC 3945, showing each component stacked upon each other. From left to right: Image (1) is component No. 1; Image (2) is component No. 1 + component No. 2; Image (3) is component No. 1 + component No. 2 + component No. 3; Image (4) is component No. 1 + component No. 2 + component No. 3 + component No. 4; Image (5) is component No. 1 + component No. 2 + component No. 3 + component No. 4 + component No. 5. Image (5) is the final best-fit model.

bar. However, we can see that the light from the ansae was not captured well in the residual. The same can be said about the rest of the ring as the component is trying to accommodate for the underfitting of the the ansae. It will likely be necessary to include an additional component to separately deal with the ring and the ansae, in order to further refine this fit.

NGC 3998

For NGC 3998, the final decomposition can be found in Figure 5.5 with the corre-

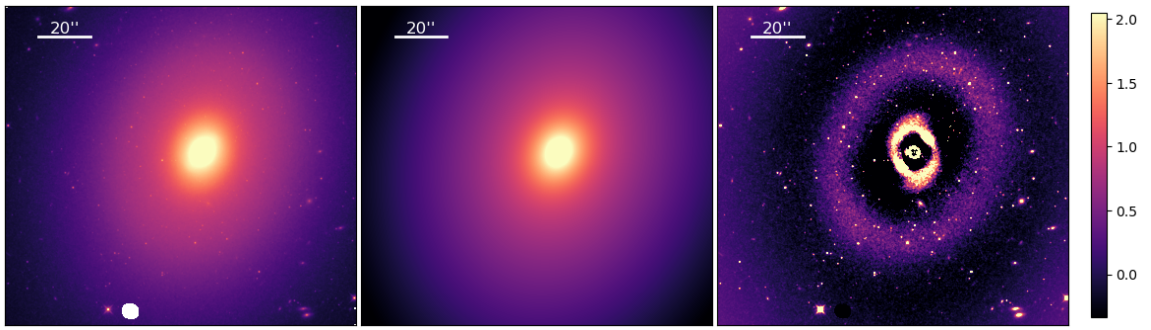

Figure 5.5: NGC 3998's final image decomposition with the F160W image(left), best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F160W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

sponding parameters in Table 5.1. The best-fit model resulted in $\chi^2_\nu = 0.699$, and the

breakdown of the best-fit model can be found in Figure 5.7. As NGC 3998 has shown evidence of being an AGN-host galaxy (Wrobel (1991)), we included the addition of a PSF, component No. 3, in the center to account for the bright nucleus. The bulge, component No. 1, has indications of being a pseudobulge based on its Sérsic index of $n = 1.99$. However, we observe in the residuals that there is a large oversubtraction in the nucleus and an undersubtraction outside of the central region. In the center, the pattern of undersubtraction indicates the presence of ansae, the points at which there is a concentrated region of light on both ends, and small spiral arms that appear to be extending out from the ansae. To further improve the fits, it is necessary to include these structural patterns to account for all the light in the central region properly. Finally, component No. 2 accounts for the large disk of the galaxy.

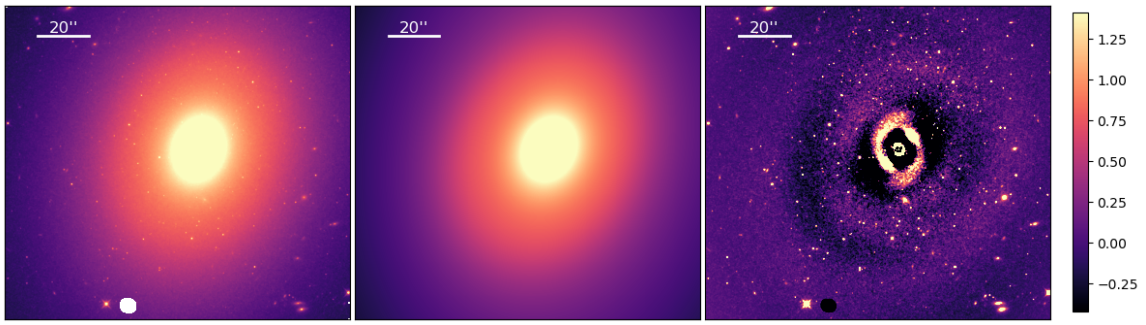

Figure 5.6: A decomposition of NGC 3998, not used as the final fit. This includes the addition of a ring. The F160W image(left), best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F160W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

We additionally considered the addition of a ring in the decomposition due to the large region of undersubtraction as seen in the residuals of Figure 5.5. The addition can be seen in Figure 5.6. By including the ring, R_s increased for the disk of the galaxy, aligning with the true physical nature. However, while the ring removed the outer light, it can be seen that there is an uneven removal when comparing the left end

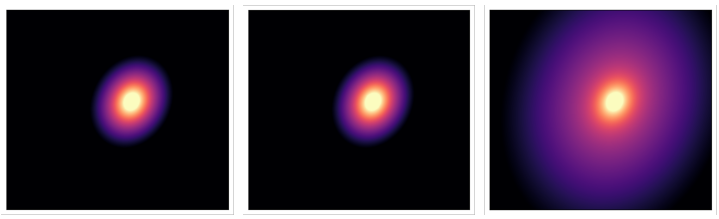

Figure 5.7: The image decomposition process for NGC 3398, showing each component stacked upon each other. From left to right: Image (1) is component No. 1; Image (2) is component No. 1 + component No. 3; Image (3) is component No. 1 + component No. 2 + component No. 3. Image (3) is the final best-fit model.

of the galaxy to the right end in the location where the ring structure had been placed. Furthermore, in the literature, there is no indication of a ring component where we seem to be observing it, leading us to believe that this addition may not be indicative of a real structure. Thus, our final model does not include a ring component.

NGC 4382

The final image decomposition of NGC 4382 used 2 luminosity profiles: one Sérsic and

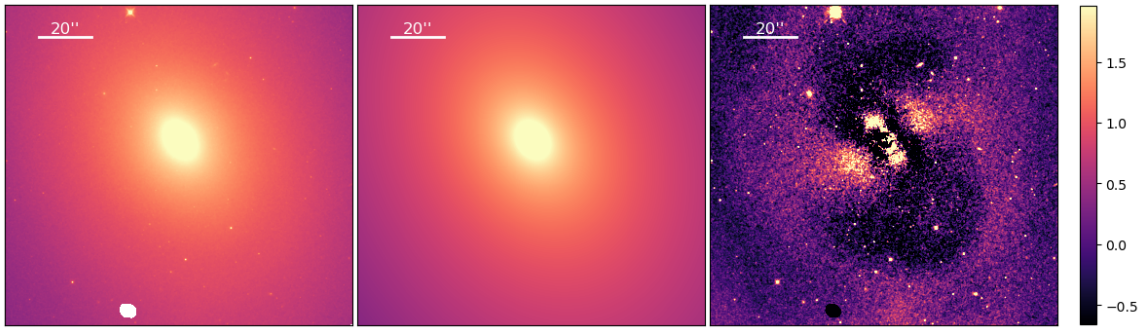

Figure 5.8: NGC 4382's final image decomposition with the F160W image(left), best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F160W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

one exponential function. The corresponding parameters for each function are listed in Table 5.1, and the breakdown of the model can be found in Figure 5.9. The Sérsic profile represents the bulge, as seen by the Sérsic index $n = 4.20$, a value we would expect to see for galactic bulges, and the exponential function represents the disk of the

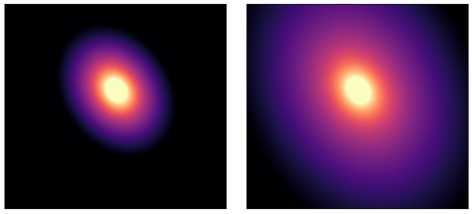

Figure 5.9: The image decomposition process for NGC 4382, showing each component stacked upon each other. From left to right: Image (1) is component No. 1; Image (2) is component No. 1 + component No. 2. Image (2) is the final best-fit model.

galaxy, evident by the extent of the profile. Previous image decomposition performed by Baggett et al. (1998) suggested that the bulge followed the de Vaucouleurs law, indicated by an index of $n = 4$, and that is supported by the decomposition done in this work. We additionally explored the addition of another Sérsic profile to capture light that was not removed in the region in the center, but GALFIT was not able to converge to a solution. Thus, we ended with a final three-component fit, including the sky background, as shown in Figure 5.8, resulting in $\chi^2_\nu = 4.573$. Based on the residual, we can observe that there is light that was not fully captured in the center. It is unclear if these patterns indicate if more profiles need to be added to fully capture the structure or if it is excess light. The observed patterns in the overfit regions could additionally suggest spirals, a structure that has been seen by Sivakoff et al. (2003) in the inner disk of this galaxy. Alternatively, this could be an indication of the counter-rotating core that has been found in the nucleus of this galaxy (McDermid et al. (2004)).

NGC 4472

We used four components, including the sky background, for NGC 4472 as described in Table 5.1. Figure 5.11 walks through the visual breakdown of the best-fit model by stacking each function. The foreground star in the left of the HST image in Figure 5.10 had originally been affecting the fit. To account for the foreground star, we considered two methods: adding a PSF component as one of the parameters or masking out the

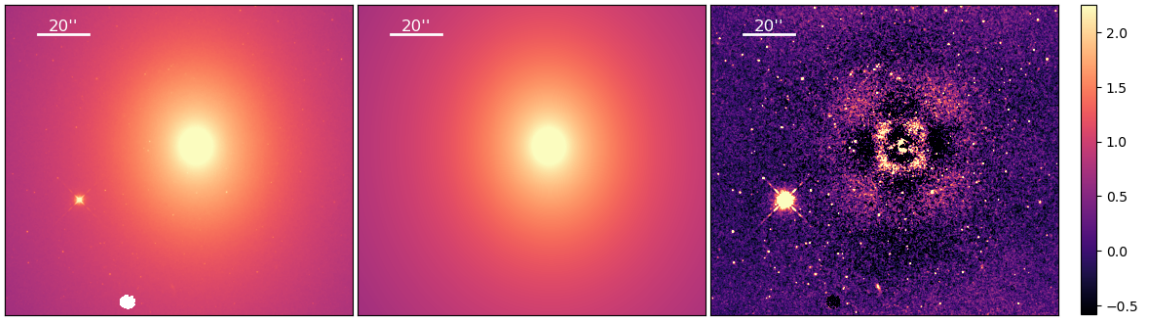

Figure 5.10: NGC 4472's final image decomposition with the F160W image(left), best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F160W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

star in the bad pixel mask. Including a PSF component caused a combination of overfitting and underfitting at the location of the star, and the exponential function, component No. 3, consequently extended out of the HST image. While the radius of the disk does physically extend beyond the FOV of the HST image (shown in the SDSS image in Figure 4.1), including the PSF seemed like a poor choice considering the residual pattern at the star. Instead, we used a bad pixel mask such that any pixel with counts over 18 in that region would be considered part of the foreground star and as part of the mask. This minimum of 18 counts ensured the bad pixel mask did not include any background pixels, which ranged from 11 to 14 counts. However, this did, in turn, decrease the radius of component No. 3 relative to what it had been with the PSF component included. We tested adding another exponential function to capture the true extent of the large disk, but GALFIT was not able to converge to a solution. Therefore, this may just be a product of the smaller FOV of the HST image, which does not include the full radius of the disk. Aside from the large disk component, similar to the situation of NGC 3945, we see evidence of a pseudobulge structure that is made through two profiles: component No. 1, a Sérsic profile with index $n = 1.13$

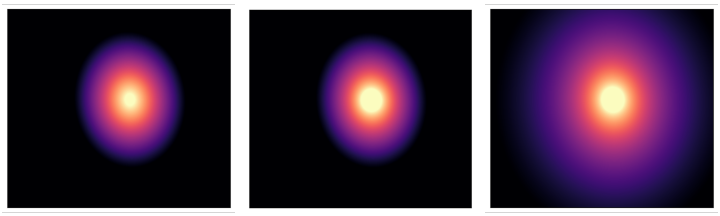

Figure 5.11: The image decomposition process for NGC 4472, showing each component stacked upon each other. From left to right: Image (1) is component No. 1; Image (2) is component No. 1 + component No. 2; Image (3) is component No. 1 + component No. 2 + component No. 3. Image (3) is the final best-fit model.

and component No. 2, a smaller exponential function in the same region. There is no strong indication of leftover structure in the residual, but there is a case of overfitting near the center which is thought to have caused the goodness-of-fit indicator to fall below 1, $\chi^2_\nu = .1059$.

Image Decomposition of the Primary Sample

No.	**sersic**	Δx	Δy	$m_{\rm Vega}$	R_e	n	b/a	P.A.	Notes
		($''$)	($''$)	(mag)	($''$)			($^\circ$)	
	radial2	Δx	Δy	...	$R_{\rm break}$	$R_{\rm soft}$	b/a	P.A.	
		($''$)	($''$)		($''$)	($''$)		($^\circ$)	
	expdisk	Δx	Δy	$m_{\rm Vega}$	R_s	...	b/a	P.A.	
		($''$)	($''$)	(mag)	($''$)			($^\circ$)	
	psf	Δx	Δy	$m_{\rm Vega}$	...	...	...	...	
		($''$)	($''$)	(mag)					
	sky	Δx	Δy	sky	$\frac{{\rm d}sky}{{\rm d}x}$	$\frac{{\rm d}sky}{{\rm d}y}$	...	...	
		($''$)	($''$)	(cts)	(cts)				

				NGC 3384					
1	sersic	1.55	-0.96	12.84	3.16	1.35	0.57	-55.76	pseudobulge
2	expdisk	1.85	-0.52	12.43	13.22	...	0.54	-54.30	disk
3	sersic	1.53	-1.07	12.36	9.04	0.79	0.80	29.72	bar
4	sersic	1.79	0.49	12.20	59.53	0.22	0.48	-49.92	bar?
5	sky	0.00	0.00	[0.00]	[0.00]	[0.00]	...	...	sky
				NGC 3945					
1	sersic	9.63	5.13	9.37	5.96	0.85	0.64	-8.40	pseudobulge
2	expdisk	9.53	5.19	9.28	12.23	...	0.66	-6.19	pseudobulge
3	expdisk	6.62	2.96	6.37	239.96	...	0.53	-3.06	disk
4	sersic	8.06	5.14	10.36	21.08	0.27	0.58	84.57	bar
5	sersic	9.51	5.11	22.66	0.46	4.03	0.91	-61.61	ring
	radial2	9.08	5.12	...	22.52	65.28	0.63	-9.03	
6	sky	0.00	0.00	[0.00]	[0.00]	[0.00]	...	...	sky
				NGC 3998					
1	sersic	6.79	4.97	8.41	5.42	1.99	0.81	-27.65	pseudobulge
2	expdisk	6.58	5.41	7.97	29.17	...	0.78	-16.50	disk
3	psf	6.66	4.93	11.39	...	...	...	...	AGN
4	sky	0.00	0.00	[0.00]	[0.00]	[0.00]	...	...	sky
				NGC 4382					
1	sersic	-0.90	9.57	7.27	26.35	4.20	0.77	34.29	bulge

2	expdisk	0.35	11.05	6.43	64.70	...	0.72	21.29	disk
3	sky	0.00	0.00	[0.00]	[0.00]	[0.00]	...	...	sky
					NGC 4472				
1	sersic	6.42	5.34	7.00	21.29	1.13	0.82	5.18	pseudobulge
2	expdisk	6.35	5.25	8.98	2.57	...	0.96	10.83	pseudobulge
3	expdisk	6.13	4.37	5.54	73.88	...	0.87	1.00	disk
4	sky	0.00	0.00	[0.00]	[0.00]	[0.00]	...	...	sky

Table 5.1: The parameters for the image decompositions for each galaxy in the main sample. Column (1): component number; (2): surface brightness profile; (3) Δx offset from the center of the HST image; (4): Δy offset from the center of the HST image. $m_{\rm Vega}$ is the magnitude offset by the Vega photometric zeropoint magnitude, R_e is the effective radius, n is the Sérsic index, b/a is the axis ratio (equivalent to q), and P.A. is the position angle. For the truncation function, labeled as radial2, $R_{\rm break}$ is the break radius, the location at where 99% of the untruncated profile's flux is, and $R_{\rm soft}$ is the softening radius where the flux drops to 1% of the untruncated model's flux. R_s is the scale length for the exponential profile and for the sky background, the three remaining parameters represent the sky value and the flux gradients along the x- and y- direction, in order.

5.1.1 Additional Galaxies

In this section, we briefly discuss the additional galaxies that we have performed preliminarily image decompositions for. These galaxies have unreliable R_e determinations.

NGC 0524

For our preliminary decomposition, we tested a one- and two-component on the HST data for NGC 0524. For the one-component fit, we treated the entire galaxy as a bulge by fitting a single Sérsic profile to the data as shown in Figure 5.12. For the two-component fit, we added an exponential profile to represent a disk. Both

fits resulted in $\chi^2_\nu < 1$, indicating that there is significant oversubtraction in the best-fit models. The residuals for both fits looked similar, so we continue with the one-component fit, resulting in $R_e = 139.62''$. In the residuals, there is indication of a ring of undersubtraction, but that is likely a product of trying to fit the light distribution with the presence of dust. The significant amount of dust in NGC 0524 makes it difficult to pick out missing structures and effectively determine a best-fit model, causing R_e to be unreliable. Consequently, there is a need to further improve on this model by accounting for the dust. There are two main methods that can be explored to mitigate the issue of dust: treating it as bad pixels so that it is disregarded in the fitting routine or interpolating over it.

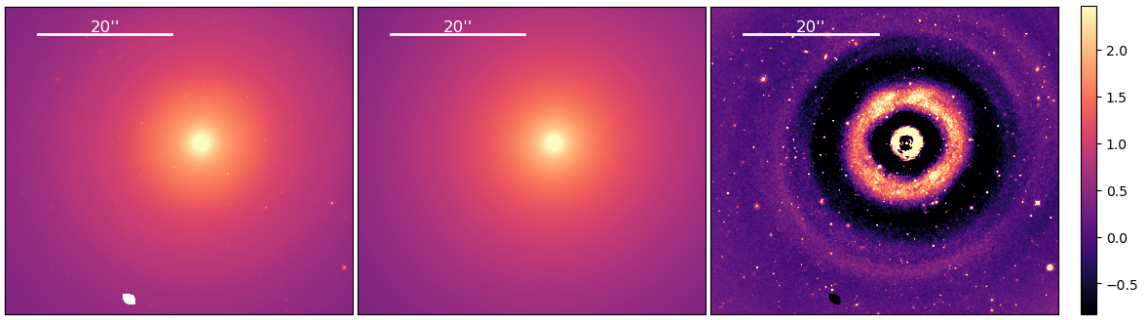

Figure 5.12: NGC 0524's preliminary image decomposition with the F110W image(left), one-component best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F110W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

NGC 4596

In Figure 5.13, we can observe the preliminary model for NGC 4596 which has $\chi^2_\nu = 6.691$. This model was developed using three surface brightness profiles, two Sérsic profiles and one exponential function profile. One Sérsic profile has an index of $n = 6.19$ indicating a bulge component at $R_e = 46.07''$. In the HST F160W image, we can see a clear bar component, and at the ends of it, spiral patterns are beginning.

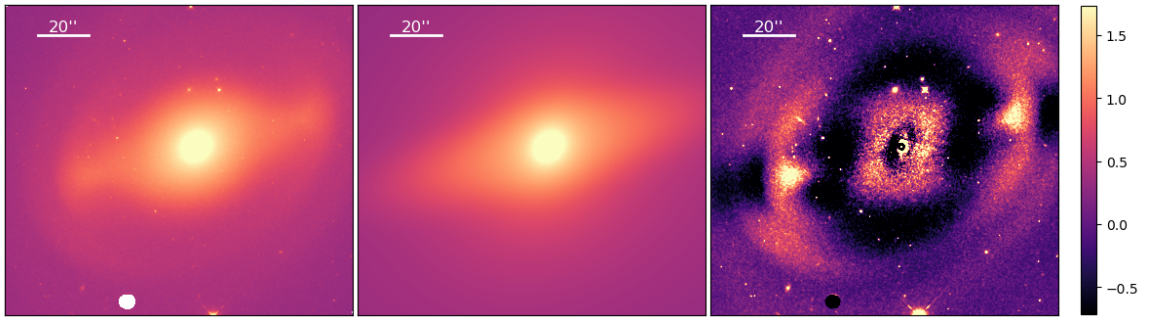

Figure 5.13: NGC 4596's preliminary image decomposition with the F160W image(left), one-component best-fit model(middle), and residual(right). All three images have been cropped to exclude the dead pixels on the edges of the CCD for visualization purposes. The F160W and best-fit model are on a logarithmic stretch while the residual is on a linear stretch. The oversubtracted regions in the residual image are indicated by counts less than 0 and undersubtracted areas by counts higher than 0, according to the bar on the right.

The other Sérsic, with an index of $n = 0.42$ and $b/a = 0.28$, is positioned such that it is modeling the bar component. Finally, we included an exponential function to attempt to model the disk, but GALFIT had difficulty convolving to parameters that were centered at the center of the galaxy. Thus, the exponential function has $\Delta x = 59.87''$, which is off centered. GALFIT was unable to convolve the entire model with the addition of more functions. Clearly, the fitting for this galaxy needs to be improved upon to fix the centroid of this component, and to model the additional structure that can be seen in the residual, such as the bright ansae at the ends of the bar and the spiral arms.

5.2 Discussion on R_e

Through this image decomposition process, we have constrained the effective radius of the bulge, R_e, for each galaxy. It is evident that a full decomposition is necessary in order to properly fit the bulge as there are structural components that cannot be observed simply based on visual inspection and require further investigation. For some cases, such as NGC 3945, we find that the FOV of the HST image does not

encompass the entire galaxy's extent. However, we are not aiming to model the whole galaxy's light distribution in this work, but instead we are focusing on modeling the central region of these galaxies to ensure we obtain an accurate fit for the bulge. Each HST image used for the main sample extends well beyond the bulge, so R_e can be effectively constrained even if larger scale structures remain less certain. Therefore, we are confident that we have a large enough FOV to significantly improve estimates of R_e through our multi-component analysis.

We compare our new R_e values to those reported in Cappellari et al. (2011), where they fit a one-component surface brightness profile to each galaxy, and to the follow-up paper, Cappellari et al. (2013), where they used a multi-Gaussian expansion (MGE) to map the light distribution in each galaxy. The MGE method fits Gaussians to the surface brightness profile of a galaxy and takes R_e to be at the location where at the half-light radius of the entire galaxy. Using the Gaussian at R_e, it circularizes the profile while maintaining the same surface brightness to obtain R_e. While this is a slight improvement to the method of Cappellari et al. (2011), it is not accounting for structure and assumes everything is circular. We find that the values reported in both works overestimate R_e significantly as shown in Table 5.2. In all cases, we find that R_{A_1}, the effective radii in Cappellari et al. (2011), and R_{A_2}, from Cappellari et al. (2013), significantly overestimate the effective radius, when compared to the determined value in this work. The overestimation varies drastically between galaxies. For NGC 3384, R_{A_2} was approximately 11.5 $\times$ the determined radius in this work, while the smallest difference was for NGC 4382, in which R_{A_2} was approximately 3.14 $\times$ R_e. R_{A_1} overestimated the radii by an average of 5.13 $\times$ our estimate of R_e, and R_{A_2}, on average, was 5.88 $\times$ R_e. It is evident that the inclusion of multiple components in the image decomposition is necessary as the R_e determined in this work is significantly smaller than that of the work done in both Cappellari et al. (2011) and Cappellari et al. (2013). This method of fitting is more reliable as we are ensuring that

Comparison of Effective Radii

(1)	(2)	(3)	(4)	(5)	(6)
ID	R_e	R_{A_1}	R_{A_1}/R_e	R_{A_2}	R_{A_2}/R_e
	($''$)	($''$)		($''$)	
NGC 3384	3.16	32.36	10.24	36.56	11.57
NGC 3945	5.96	28.18	4.73	29.72	4.99
NGC 3998	5.42	19.95	3.68	23.99	4.43
NGC 4382	26.35	66.07	2.51	82.79	3.14
NGC 4472	21.29	95.50	4.49	104.47	4.91

Table 5.2: Comparison of effective radius and the stellar velocity dispersion measurements between this work, Cappellari et al. (2011), and Cappellari et al. (2013). Column (1): galaxy name; (2): R_e is the effective radius for each galaxy determined in this work; (3): R_{A_1} is the effective radius from Cappellari et al. (2011); (4) the ratio between R_{A_1} and R_e; (5): R_{A_2} is the effective radius from Cappellari et al. (2013); (6) the ratio between R_{A_2} and R_e.

each component properly accounts for its share of the light distribution. The aid of visual inspection of residuals to perform a decomposition also makes it more reliable. Figure 5.14 provides a visual comparison between R_e, R_{A_1}, and R_{A_2} to emphasize the difference in radii measurements by overlaying circles of radius R_e, R_{A_1}, and R_{A_2} on the SDSS images for each galaxy.

As we have a small sample size, it is not possible to make conclusions about how, or if, the overestimation in R_e is dependent on morphological type or the presence of specific structures; only one of the galaxies is classified as an elliptical, NGC 4472, while the other four galaxies were identified as lenticular types. Furthermore, when comparing the overestimation to the complexity of each galaxy, there is not a significant correlation between the number of functions used and the corresponding overestimation. NGC 3945, the galaxy with the most complex best-fit model, was fit with six components and a truncation function, resulting in an overestimation of 4.99 by Cappellari et al. (2013). NGC 4472 was similarly overestimated by $4.91 \times R_e$ but

was fit with only four components. On the other hand, the galaxy with the largest overestimation, NGC 3384, was modeled using five components. This suggests that it is not possible to apply a simple correction to the entire sample in Batiste et al. (2017b), but instead, independent luminosity function fitting must be done for every galaxy to properly estimate R_e.

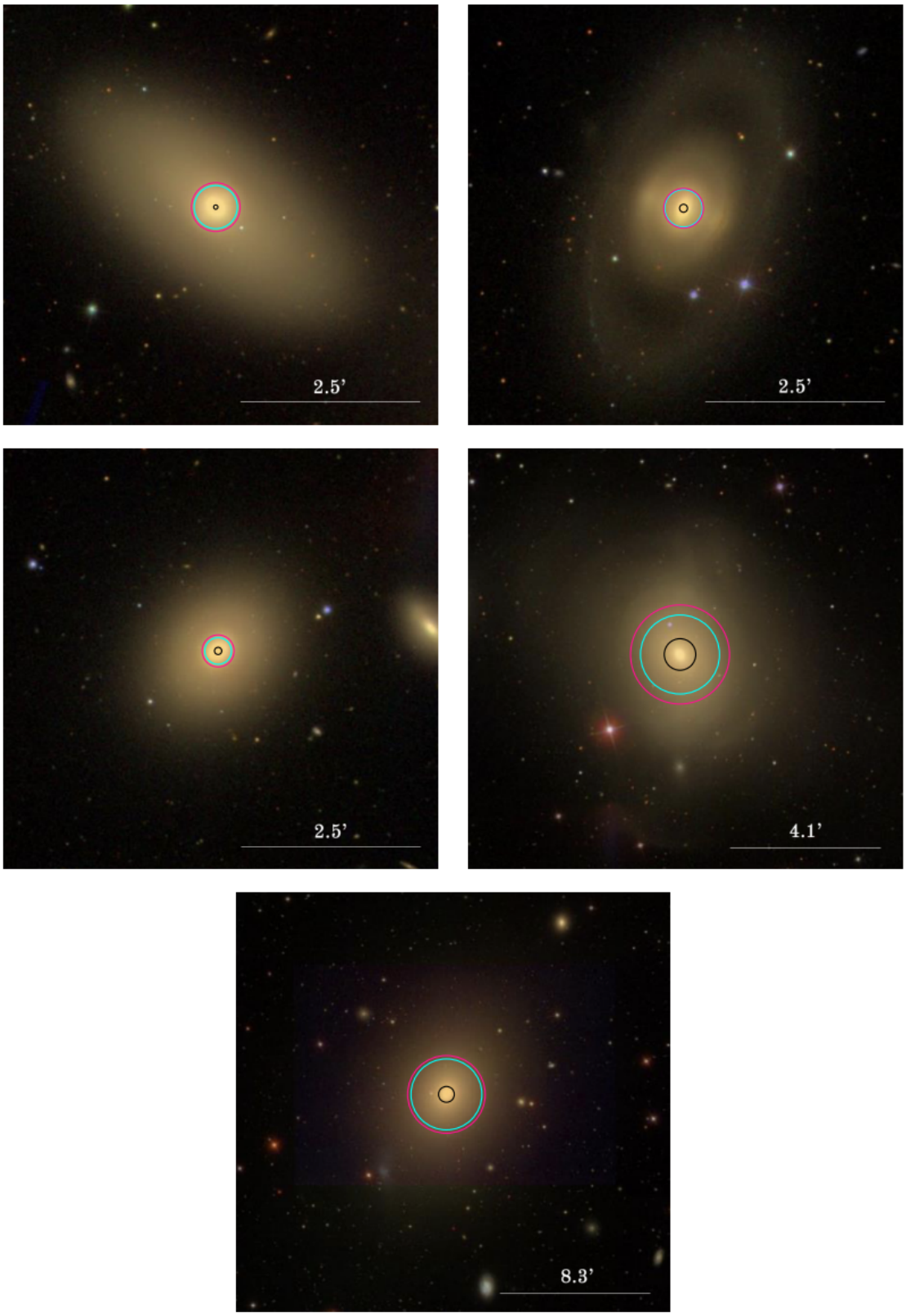

Figure 5.14: The SDSS data overlapped with the effective radii for the main sample. The solid inner black circle indicates R_e from this work, the middle blue circle is R_{A_1}, the effective radius from Cappellari et al. (2011), and the pink, outermost circle is R_{A_2} from Cappellari et al. (2013). In some cases, the R_{A_1} and R_{A_2} were close, making the circles overlap.

Chapter 6

The $M_{\mathbf{BH}} - \sigma_*$ Relation

With estimates of the effective radius for the bulge, R_e, we are able to measure the stellar velocity dispersion within that region. To do so, we utilized Voronoi binned kinematic maps from Cappellari et al. (2011) and Emsellem et al. (2004) for the five galaxies as shown in Figure 6.1, which overlays the effective radii measurements on the maps. Following the method in Batiste et al. (2017a), in which the second moment of the LOSVD is used to find the stellar velocity dispersion, we determine σ_e within our effective radius for each galaxy. For one of the galaxies, NGC 4382, we apply an aperture correction to the calculation of σ_e as R_e extended beyond the Voronoi binned kinematic data, as shown in Figure 6.1. We follow the same procedure that was performed by Cappellari et al. (2013) to correct the estimate of the stellar velocity dispersion within each galaxy's effective radius. Cappellari et al. (2006) provides the corrected stellar velocity dispersion, σ_e:

$$\left(\frac{\sigma_R}{\sigma_e}\right) = \left(\frac{R}{R_e}\right)^{-0.066\pm0.035} \tag{6.1}$$

In Equation 6.1, σ_R is the stellar velocity dispersion at a given radius, R. Here we define σ_R and R to be the values for the maximum extent of the available kinematic data. R_e is the effective radius as determined by the work in this project and σ_e

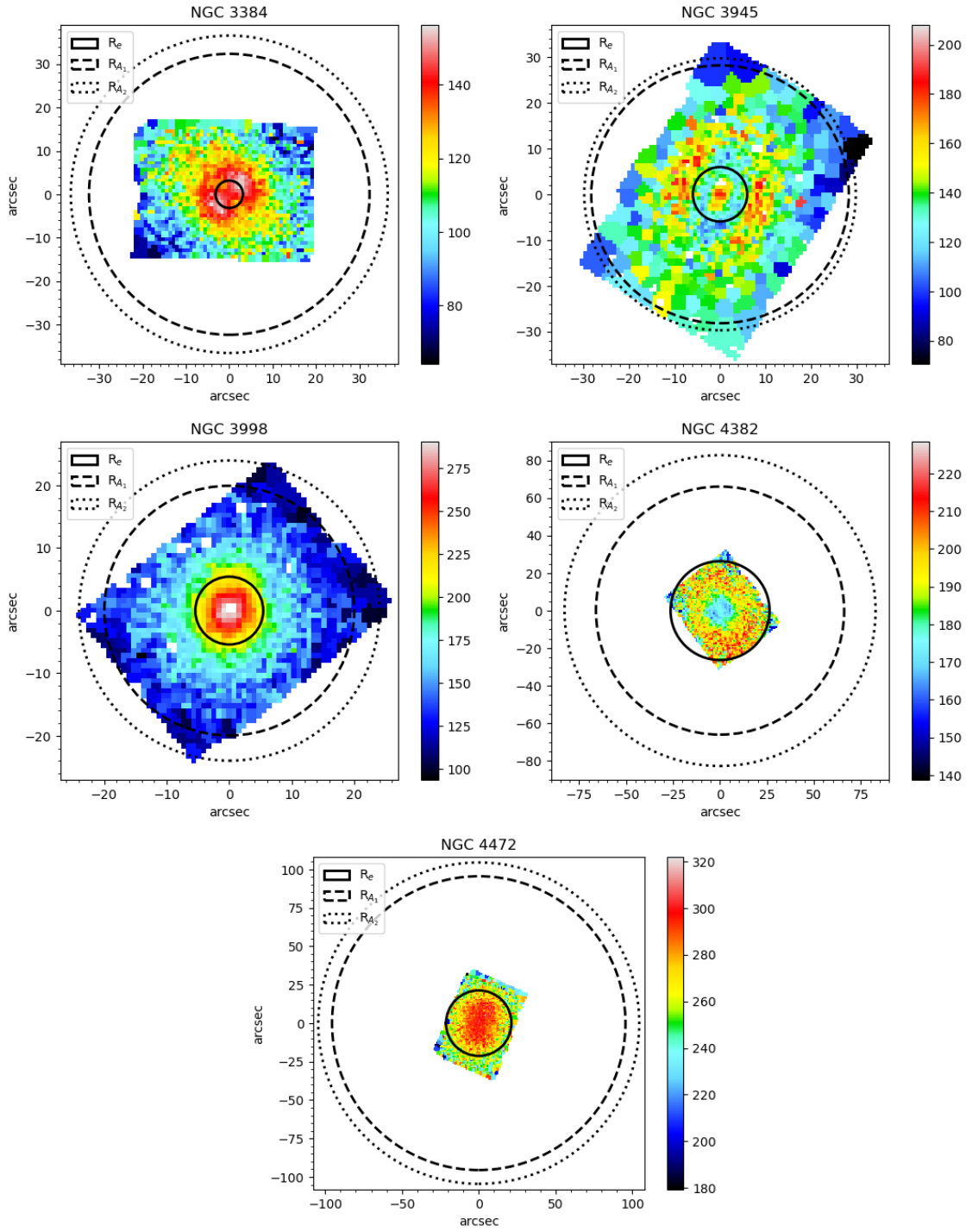

Figure 6.1: The Voronoi binned kinematics from Cappellari et al. (2011) and Emsellem et al. (2004) for the main sample. The axes represent the spatial position and the colors are indicative of the velocities as shown by the scale bar on the right of each map. Higher velocities are indicated by redder colors while lower velocities with blue colors. The solid black circle indicates R_e from this work, the dashed black circle is R_{A_1}, the effective radius from Cappellari et al. (2011), and the dotted black circle is R_{A_2} from Cappellari et al. (2013).

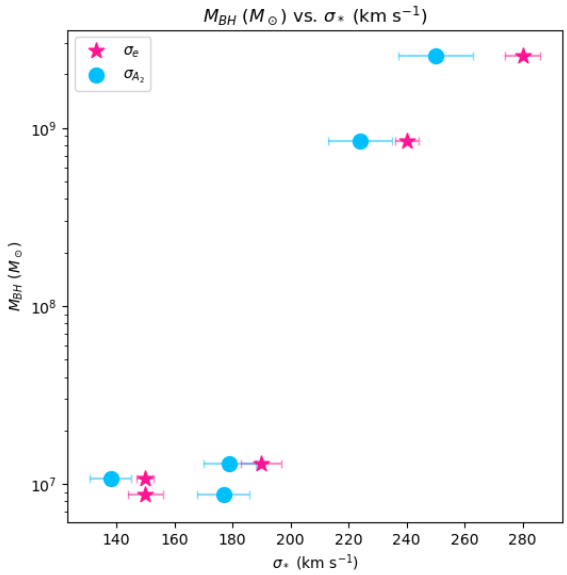

Figure 6.2: $M_{\rm BH}$ as a function of σ_*. This compares σ_* values for each galaxy. The pink stars reflect the σ_e for the estimated R_e in this work and the blue circles represent σ_{A_2} and the R_{A_2} from Cappellari et al. (2013).

is the velocity dispersion at R_e. We did not perform this correction for the rest of the sample as R_e for each galaxy fell within the extent of the kinematic data. Table 6.1 provides the R_e and σ_e, estimated from the kinematic maps in Cappellari et al. (2011) with 1σ in uncertainty for each galaxy, and it additionally includes R_{A_2}, the effective radius quoted in Cappellari et al. (2013), and the corresponding stellar velocity dispersion, σ_{A_2}. With the lower R_e values, we notice a difference between σ_e and σ_{A_2} values as we define a new radius to measure the stellar velocity dispersion within. Overall, σ_e is generally higher than σ_{A_2} in each case except for NGC 3945. The increase in σ_e is expected with the decreased effective radius as it has been shown, for early-type galaxies, that σ_* decreases with radius (Falcón-Barroso et al. (2017)). However, previous literature also indicates that inclined disk galaxies can bias σ_* estimates high due to disk rotation (Bellovary et al. (2014)). As σ_e does not deviate from σ_{A_2} by the similar amount in each case, a simple correction cannot be made to the stellar velocity dispersion values, emphasizing that determining improved R_e measurements through individual decompositions are necessary for each galaxy.

Stellar Velocity Dispersion Values

(1)	(2)	(3)	(4)	(5)	(6)
ID	R_e	R_{A_2}	σ_e	Std. Deviation	σ_{A_2}
	($''$)	($''$)	(km s^{-1})	(km s^{-1})	(km s^{-1})
NGC 3384	3.16	36.56	150 ± 3	5	138 ± 7
NGC 3945	5.96	29.72	150 ± 6	13	177 ± 9
NGC 3998	5.42	23.99	240 ± 4	20	224 ± 11
NGC 4382	26.35	82.79	190 ± 7	11	179 ± 9
NGC 4472	21.29	104.47	280 ± 6	15	250 ± 13

Table 6.1: Comparison of the stellar velocity dispersion measurements between this work and Cappellari et al. (2013). Column (1): galaxy name; (2): R_e is the effective radius for each galaxy determined in this work; (3): R_{A_2} is the effective radius from Cappellari et al. (2013); (4) σ_e is the averaged stellar velocity dispersion within R_e; (5) standard deviation for σ_e; (6) σ_{A_2} is the stellar velocity dispersion within R_{A_2} from Cappellari et al. (2013)

With improved estimates of σ_e, we are able to investigate how these new values can impact the $M_{\rm BH}$ – σ_* relation. The general $M_{\rm BH}$ – σ_* relation is of the following form:

$$\log\left(\frac{M_{\rm BH}}{M_\odot}\right) = \alpha + \beta \log\left(\frac{\sigma_*}{200 \text{ km s}^{-1}}\right) \tag{6.2}$$

In Batiste et al. (2017a), the best-fit relation for the larger quiescent sample using the Bayesian LINMIX_ERR routine (Kelly (2007)) is found to be:

$$\log\left(\frac{M_{\rm BH}}{M_\odot}\right) = (8.66 \pm 0.09) + (4.76 \pm 0.60) \log\left(\frac{\sigma_*}{200 \text{ km s}^{-1}}\right) \tag{6.3}$$

This relation was fitted using a standard forward regression model and $M_{\rm BH}$ data from Kormendy & Ho (2013). For quiescent galaxies, $M_{\rm BH}$ – σ_* can be seen in Figure 1.1, represented by the grey dotted line. When comparing to literature values, the slope in Equation 6.3 is consistent with the one from the parametrization in Kormendy & Ho (2013), but the intercept is higher. The difference in intercepts likely arises due

to the stellar velocity dispersion measurements from the ATLAS^{3D} data, which are lower than the literature values. This causes the $M_{\rm BH} - \sigma_*$ to be shifted to the left with an increased intercept. As this sample is small, we do not fit a best fit line to these data points, but we instead discuss the impact. The improved σ_e values from this work generally increased with the improved values of R_e when compared to the values determined from Cappellari et al. (2013) as shown in Figure 6.2. These new estimates will cause the relation to be shifted slightly to the right. If this same general trend is found in majority of the quiescent galaxies in Batiste et al. (2017b), then the intercept will decrease with the improved σ_e. Assuming that R_e for each galaxy is overestimated and σ_e is biased low, we expect the relation to shift towards the right with improved image decompositions and R_e measurements for the rest of the sample. Thus, it is necessary to continue investigating the rest of the sample to perform a similar analysis in finding R_e and estimating σ_e to refine $M_{\rm BH} - \sigma_*$.

Chapter 7

Conclusions and Future Work

In this project, our objective was to improve R_e measurements for a subset of galaxies from the quiescent sample of Batiste et al. (2017b) in order to make more accurate measurements of σ_* and investigate the affects of these improved measurements on the best-fitting $M_{\rm BH} - \sigma_*$ relation. As discussed in Batiste et al. (2017b), the determination of R_e, the effective radius of the bulge, is crucial in constraining this relation and the poor measurements of R_e will sytematically affect σ_*. Thus, for the five galaxies in the main sample, NGC 3384, NGC 3945, NGC 3998, NGC 4382 and NGC 4472, we utilize the 2D image decomposition algorithm, GALFIT, to develop surface brightness models and isolate the bulge from the rest of the galaxy structure. From these best-fit models, we were able to extract R_e for each galaxy's bulge and found, in comparison to the work done in Cappellari et al. (2013), our R_e values were significantly smaller. We performed preliminary image decompositions on two additional galaxies, but due to factors such as dust and FOV size, we consider the determined R_e values to be less reliable than those from the main sample as the residuals indicate significant leftover structure. We additionally estimated σ_e within R_e for each galaxy in the main sample using SAURON IFS kinematic data obtained from Cappellari et al. (2011) and Emsellem et al. (2004). We found that σ_e at R_e was generally higher compared

to the stellar velocity dispersion values in Cappellari et al. (2013) but this was not true for every case, specifically for NGC 3945. Using the estimates of σ_e and $M_{\rm BH}$ from Kormendy & Ho (2013), we examine the impact of improved σ_e values on the $M_{\rm BH}$ – σ_* relation. If the same trend is true for the rest of the larger sample in Batiste et al. (2017b), then we expect the $M_{\rm BH}$ – σ_* relation to shift more towards the right. This would cause the intercept to decrease and fall closer to values in the literature. In the future, we seek to develop 2D luminosity profiles for the other quiescent galaxies presented in Batiste et al. (2017b), including improving those part of the group of additional galaxies with unreliable R_e determinations in this work. With an improved $M_{\rm BH}$ – σ_* relation for quiescent galaxies, we will be able to better constrain the estimate of f to determine $M_{\rm BH}$ for AGN-host galaxies and understand the underlying physics connecting $M_{\rm BH}$ and σ_*.

Chapter 8

Appendix

The parameter space explored for each of the galaxies is shown below. This is an output log from GALFIT that is updated with every run. The first column indicates the profile used. Each profile follows with the final parameters that GALFIT convolved to. These parameters are in pixels rather than arcseconds. The second line under each profile reflects the statistical error for each parameter. For the `sersic` profile, the order of parameters goes as such: $(x_0,\, y_0)$, $m_{\rm tot}$, R_e, n, $q = b/a$, and $\theta_{\rm P.A.}$. The `radial2` profile is a truncation of the `sersic` preceding that component, and its parameters, in order, are: $(x_0,\, y_0)$, $R_{\rm break}$, $R_{\rm soft}$, $q = b/a$, and $\theta_{\rm P.A.}$. For the `expdisk` profile, the order of parameters goes as such: $(x_0,\, y_0)$, $m_{\rm tot}$, R_s, $q = b/a$, and $\theta_{\rm P.A.}$. The order of the `psf` profile parameters is: $(x_0,\, y_0)$ and $m_{\rm tot}$. For the `sky` profile, the order is: $(x_0,\, y_0)$, sky, $\frac{{\rm d}sky}{{\rm d}x}$, and $\frac{{\rm d}sky}{{\rm d}y}$. If values are in brackets, that indicates a value that was fixed by the user. Any value surrounded by asterisks are parameters that GALFIT could not convolve and are not physical values. The `Chi^2/nu` value indicates the goodness-of-fit value.

8.1 Output Log of NGC 0524

```
Input image     : ngc0524_drz.fits[1][1:1091,1:973]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc0524.fits

 expdisk   : (  638.69,   533.78)   13.51     *0.01*  *0.07*  -84.45
             (    0.00,     0.00)    0.00     *0.00*  *0.00*    0.00
 sersic    : (  609.58,   531.30)    3.58   1068.56    5.95    0.96   -69.00
             (    0.00,     0.00)    0.00      1.86    0.00    0.00     0.15
 sky       : [546.00, 487.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 457662.61532,  ndof = 1061530
 Chi^2/nu = 0.431

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc0524_drz.fits[1][1:1091,1:973]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc0524.fits

 sersic    : (  609.59,   531.30)    3.58   1064.69    5.95    0.96   -69.30
             (    0.00,     0.00)    0.00      1.85    0.00    0.00     0.15
 sky       : [546.00, 487.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 458274.22265,  ndof = 1061536
 Chi^2/nu = 0.432

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc0524_drz.fits[1][1:1091,1:973]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc0524.fits

 expdisk   : (  609.31,   530.08)    5.65    378.17    0.86   -43.98
             (    0.29,     0.35)    0.01      1.43    0.00     0.61
 sersic    : (  609.60,   531.31)    4.31    425.55    4.79    0.96   -73.64
```

```
             (    0.00,     0.00)    0.01       3.03    0.01    0.00      0.18
 sky       : [546.00, 487.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 467887.51544,  ndof = 1061530
 Chi^2/nu = 0.441

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc0524_drz.fits[1][1:1100,1:973]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc0524.fits

 sersic    : (  609.59,   531.30)    3.58   1073.99    5.96    0.96   -69.21
             (    0.00,     0.00)    0.00      1.87    0.00    0.00      0.15
 sky       : [550.50, 487.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 457561.13643,  ndof = 1056299
 Chi^2/nu = 0.433

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc0524_drz.fits[1][1:1100,1:973]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc0524.fits

 expdisk   : (  586.31,   497.60)    5.40   1489.10    0.44   -37.90
             (    4.41,     5.99)    0.08    126.24    0.03     0.86
 sersic    : (  609.59,   531.30)    3.83    761.04    5.49    0.96   -71.70
             (    0.00,     0.00)    0.00      4.11    0.01    0.00      0.17
 sky       : [550.50, 487.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 457488.28594,  ndof = 1056293
 Chi^2/nu = 0.433

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

```
Input image     : ngc0524_drz.fits[1][1:1100,1:973]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc0524.fits

 expdisk   : (  456.22,   369.65)    3.98   8484.93    0.10   -43.47
             (  103.61,   109.41)    0.60   4656.62    0.05     0.97
 sersic    : (  609.59,   531.30)    3.72    883.42    5.69    0.96   -70.57
             (    0.00,     0.00)    0.00      3.11    0.01    0.00     0.17
 sky       : [550.50, 487.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 456407.63833,  ndof = 1056293
 Chi^2/nu = 0.432

--------------------------------------------------------------------------------
```

8.2 Output Log of NGC 3384

```
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc3384.fits

 gaussian  : ( 3803.90,   774.99)   23.82      0.72   *0.05* [-90.00]
             (   27.53, 46960372.00) 66421.33      4.84 *103774.89*    [0.00]
 sersic    : ( 2143.67,  2131.54)    7.32    233.40    2.48    0.94  [-90.00]
             (    0.02,     0.01)    0.00      0.07    0.00    0.00    [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6643393.87333,  ndof = 16192565
 Chi^2/nu = 0.410

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
```

```
Restart file    : galfit.02
Output image    : ngc3384.fits

 sersic    : ( 2143.69,  2131.53)    7.32    233.34    2.48    0.94  [-90.00]
             (    0.02,     0.01)    0.00      0.07    0.00    0.00    [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6643380.84971,  ndof = 16192570
 Chi^2/nu = 0.410

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc3384.fits

 sersic    : ( 2142.09,  2129.87)    8.26    720.47    3.18   *0.03* [-90.00]
             (    0.00,     0.00)    0.00      0.00    0.00   *0.00*   [0.00]
 expdisk   : ( 2242.46,  2229.87)  *67.13*    *0.01*   0.63  [-90.00]
             (872803012103954969395 2.00, 52172867491697587650 56.00) *859192233310115856384 0.00* *10
[0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 37452313.62574,  ndof = 16192565
 Chi^2/nu = 2.313

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc3384.fits

 sersic    : ( 2143.96,  2131.56)    7.32    233.61    2.49    0.94  [-90.00]
             (     nan,      nan)     nan       nan     nan     nan    [0.00]
 expdisk   : ( 2143.79,  2315.77) *124.39*    *0.02*   0.13  [-89.70]
             (     nan,      nan)    *nan*     *nan*    nan    [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 6644978.90415,  ndof = 16192565
 Chi^2/nu = 0.410

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc3384.fits

 sersic    : ( 2142.09,  2129.87)    8.26    720.47    3.18   *0.03* [-90.00]
             (    0.00,     0.00)    0.00      0.00    0.00   *0.00*   [0.00]
 expdisk   : ( 2242.46,  2229.87)  *67.13*    *0.01*   0.63  [-90.00]
             (872803012103954969395 2.00, 5217286749169758765056.00) *8591922333101158563840.00* *10
[0.00]
 sky       : [2012.50, 2012.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 37452313.62574,  ndof = 16192565
 Chi^2/nu = 2.313

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc3384.fits

 sersic    : ( 2142.09,  2129.87)    8.26    720.47    3.18   *0.03* [-90.00]
             (    0.00,     0.00)    0.00      0.00    0.00   *0.00*   [0.00]
 expdisk   : ( 2242.46,  2229.87)  *67.13*    *0.01*   0.63  [-90.00]
             (872803012103954969395 2.00, 5217286749169758765056.00) *8591922333101158563840.00* *10
[0.00]
 sky       : [2012.50, 2012.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 37452313.62574,  ndof = 16192565
 Chi^2/nu = 2.313

--------------------------------------------------------------------------------
```

```
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc3384.fits

 sersic    : ( 2143.23,  2130.60)    7.23    312.30    2.87    0.68   -51.41
             (    0.02,     0.01)    0.00      0.10    0.00    0.00     0.02
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5875832.78712,  ndof = 16192569
 Chi^2/nu = 0.363

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc3384.fits

 sersic    : ( 2142.74,  2129.83)    7.90    127.47    2.04    0.95  [-51.41]
             (    0.01,     0.01)    0.00      0.09    0.00    0.00    [0.00]
 expdisk   : ( 2155.14,  2151.62)    7.96    536.36    0.44   -51.22
             (    0.14,     0.11)    0.00      0.30    0.00     0.01
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4823776.77816,  ndof = 16192564
 Chi^2/nu = 0.298

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc3384.fits

 sersic    : ( 2142.50,  2129.83)    7.36    248.99    2.55    0.74  [-51.41]
             (    0.02,     0.01)    0.00      0.14    0.00    0.00    [0.00]
```

```
 expdisk   : ( 2701.57,  2625.40)    9.21  [1000.00]  [0.44] [-51.22]
             (    2.00,     1.69)    0.00     [0.00]  [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5672350.08495,  ndof = 16192567
 Chi^2/nu = 0.350

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])  [7.31]   [20.00]  [2.87]  [0.68] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ([2143.23], [2130.60])   7.85  [1000.00]  [0.44] [-51.22]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 98096344.12711,  ndof = 16192575
 Chi^2/nu = 6.058

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])  [7.31]   [20.00]  [2.87]  [0.68] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ([2143.23], [2130.60])  [7.85]   485.32   [0.44] [-51.22]
             (   [0.00],   [0.00])  [0.00]     0.48   [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 94693751.64548,  ndof = 16192575
 Chi^2/nu = 5.848
```

```
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])  [7.31]   [20.00]  [2.87]  [0.68] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ([2143.23], [2130.60])   7.67    426.39    0.54  [-51.22]
             (   [0.00],   [0.00])   0.00      0.46    0.00    [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 94372330.31881,  ndof = 16192573
 Chi^2/nu = 5.828

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])  [7.91]  [127.00]  [2.04]  [0.95] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ([2143.23], [2130.60])   7.96   [534.00]  [0.44] [-51.22]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4831353.32901,  ndof = 16192575
 Chi^2/nu = 0.298

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc3384.fits
```

```
 sersic    : ([2143.23], [2130.60])  13.79     11.25   [2.04]  [0.95] [-51.41]
             (   [0.00],   [0.00])   0.02      0.54   [0.00]  [0.00]   [0.00]
 sersic    : ([2143.23], [2130.60])  [7.91]  [127.00]  [2.04]  [0.95] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ([2143.23], [2130.60])  [7.96]  [534.00]  [0.44] [-51.22]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4830269.30666,  ndof = 16192574
 Chi^2/nu = 0.298

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60]) [13.19]   [11.25]  [4.75]  [0.95]  -55.88
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   29.12
 sersic    : ([2143.23], [2130.60])  [7.91]  [127.00]  [2.04]  [0.95] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ([2143.23], [2130.60])  [7.96]  [534.00]  [0.44] [-51.22]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4831528.15477,  ndof = 16192575
 Chi^2/nu = 0.298

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.10
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])  [7.91]  [127.00]  [2.04]  [0.95] [-51.41]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
```

```
 expdisk   : ( 2154.00,  2149.84)   [7.96]   [534.00]   [0.44] [-51.22]
             (    0.14,     0.11)   [0.00]     [0.00]   [0.00]    [0.00]
 sky       : [2012.50, 2012.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 4824794.38018,  ndof = 16192574
 Chi^2/nu = 0.298

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])   [7.91]   [127.00]   [2.04]   [0.95] [-51.41]
             (   [0.00],   [0.00])   [0.00]     [0.00]   [0.00]   [0.00]    [0.00]
 expdisk   : ( 2154.00,  2149.84)   [7.96]   [534.00]   [0.44] [-51.22]
             (    0.14,     0.11)   [0.00]     [0.00]   [0.00]    [0.00]
 sky       : [2012.50, 2012.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 4800919.74611,  ndof = 16192574
 Chi^2/nu = 0.296

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])   [7.91]   [127.00]   [2.04]    1.00   [-51.41]
             (   [0.00],   [0.00])   [0.00]     [0.00]   [0.00]    0.00     [0.00]
 sky       : [2012.50, 2012.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 9522390.35771,  ndof = 16192575
 Chi^2/nu = 0.588

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc3384.fits

 sersic    : ([2143.23], [2130.60])   7.60    [127.00]  [2.04]  [0.95] [-51.41]
             (   [0.00],   [0.00])   0.00      [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 8835817.40740,  ndof = 16192575
 Chi^2/nu = 0.546

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc3384.fits

 sersic    : ( 2142.83,  2129.22)    7.90    128.45    2.07    0.95   -57.06
             (    0.01,     0.01)    0.00      0.09    0.00    0.00     0.16
 expdisk   : ( 2155.19,  2152.90)    7.97    537.58    0.44   -51.12
             (    0.13,     0.11)    0.00      0.30    0.00     0.01
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4796619.07620,  ndof = 16192563
 Chi^2/nu = 0.296

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc3384.fits

 sersic    : ( 2143.14,  2127.11)    8.52    185.97    0.96    0.76    33.64
             (    0.03,     0.03)    0.00      0.17    0.00    0.00     0.04
 sersic    : ( 2143.12,  2129.50)    9.05     70.47    1.48    0.53   -56.12
```

```
             (    0.02,     0.01)    0.00      0.08    0.00    0.00     0.03
 expdisk    : ( 2152.13,  2150.49)    7.85    507.61    0.46   -51.36
             (    0.12,     0.10)    0.00      0.21    0.00     0.01
 sky        : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4615021.19616,  ndof = 16192556
 Chi^2/nu = 0.285

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc3384.fits

 sersic     : ( 2143.72,  2126.45)    8.53    185.51    0.95    0.75    33.72
             (    0.03,     0.03)    0.00      0.17    0.00    0.00     0.05
 sersic     : ( 2143.17,  2129.50)    9.06     70.24    1.49    0.52   -56.32
             (    0.02,     0.01)    0.00      0.08    0.00    0.00     0.03
 expdisk    : ( 2152.08,  2150.41)    7.85    506.19    0.46   -51.35
             (    0.12,     0.10)    0.00      0.21    0.00     0.01
 sky        : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4614200.25455,  ndof = 16192556
 Chi^2/nu = 0.285

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc3384.fits

 sersic     : ( 2105.97,  2150.37)   10.21    656.24    0.16    0.89    55.78
             (    0.56,     0.42)    0.00      0.73    0.00    0.00     0.31
 sersic     : ( 2143.18,  2129.47)    8.99     67.23    1.43    0.56   -56.34
             (    0.02,     0.01)    0.00      0.07    0.00    0.00     0.03
 sersic     : ( 2143.31,  2126.64)    8.59    184.52    0.72    0.79    33.28
             (    0.04,     0.05)    0.00      0.15    0.00    0.00     0.06
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```
 expdisk   : ( 2157.92,  2151.69)    7.96    533.29    0.42   -51.08
             (    0.13,     0.11)    0.00      0.23    0.00     0.01
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4551423.20493,  ndof = 16192549
 Chi^2/nu = 0.281

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc3384.fits

 sersic    : ( 2142.55,  2126.50)    8.47    184.66    0.93    0.79    33.82
             (    0.04,     0.05)    0.00      0.01    0.00    0.00     0.01
 sersic    : ( 2142.09,  2129.94)    9.22     68.33    0.80    0.53   -55.72
             (    0.01,     0.00)    0.00      0.00    0.00    0.00     0.00
 gaussian  : ( 2138.35,  2129.72)   10.02     [0.50]  *0.02*  -54.50
             (    0.00,     0.00)    0.00     [0.00]  *0.00*    0.00
 expdisk   : ( 2151.90,  2150.28)    7.84    504.07    0.46   -51.40
             (    0.19,     0.15)    0.00      0.34    0.00     0.02
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 11257245.55082,  ndof = 16192551
 Chi^2/nu = 0.695

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc3384.fits

 sersic    : ( 2142.69,  2125.86)    8.54    188.08    0.93    0.76    34.05
             (    0.03,     0.04)    0.00      0.04    0.00    0.00     0.00
 sersic    : ( 2142.01,  2130.24)    9.08     72.60    1.20    0.54   -55.52
             (    0.00,     0.00)    0.00      0.01    0.00    0.00     0.00
 gaussian  : ( 2142.48,  2129.50)   12.72     *0.01*   0.48   -30.58
```

```
             (    0.00,     0.00)    0.00     *0.00*   0.00     0.00
 expdisk   : ( 2151.81,  2150.64)    7.84    505.58    0.46   -51.37
             (    0.12,     0.09)    0.00      0.21    0.00     0.01
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4580623.41144,  ndof = 16192550
 Chi^2/nu = 0.283

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Input image     : NGC3384_drz.fits[1][1:4024,1:4024]
Init. par. file : input.txt
Restart file    : galfit.11
Output image    : ngc3384.fits

 sersic    : ( 2142.77,  2125.87)    8.55    189.33    0.92    0.76    34.03
             (    0.04,     0.04)    0.00      0.17    0.00    0.00     0.05
 sersic    : ( 2141.96,  2130.15)    9.08     73.31    1.16    0.55   -55.57
             (    0.02,     0.01)    0.00      0.07    0.00    0.00     0.03
 sersic    : ( 2142.81,  2129.71)   12.30      0.92  *10.67*  *0.03*  -49.69
             (    0.14,     0.15)    0.03      0.08   *1.34*  *0.00*    0.36
 expdisk   : ( 2151.74,  2150.59)    7.84    505.13    0.46   -51.37
             (    0.12,     0.09)    0.00      0.20    0.00     0.01
 sky       : [2012.50, 2012.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4575860.08329,  ndof = 16192549
 Chi^2/nu = 0.283

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.12
Output image    : ngc3384.fits

 sersic    : ( 2142.59,  2127.37)    8.34    175.34    0.85    0.89    30.34
             (    0.02,     0.02)    0.00      0.09    0.00    0.00     0.07
 sersic    : ( 2141.87,  2130.17)    9.34     65.09    0.91    0.56   -53.76
             (    0.01,     0.01)    0.00      0.03    0.00    0.00     0.03
```

```
 sersic    : ( 2142.74,  2129.85)   10.93     97.13  *20.00*   0.29   -68.40
             (    0.01,     0.01)    0.03      8.87   *0.44*   0.00     0.12
 expdisk   : ( 2152.75,  2152.70)    7.76    636.96    0.47   -51.33
             (    0.10,     0.08)    0.00      0.28    0.00     0.01
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 783800.81791,  ndof = 6164974
 Chi^2/nu = 0.127

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.13
Output image    : ngc3384.fits

 sersic    : ( 2142.48,  2127.31)    8.42    181.01    0.86    0.86    31.64
             (    0.02,     0.02)    0.00      0.10    0.00    0.00     0.05
 sersic    : ( 2142.18,  2130.03)    9.05     69.39    1.49    0.55   -55.54
             (    0.01,     0.01)    0.00      0.06    0.00    0.00     0.02
 expdisk   : ( 2152.54,  2152.09)    7.75    634.45    0.47   -51.72
             (    0.10,     0.08)    0.00      0.31    0.00     0.01
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 807975.65547,  ndof = 6164981
 Chi^2/nu = 0.131

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.14
Output image    : ngc3384.fits

 sersic    : ( 2155.09,  2167.45)    8.49   1193.12    0.27    0.48   -50.72
             (    0.22,     0.20)    0.00      0.69    0.00    0.00     0.01
 sersic    : ( 2142.16,  2129.97)    9.09     65.10    1.38    0.56   -55.70
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2141.75,  2128.01)    8.47    180.07    0.80    0.86    28.44
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```
             (    0.02,     0.02)    0.00      0.10    0.00    0.00     0.06
 expdisk   : ( 2151.54,  2141.92)    8.75    336.61    0.52   -54.00
             (    0.12,     0.12)    0.00      1.61    0.00     0.01
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 737281.17358,  ndof = 6164974
 Chi^2/nu = 0.120

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.15
Output image    : ngc3384.fits

 sersic    : ( 2142.20,  2129.99)    9.07     66.74    1.42    0.56   -55.38
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2141.40,  2128.21)    8.47    186.66    0.82    0.82    25.28
             (    0.03,     0.03)    0.00      0.11    0.00    0.00     0.05
 sersic    : ( 2151.48,  2166.21)    8.61   1180.37    0.24    0.50   -51.37
             (    0.18,     0.17)    0.01      0.65    0.00    0.00     0.01
 expdisk   : ( 2153.12,  2146.31)    8.78    391.80    0.46   -49.70
             (    0.16,     0.12)    0.01      1.79    0.00     0.03
 expdisk   : ( 2157.63,  2127.20)   10.85    269.00    0.33   -84.00
             (    0.91,     0.29)    0.01      1.19    0.00     0.07
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 732941.45728,  ndof = 6164968
 Chi^2/nu = 0.119

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.16
Output image    : ngc3384.fits

 sersic    : ( 2142.19,  2129.99)    9.06     67.14    1.43    0.56   -55.24
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
```

```
 sersic    : ( 2141.40,  2128.18)    8.50    187.56    0.81    0.81    24.82
             (    0.03,     0.03)    0.00      0.11    0.00    0.00     0.05
 sersic    : ( 2151.90,  2166.62)    8.62   1184.04    0.24    0.50   -51.38
             (    0.20,     0.16)    0.01      0.66    0.00    0.00     0.01
 expdisk   : ( 2153.01,  2145.70)    8.74    387.20    0.47   -50.21
             (    0.13,     0.12)    0.01      1.71    0.00     0.02
 expdisk   : ( 2154.11,  2126.83)   10.89    243.60    0.33   -85.87
             (    0.84,     0.23)    0.01      1.09    0.00     0.07
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 732887.06139,  ndof = 6164968
 Chi^2/nu = 0.119

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.17
Output image    : ngc3384.fits

 sersic    : ( 2142.15,  2129.97)    8.99     71.92    1.57    0.56   -55.29
             (    0.01,     0.01)    0.00      0.08    0.00    0.00     0.02
 sersic    : ( 2142.78,  2128.49)    8.59    187.91    0.82    0.79    25.91
             (    0.03,     0.06)    0.00      0.11    0.00    0.00     0.04
 sersic    : ( 2168.45,  2166.53)    8.98    832.36    0.44    0.45   -53.60
             (    0.18,     0.18)    0.01      1.93    0.00    0.00     0.03
 sersic    : ( 2139.19,  2157.22)    8.86   1259.72    0.14    0.52   -49.80
             (    0.36,     0.37)    0.01      0.83    0.00    0.00     0.02
 expdisk   : ( 2131.49,  2123.30)   10.19    285.40    0.43   -33.90
             (    0.55,     0.49)    0.01      2.31    0.00     0.08
 expdisk   : ( 2147.90,  2132.89)    9.99    200.21    0.51   -79.69
             (    0.29,     0.20)    0.01      1.08    0.00     0.08
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 723112.26743,  ndof = 6164961
 Chi^2/nu = 0.117

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.18
Output image    : ngc3384.fits

 sersic    : ( 2142.31,  2130.01)    9.00     70.89    1.52    0.56   -55.47
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.03
 sersic    : ( 2142.76,  2127.21)    8.73    199.66    0.79    0.71    29.69
             (    0.04,     0.05)    0.00      0.13    0.00    0.00     0.04
 sersic    : ( 2146.18,  2162.38)    8.69   1159.46    0.21    0.52   -50.76
             (    0.19,     0.18)    0.00      0.50    0.00    0.00     0.02
 sersic    : ( 2128.05,  2124.26)   10.38    361.76    1.08    0.39   -21.46
             (    0.28,     0.43)    0.01      1.84    0.00    0.00     0.06
 expdisk   : ( 2160.32,  2154.70)    8.86    445.95    0.40   -52.90
             (    0.18,     0.13)    0.00      1.62    0.00     0.01
 expdisk   : ( 2149.84,  2128.53)   10.11    201.33    0.42   -87.53
             (    0.34,     0.12)    0.01      0.58    0.00     0.05
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 729146.95145,  ndof = 6164961
 Chi^2/nu = 0.118

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.19
Output image    : ngc3384.fits

 sersic    : ( 2142.16,  2129.94)    8.81     85.13    1.77    0.55   -54.02
             (    0.01,     0.01)    0.00      0.10    0.00    0.00     0.02
 sersic    : ( 2142.13,  2129.61)    8.93    169.57    0.78    0.74    26.87
             (    0.04,     0.04)    0.00      0.18    0.00    0.00     0.05
 sersic    : ( 2151.15,  2167.69)    8.82   1328.75    0.13    0.50   -49.48
             (    0.39,     0.36)    0.01      1.84    0.00    0.00     0.03
 sersic    : ( 2155.19,  2155.22)    8.75    781.84    0.39    0.50   -51.98
             (    0.15,     0.09)    0.01      1.61    0.00    0.00     0.01
 sersic    : ( 2143.49,  2125.91)    9.60    274.79    0.38    0.85   -48.18
             (    0.13,     0.14)    0.00      0.48    0.00    0.00     0.17
 expdisk   : ( 2687.72,  2337.98)   12.77   1015.26    0.15   -79.50
```

```
             (   22.82,     4.61)    0.04     48.23    0.00     0.26
 expdisk    : ( 2145.70,  2130.24)   11.62    138.97    0.29    89.29
             (    0.57,     0.25)    0.01      1.07    0.00     0.07
 sky        : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 719797.52111,  ndof = 6164954
 Chi^2/nu = 0.117

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.20
Output image    : ngc3384.fits

 sersic     : ( 2142.23,  2130.12)    9.07     71.93    1.56    0.53   -55.56
             (    0.01,     0.01)    0.00      0.06    0.00    0.00     0.02
 sersic     : ( 2142.35,  2127.02)    8.36    184.91    0.99    0.84    29.75
             (    0.02,     0.02)    0.00      0.11    0.00    0.00     0.04
 expdisk    : ( 2143.77,  2157.80)    7.98    748.36    0.41   -44.02
             (    0.19,     0.16)    0.00      0.99    0.00     0.03
 expdisk    : ( 2201.74,  2153.57)    9.42    614.54    0.34   -73.19
             (    0.59,     0.26)    0.01      1.47    0.00     0.04
 sky        : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 794042.41929,  ndof = 6164975
 Chi^2/nu = 0.129

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.21
Output image    : ngc3384.fits

 sersic     : ( 2142.15,  2130.04)    8.93     75.38    1.59    0.56   -55.41
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic     : ( 2150.16,  2128.64)    9.46    291.68    1.14    0.66    75.86
             (    0.18,     0.15)    0.01      1.43    0.00    0.00     0.09
```

```
 sersic    : ( 2141.50,  2125.27)    8.87    188.78    0.77    0.74    17.33
             (    0.05,     0.07)    0.01      0.13    0.00    0.00     0.07
 expdisk   : ( 2128.23,  2150.77)    8.26    721.72    0.41   -38.19
             (    0.26,     0.23)    0.00      1.12    0.00     0.06
 expdisk   : ( 2220.77,  2177.96)    8.82    830.91    0.31   -65.22
             (    0.83,     0.42)    0.01      3.54    0.00     0.04
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 786490.74513,  ndof = 6164968
 Chi^2/nu = 0.128

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.22
Output image    : ngc3384.fits

 sersic    : ( 2142.19,  2129.99)    9.06     66.86    1.42    0.56   -55.31
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2151.82,  2166.43)    8.61   1182.16    0.24    0.50   -51.41
             (    0.19,     0.16)    0.01      0.66    0.00    0.00     0.01
 sersic    : ( 2141.42,  2128.19)    8.48    186.88    0.82    0.82    25.07
             (    0.03,     0.03)    0.00      0.11    0.00    0.00     0.05
 expdisk   : ( 2152.99,  2145.92)    8.77    389.86    0.46   -49.92
             (    0.15,     0.12)    0.01      1.79    0.00     0.02
 expdisk   : ( 2155.52,  2127.43)   10.87    254.30    0.33   -84.62
             (    0.87,     0.26)    0.01      1.15    0.00     0.07
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 732914.88472,  ndof = 6164968
 Chi^2/nu = 0.119

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.23
Output image    : ngc3384.fits
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```
 sersic    : ( 2142.19,  2129.99)    9.06     67.14    1.43    0.56   -55.25
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2151.87,  2166.48)    8.62   1183.93    0.24    0.50   -51.38
             (    0.24,     0.20)    0.01      0.63    0.00    0.00     0.01
 sersic    : ( 2141.41,  2128.09)    8.50    187.55    0.81    0.81    24.83
             (    0.03,     0.03)    0.00      0.11    0.00    0.00     0.05
 expdisk   : ( 2152.89, [2145.92])   8.74    387.55    0.47   -50.21
             (    0.11,    [0.00])   0.00      1.60    0.00     0.02
 expdisk   : ( 2155.01, [2127.43])  10.90    244.11    0.33   -85.85
             (    0.73,    [0.00])   0.01      1.08    0.00     0.07
 sky       : [2100.00, 2100.00]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 732887.82239,  ndof = 6164970
 Chi^2/nu = 0.119

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.24
Output image    : ngc3384.fits

 sersic    : ( 2142.19,  2129.99)    9.06     67.15    1.43    0.56   -55.24
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2151.91,  2166.63)    8.62   1184.09    0.24    0.50   -51.38
             (    0.20,     0.16)    0.01      0.66    0.00    0.00     0.01
 sersic    : ( 2141.40,  2128.18)    8.50    187.57    0.81    0.81    24.82
             (    0.03,     0.03)    0.00      0.11    0.00    0.00     0.05
 expdisk   : ( 2153.00,  2145.69)    8.74    387.05    0.47   -50.21
             (    0.13,     0.12)    0.01      1.71    0.00     0.02
 expdisk   : ( 2154.11,  2126.82)   10.89    243.52    0.33   -85.89
             (    0.84,     0.23)    0.01      1.09    0.00     0.07
 sky       : [2100.00, 2100.00]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 732887.01231,  ndof = 6164968
 Chi^2/nu = 0.119

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.25
Output image    : ngc3384.fits

 sersic    : ([2142.19], [2129.99])  [9.06]   [67.15]  [1.43]  [0.56] [-55.24]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : ([2151.91], [2166.63])  [8.62] [1184.09]  [0.24]  [0.50] [-51.38]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : ([2141.40], [2128.18])  [8.50]  [187.57]  [0.81]  [0.81]  [24.82]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : ( 2142.57,  2129.57)   13.52     56.20   *0.05*   1.00   [24.82]
             (    0.33,     0.30)    0.01      3.80   *0.01*   0.01    [0.00]
 expdisk   : ([2153.00], [2145.69])  [8.74]  [387.05]  [0.47] [-50.21]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]
 expdisk   : ([2154.11], [2126.82]) [10.89]  [253.52]  [0.33] [-85.89]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 732279.91740,  ndof = 6164995
 Chi^2/nu = 0.119

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--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.26
Output image    : ngc3384.fits

 sersic    : ( 2142.15,  2129.96)    9.07     65.39    1.38    0.57   -55.70
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2155.59,  2167.91)    8.49   1195.72    0.28    0.48   -50.71
             (    0.22,     0.20)    0.00      0.75    0.00    0.00     0.01
 sersic    : ( 2141.77,  2128.02)    8.48    180.48    0.79    0.86    28.35
             (    0.02,     0.02)    0.00      0.10    0.00    0.00     0.06
 expdisk   : ( 2151.19,  2141.45)    8.74    334.00    0.52   -54.06
             (    0.11,     0.11)    0.00      1.64    0.00     0.02
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
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```
 Chi^2 = 737247.22767,  ndof = 6164974
 Chi^2/nu = 0.120

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--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.27
Output image    : ngc3384.fits

 sersic    : ( 2142.15,  2129.96)    9.07     65.38    1.38    0.57   -55.70
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2155.62,  2167.94)    8.49   1195.91    0.28    0.48   -50.71
             (    0.22,     0.20)    0.00      0.77    0.00    0.00     0.01
 sersic    : ( 2141.77,  2128.04)    8.48    180.39    0.79    0.86    28.31
             (    0.02,     0.02)    0.00      0.10    0.00    0.00     0.06
 expdisk   : ( 2151.17,  2141.38)    8.74    334.01    0.52   -54.07
             (    0.11,     0.11)    0.00      1.65    0.00     0.02
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 737248.35245,  ndof = 6164974
 Chi^2/nu = 0.120

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Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.28
Output image    : ngc3384.fits

 sersic    : ( 2142.15,  2129.96)    9.07     65.39    1.38    0.57   -55.70
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2155.59,  2167.91)    8.49   1195.72    0.28    0.48   -50.71
             (    0.22,     0.20)    0.00      0.75    0.00    0.00     0.01
 sersic    : ( 2141.77,  2128.02)    8.48    180.48    0.79    0.86    28.35
             (    0.02,     0.02)    0.00      0.10    0.00    0.00     0.06
 expdisk   : ( 2151.19,  2141.45)    8.74    334.00    0.52   -54.06
             (    0.11,     0.11)    0.00      1.64    0.00     0.02
 sky       : [2100.00, 2100.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 737247.22767,  ndof = 6164974
 Chi^2/nu = 0.120

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--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][700:3500,1000:3200]
Init. par. file : input.txt
Restart file    : galfit.29
Output image    : ngc3384.fits

 sersic    : ( 2142.19,  2129.99)    9.06     67.15    1.43    0.56   -55.24
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.02
 sersic    : ( 2151.92,  2166.62)    8.61   1184.07    0.24    0.50   -51.38
             (    0.20,     0.16)    0.01      0.66    0.00    0.00     0.01
 sersic    : ( 2141.39,  2128.18)    8.50    187.59    0.81    0.81    24.82
             (    0.03,     0.03)    0.00      0.11    0.00    0.00     0.05
 expdisk   : ( 2153.00,  2145.67)    8.74    386.56    0.47   -50.22
             (    0.13,     0.12)    0.01      1.70    0.00     0.02
 expdisk   : ( 2154.09,  2126.80)   10.90    243.35    0.33   -85.92
             (    0.84,     0.23)    0.01      1.09    0.00     0.07
 sky       : [2100.00, 2100.00]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 732886.96624,  ndof = 6164968
 Chi^2/nu = 0.119

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Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.30
Output image    : ngc3384.fits

 sersic    : ( 2142.18,  2129.97)    9.07     66.11    1.39    0.56   -54.62
             (    0.02,     0.01)    0.00      0.06    0.00    0.00     0.03
 sersic    : ( 2146.65,  2159.52)    8.47   1221.95    0.21    0.48   -50.02
             (    0.21,     0.18)    0.00      0.37    0.00    0.00     0.01
 sersic    : ( 2140.98,  2127.28)    8.70    193.98    0.78    0.73    24.29
             (    0.04,     0.06)    0.00      0.20    0.00    0.00     0.06
```

```
 expdisk   : ( 2147.67,  2141.06)    8.72    284.57    0.50   -51.63
             (    0.12,     0.14)    0.00      0.75    0.00     0.03
 expdisk   : ( 2156.88,  2126.67)   10.73    174.71    0.36    87.24
             (    0.77,     0.35)    0.01      0.89    0.00     0.09
 sky       : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4850391.12126,  ndof = 16824467
 Chi^2/nu = 0.288

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--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.31
Output image    : ngc3384.fits

 sersic    : ( 2142.14,  2129.93)    9.09     64.39    1.35    0.57   -55.76
             (    0.02,     0.01)    0.00      0.06    0.00    0.00     0.03
 sersic    : ( 2146.94,  2159.51)    8.44   1215.11    0.22    0.48   -49.91
             (    0.21,     0.17)    0.00      0.47    0.00    0.00     0.01
 sersic    : ( 2141.77,  2127.59)    8.60    184.38    0.79    0.80    29.72
             (    0.04,     0.05)    0.00      0.15    0.00    0.00     0.07
 expdisk   : ( 2148.16,  2138.83)    8.68    269.92    0.54   -54.30
             (    0.15,     0.12)    0.00      0.94    0.00     0.02
 sky       : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4856142.72673,  ndof = 16824473
 Chi^2/nu = 0.289

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.32
Output image    : ngc3384.fits

 sersic    : ( 2142.19,  2130.03)    9.01     71.50    1.43    0.55   -55.67
             (    0.02,     0.01)    0.00      0.08    0.00    0.00     0.03
 sersic    : ( 2142.92,  2126.32)    8.60    189.06    0.90    0.74    33.70
```

```
             (    0.04,     0.04)    0.00      0.18    0.00    0.00     0.05
 expdisk    : ( 2148.00,  2146.76)    7.84    487.71    0.47   -51.50
             (    0.12,     0.10)    0.00      0.21    0.00     0.01
 sky        : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5371216.08395,  ndof = 16824480
 Chi^2/nu = 0.319

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--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.33
Output image    : ngc3384.fits

 sersic     : ( 2142.19,  2130.03)    9.01     71.51    1.43    0.55   -55.67
             (    0.02,     0.01)    0.00      0.08    0.00    0.00     0.03
 sersic     : ( 2142.92,  2126.32)    8.60    189.06    0.90    0.74    33.70
             (    0.04,     0.04)    0.00      0.18    0.00    0.00     0.05
 expdisk    : ( 2148.00,  2146.76)    7.84    487.71    0.47   -51.50
             (    0.12,     0.10)    0.00      0.21    0.00     0.01
 sky        : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5371215.99604,  ndof = 16824480
 Chi^2/nu = 0.319

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Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.34
Output image    : ngc3384.fits

 sersic     : ( 2142.14,  2129.93)    9.09     64.39    1.35    0.57   -55.76
             (    0.02,     0.01)    0.00      0.06    0.00    0.00     0.03
 sersic     : ( 2146.95,  2159.51)    8.44   1214.97    0.22    0.48   -49.92
             (    0.21,     0.17)    0.00      0.47    0.00    0.00     0.01
 sersic     : ( 2141.78,  2127.59)    8.60    184.42    0.79    0.80    29.72
             (    0.04,     0.05)    0.00      0.15    0.00    0.00     0.07
```

```
 expdisk   : ( 2148.15,  2138.82)    8.68    269.68    0.54   -54.30
             (    0.15,     0.12)    0.00      0.94    0.00     0.02
 sky       : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4856142.67299,  ndof = 16824473
 Chi^2/nu = 0.289

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Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.35
Output image    : ngc3384.fits

 sersic    : ( 2142.14,  2129.93)    9.09     64.39    1.35    0.57   -55.76
             (    0.02,     0.01)    0.00      0.06    0.00    0.00     0.03
 sersic    : ( 2146.95,  2159.51)    8.44   1215.04    0.22    0.48   -49.92
             (    0.21,     0.17)    0.00      0.47    0.00    0.00     0.01
 sersic    : ( 2141.77,  2127.59)    8.60    184.41    0.79    0.80    29.72
             (    0.04,     0.05)    0.00      0.15    0.00    0.00     0.07
 expdisk   : ( 2148.16,  2138.83)    8.68    269.82    0.54   -54.30
             (    0.15,     0.12)    0.00      0.94    0.00     0.02
 sky       : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4856142.70094,  ndof = 16824473
 Chi^2/nu = 0.289

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.36
Output image    : ngc3384.fits

 sersic    : ( 2142.14,  2129.93)   12.84     64.39    1.35    0.57   -55.76
             (    0.02,     0.01)    0.00      0.06    0.00    0.00     0.03
 sersic    : ( 2146.95,  2159.51)   12.20   1214.94    0.22    0.48   -49.92
             (    0.21,     0.17)    0.00      0.48    0.00    0.00     0.01
 sersic    : ( 2141.77,  2127.59)   12.36    184.41    0.79    0.80    29.72
```

```
             (    0.04,     0.05)    0.00      0.15    0.00    0.00     0.07
 expdisk    : ( 2148.16,  2138.82)   12.43    269.70    0.54   -54.30
             (    0.15,     0.12)    0.00      0.94    0.00     0.02
 sky        : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4856142.80596,  ndof = 16824473
 Chi^2/nu = 0.289

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.37
Output image    : ngc3384.fits

 sersic     : ( 2142.19,  2130.03)   12.76     71.77    1.44    0.55   -55.66
             (    0.02,     0.01)    0.00      0.08    0.00    0.00     0.03
 sersic     : ( 2142.92,  2126.30)   12.36    189.20    0.90    0.73    33.72
             (    0.04,     0.04)    0.00      0.18    0.00    0.00     0.05
 expdisk    : ( 2147.98,  2146.76)   11.60    487.50    0.47   -51.50
             (    0.12,     0.10)    0.00      0.21    0.00     0.01
 sky        : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                  [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5371215.85771,  ndof = 16824480
 Chi^2/nu = 0.319

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.38
Output image    : ngc3384.fits

 sersic     : ( 2142.20,  2130.04)   12.62     77.79    1.70    0.57   -55.69
             (    0.02,     0.01)    0.00      0.27    0.00    0.00     0.04
 expdisk    : ( 2010.75,  2302.13)   12.27    491.06    0.40   -51.08
             (    0.22,     0.21)    0.00      0.22    0.00     0.01
 sersic     : ( 2142.48,  2127.50)   12.48    148.17    0.65    0.94   -15.57
             (    0.05,     0.05)    0.00      0.12    0.00    0.00     0.78
```

```
 expdisk   : ( 2302.08,  1973.51)   12.40    488.95    0.38   -50.94
             (    0.28,     0.21)    0.00      0.28    0.00     0.01
 sky       : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5238704.47928,  ndof = 16824474
 Chi^2/nu = 0.311

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : NGC3384_drz.fits[1][1:4220,1:4298]
Init. par. file : input.txt
Restart file    : galfit.39
Output image    : ngc3384.fits

 sersic    : ( 2142.18,  2129.97)   12.83     66.10    1.39    0.56   -54.62
             (    0.02,     0.01)    0.00      0.06    0.00    0.00     0.03
 sersic    : ( 2146.64,  2159.52)   12.22   1222.09    0.21    0.48   -50.02
             (    0.21,     0.18)    0.00      0.37    0.00    0.00     0.01
 sersic    : ( 2140.98,  2127.28)   12.45    193.93    0.78    0.73    24.29
             (    0.04,     0.06)    0.00      0.20    0.00    0.00     0.06
 expdisk   : ( 2147.68,  2141.08)   12.48    284.83    0.50   -51.64
             (    0.12,     0.14)    0.00      0.75    0.00     0.03
 expdisk   : ( 2156.86,  2126.69)   14.48    174.51    0.36    87.28
             (    0.77,     0.35)    0.01      0.89    0.00     0.09
 sky       : [2110.50, 2149.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4850391.11298,  ndof = 16824467
 Chi^2/nu = 0.288

--------------------------------------------------------------------------------
```

8.3 Output Log of NGC 3945

```
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.01
```

```
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00]) [15.70]    [60.00]   [2.00]   [0.96]   -13.71
             (    [0.00],    [0.00])  [0.00]     [0.00]   [0.00]   [0.00] 8242.35
 sky       : [530.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 48369801.02366,  ndof = 1006999
 Chi^2/nu = 48.034

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])    6.25     [60.00]   [2.00]    1.00   [-90.00]
             (    [0.00],    [0.00])    0.00      [0.00]   [0.00]    0.00     [0.00]
 sky       : [530.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 7142716.94194,  ndof = 1006998
 Chi^2/nu = 7.093

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])    6.06      91.26    [2.00]    0.79     [0.00]
             (    [0.00],    [0.00])    0.00       0.07    [0.00]    0.00     [0.00]
 sky       : [530.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 5568130.90248,  ndof = 1006997
 Chi^2/nu = 5.529

--------------------------------------------------------------------------------
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```

```
Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])  15.26     *0.02*   7.35   *0.03*  -72.95
             (   [0.00],   [0.00]) 23237.62   *329.47* 24674.07 *2747.80* 42842.86
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 48347141.35641,  ndof = 1006995
 Chi^2/nu = 48.011

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00]) [10.00]   [20.30]  [2.00]   0.28    -8.35
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]   0.01     0.52
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 44404429.32039,  ndof = 1006998
 Chi^2/nu = 44.096

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00]) [10.00]   [26.39]  [2.00]   0.34   [81.65]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]   0.01    [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 44705510.10039,  ndof = 1006999
```

```
 Chi^2/nu = 44.395

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00]) [10.00]     5.42   [2.00]  [0.77]  [79.65]
             (   [0.00],   [0.00])  [0.00]     0.09   [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 44233657.99744,  ndof = 1006999
 Chi^2/nu = 43.926

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00]) [10.00]     5.66   [2.00]  [0.77] [-19.00]
             (   [0.00],   [0.00])  [0.00]     0.10   [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 44220030.77957,  ndof = 1006999
 Chi^2/nu = 43.913

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00]) [10.00]   [20.30]   0.68   [0.77] [-19.00]
```

```
             (   [0.00],   [0.00])  [0.00]    [0.00]   0.03   [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 44438537.00735,  ndof = 1006999
 Chi^2/nu = 44.130

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.10
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])  [3.00]   [20.30]   3.79   [0.77] [-19.00]
             (   [0.00],   [0.00])  [0.00]    [0.00]   0.01   [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 57642345934.86642,  ndof = 1006999
 Chi^2/nu = 57241.711

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.11
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   7.25    [20.30]  [2.00]  [0.77] [-19.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 23184449.09617,  ndof = 1006999
 Chi^2/nu = 23.023

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
```

```
Restart file    : galfit.12
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.08    [90.30]  [2.00]  [0.77] [-19.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5563590.33908,  ndof = 1006999
 Chi^2/nu = 5.525

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.13
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.13    [90.30]  [2.00]  [0.77] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : ( [603.60], [515.00])   9.65     [4.30]  [2.00]  [0.90] [-90.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4498300.06942,  ndof = 1006998
 Chi^2/nu = 4.467

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.14
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.26    [90.30]  [2.00]  [0.77] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : (  605.28,   514.34)   [7.00]   217.38   [2.00]  [0.90] [-90.00]
             (    0.13,     0.13)   [0.00]     1.29   [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
 Chi^2 = 5137127.95485,  ndof = 1006996
 Chi^2/nu = 5.101

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.15
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.58    [90.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : (  605.38,   514.48)   [7.00]   149.82   [2.00]  [0.90] [-90.00]
             (    0.07,     0.07)   [0.00]     0.42   [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 5305420.89191,  ndof = 1006996
 Chi^2/nu = 5.269

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.16
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.42    [70.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9463547.90685,  ndof = 1006999
 Chi^2/nu = 9.398

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.17
```

```
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.43    [70.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9867881.58947,  ndof = 1006999
 Chi^2/nu = 9.799

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.18
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.44    [70.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9500778.66503,  ndof = 1006999
 Chi^2/nu = 9.435

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.19
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   6.44    [70.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9470600.83787,  ndof = 1006999
 Chi^2/nu = 9.405

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

```
Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.20
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   8.54     [70.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00      [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9470600.81914,  ndof = 1006999
 Chi^2/nu = 9.405

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.21
Output image    : ngc3945.fits

 sersic    : ( [603.60], [515.00])   8.54     [70.30]  [2.00]  [0.50] [-10.00]
             (   [0.00],   [0.00])   0.00      [0.00]  [0.00]  [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9470600.81914,  ndof = 1006999
 Chi^2/nu = 9.405

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.22
Output image    : ngc3945.fits

 sersic    : (  606.00,   514.29)   10.79     *0.01*   1.72    0.53    -7.08
             ( 4378.37,   193.45)    5.26     *0.06*  93.14   17.92  4626.96
 expdisk   : (  603.71,   515.03)    7.56    106.87    0.84   -11.47
             (    0.08,     0.09)    0.00      0.11    0.00     0.19
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 22356603.30615,  ndof = 1006987
 Chi^2/nu = 22.201

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.23
Output image    : ngc3945.fits

 sersic    : (  604.18,   514.84)    8.24    104.22    3.54    0.72    -9.70
             (    0.01,     0.01)    0.00      0.42    0.01    0.00     0.05
 expdisk   : (  605.28,   513.85)    8.73    265.48    0.51    85.68
             (    0.41,     0.22)    0.00      1.42    0.00     0.11
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2892781.17590,  ndof = 1006987
 Chi^2/nu = 2.873

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.24
Output image    : ngc3945.fits

 sersic    : (  603.84,   514.75)    8.65   1249.40  *20.00*   0.78   -72.97
             (    0.00,     0.01)    0.07    220.36   *0.54*   0.00     0.33
 expdisk   : (  605.01,   515.16)    9.33     33.16    0.57    -6.14
             (    0.01,     0.02)    0.00      0.02    0.00     0.04
 expdisk   : (  602.13,   513.86)    8.38    167.28    0.83    85.99
             (    0.14,     0.13)    0.01      0.24    0.00     0.18
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2218281.20135,  ndof = 1006981
 Chi^2/nu = 2.203

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.25
Output image    : ngc3945.fits

 sersic    : (  604.14,   514.82)    7.84    189.11    4.72    0.71    -9.65
             (    0.01,     0.01)    0.00      0.73    0.01    0.00     0.04
 expdisk   : (  606.24,   514.70)    9.52    252.54    0.30    85.06
             (    0.60,     0.20)    0.00      1.44    0.00     0.07
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2891104.06186,  ndof = 1006987
 Chi^2/nu = 2.871

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.26
Output image    : ngc3945.fits

 sersic    : ( [604.14], [514.82])  [7.84]  [189.11]  [4.72]  [0.71]  [-9.65]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 expdisk   : ( [606.24], [514.70])  [9.52]  [252.54]  [0.30]  [85.06]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]   [0.00]
 sersic    : (  605.41,   515.52)   12.07     65.54    0.05    0.41    -4.70
             (    0.08,     0.16)    0.00      1.02    0.00    0.00     0.11
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2743124.06802,  ndof = 1006993
 Chi^2/nu = 2.724

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.27
```

```
Output image    : ngc3945.fits

 sersic    : (  603.87,   514.76)    9.38   [189.11] *14.97*   0.78   -67.95
             (    0.00,     0.00)    0.01     [0.00]  *0.07*   0.00     0.38
 expdisk   : (  602.51,   514.04)    8.29    158.53    0.85    87.13
             (    0.12,     0.11)    0.00      0.21    0.00     0.19
 sersic    : (  604.97,   515.14)    9.41     53.19    0.79    0.57    -6.01
             (    0.01,     0.02)    0.00      0.03    0.00    0.00     0.04
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2194132.27298,  ndof = 1006981
 Chi^2/nu = 2.179

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.28
Output image    : ngc3945.fits

 sersic    : (  604.14,   514.82)    7.84    189.12    4.72    0.71    -9.64
             (    0.01,     0.01)    0.00      0.73    0.01    0.00     0.04
 expdisk   : (  606.24,   514.70)    9.52    252.49    0.30    85.06
             (    0.60,     0.20)    0.00      1.44    0.00     0.07
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2891104.12900,  ndof = 1006987
 Chi^2/nu = 2.871

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.29
Output image    : ngc3945.fits

 sersic    : (  604.14,   514.82)    7.44    291.56    5.38    0.81   -11.50
             (    0.01,     0.01)    0.00      0.79    0.01    0.00     0.07
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 3111899.95418,  ndof = 1006993
 Chi^2/nu = 3.090

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.30
Output image    : ngc3945.fits

 sersic    : (  604.14,   514.83)    7.44    293.41    5.40    0.81   -11.71
             (     nan,      nan)     nan       nan     nan     nan      nan
 expdisk   : (  608.54,   458.82)   13.09     *0.01*  *0.01*   -5.99
             (     nan,      nan)     nan      *nan*   *nan*     nan
 sky       : [530.50, 475.50]  [0.00e+00]   [0.00e+00]   [0.00e+00]
                               [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 3101982.32689,  ndof = 1006987
 Chi^2/nu = 3.080

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.31
Output image    : ngc3945.fits

 sersic    : (  607.61,   515.41)    8.05    744.44    2.27    0.53    85.88
             (    0.21,     0.13)    0.01      9.73    0.02    0.00     0.11
 sersic    : (  604.13,   514.79)    8.35    100.16    3.52    0.68    -9.14
             (    0.01,     0.01)    0.00      0.42    0.01    0.00     0.04
 sky       : [530.50, 475.50]  [0.00e+00]   [0.00e+00]   [0.00e+00]
                               [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 2854988.03323,  ndof = 1006986
 Chi^2/nu = 2.835

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```
Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.32
Output image    : ngc3945.fits

 sersic    : (  604.15,   514.80)    7.44    269.73    5.40    0.96   -85.29
             (    0.01,     0.01)    0.00      0.79    0.01    0.00     0.15
     c0    :   -0.29
           :    0.00
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3690889.85772,  ndof = 1006992
 Chi^2/nu = 3.665

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.33
Output image    : ngc3945.fits

 sersic    : (  604.21,   514.83)    7.97    123.95    3.44    0.79   -10.61
             (    0.01,     0.01)    0.00      0.19    0.00    0.00     0.07
 sersic3 / : ( [604.14], [514.82]) [16.44]  [100.00]  [5.40]  [0.70]   [2.00]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 radial2    : [2] [0]  ( [604.14], [514.82]) [320.00] [350.00]  [0.70]  [0.00]
                       ( [0.00],    [0.00])   [0.00]   [0.00]   [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3711562.92874,  ndof = 1006993
 Chi^2/nu = 3.686

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.34
Output image    : ngc3945.fits
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```
 sersic    : (  604.16,   514.82)    7.65    208.72    4.63    0.79   -10.60
             (    0.01,     0.01)    0.00      0.52    0.01    0.00     0.07
 sersic3 / : ( [604.14], [514.82])  17.93   [100.00]  [5.40]  [0.70]   86.45
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]    0.37
 radial2    : [2] [0]  ( [604.14], [514.82]) [320.00] [350.00]  [0.70]  [0.00]
                        ( [0.00],    [0.00])   [0.00]   [0.00]   [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3002610.31771,  ndof = 1006991
 Chi^2/nu = 2.982

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.35
Output image    : ngc3945.fits

 sersic    : (  604.34,   514.89)    8.18    115.61    2.55    0.67    -8.16
             (    0.01,     0.01)    0.00      0.14    0.00    0.00     0.04
 sersic3 / : ( [604.14], [514.82])  18.55      4.35   [5.40]  [0.70]   83.92
             (   [0.00],   [0.00])   0.00      0.04   [0.00]  [0.00]    0.08
 radial2    : [2] [0]  ( [604.14], [514.82]) 115.51  457.13   [0.70]  [0.00]
                        ( [0.00],    [0.00])    0.48    0.44   [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2491136.12927,  ndof = 1006988
 Chi^2/nu = 2.474

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.36
Output image    : ngc3945.fits

 sersic    : (  604.58,   514.98)    8.76     64.52    1.36    0.65    -7.88
             (    0.01,     0.01)    0.00      0.07    0.00    0.00     0.03
 expdisk   : (  598.66,   512.45)    8.32    281.62    0.86    -8.71
```

```
             (    0.29,     0.37)    0.00       1.54    0.00     0.46
 sersic3 / : ( [604.14], [514.82])  18.79       2.76    [5.40]   [0.70]    85.43
             (   [0.00],   [0.00])   0.00       0.02    [0.00]   [0.00]     0.08
 radial2    : [3] [0]  ( [604.14], [514.82]) 100.26  390.75    [0.70]   [0.00]
                        ( [0.00],    [0.00])    0.33    0.41    [0.00]    [0.00]
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2127627.99120,  ndof = 1006982
 Chi^2/nu = 2.113

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.37
Output image    : ngc3945.fits

 sersic    : (  604.64,   515.07)    8.70     67.15    1.43    0.66    -7.76
             (    0.01,     0.01)    0.00      0.13    0.00    0.00     0.03
 expdisk   : (  587.96,   512.36)    8.33    335.79    0.79    -7.03
             (    0.46,     0.56)    0.00      4.49    0.01     0.38
 sersic3 / : (  603.67,   514.74)   19.09      2.62    6.28    0.75    84.49
             (    0.00,     0.01)    0.04      0.02    0.04    0.00     0.10
 radial2    : [3] [0]  (  601.60,   515.67)  101.07  442.51    0.61   [0.00]
                       (  0.06,     0.30)    1.13    2.47    0.00   [0.00]
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2107621.53134,  ndof = 1006975
 Chi^2/nu = 2.093

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.38
Output image    : ngc3945.fits

 sersic    : (  604.12,   514.69)   10.73     59.58    0.34    0.41    -5.27
             (    0.04,     0.07)    0.01      0.09    0.00    0.00     0.04
```

```
 sersic    : (  604.79,   515.10)    8.23    124.64    2.92    0.82   -13.93
             (    0.01,     0.01)    0.01      1.32    0.02    0.00     0.10
 expdisk   : (  549.34,   510.95)    7.23   1291.14    0.63    3.32
             (    2.98,     4.56)    0.11    122.74    0.03    0.84
 sersic3 / : (  603.60,   514.70)   19.67      0.96    5.87    0.69    89.15
             (    0.01,     0.01)    0.07      0.01    0.03    0.00     0.13
 radial2    : [4] [0]  (  603.69,   519.16)  172.53  441.06    0.61  -10.73
                       (  0.09,     0.58)    2.01    4.56    0.01    0.21
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1997746.16460,  ndof = 1006967
 Chi^2/nu = 1.984

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--------------------------------------------------------------------------------

Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.39
Output image    : ngc3945.fits

 sersic    : (  604.71,   515.03)    8.65     68.71    1.52    0.66    -8.46
             (    0.01,     0.01)    0.00      0.16    0.00    0.00     0.03
 sersic3 / : (  603.58,   514.70)   19.30      0.57    1.73   *0.09*  -28.79
             (    0.41,     0.57)   55.86      0.08    3.51   *0.39*    6.22
 radial2    : [2] [0]  (  599.92,   516.08)    7.68   17.42    0.67  -13.51
                       ( 37.52,    35.78)   22.90   45.44    4.98  568.21
 expdisk   : (  590.43,   511.74)    8.28    369.35    0.77    -6.87
             (    0.52,     0.43)    0.00      6.01    0.01     0.38
 sersic3 / : (  603.76,   514.61)   19.38      3.61    5.61    0.76   -88.66
             (    0.03,     0.03)    0.05      0.13    0.08    0.00     0.17
 radial2    : [5] [0]  (  602.87,   514.79)  114.56  464.56    0.58    -9.93
                       (  0.05,     0.35)    1.16    2.97    0.00    0.14
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2090853.48643,  ndof = 1006961
 Chi^2/nu = 2.076

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```
Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.40
Output image    : ngc3945.fits

 sersic    : (  604.74,   515.04)    8.74     61.58    1.47    0.68    -8.74
             (    0.01,     0.01)    0.00      0.10    0.00    0.00     0.04
 expdisk   : (  595.37,   512.81)    8.33    227.28    0.95   -19.26
             (    0.28,     0.25)    0.00      0.94    0.00     1.06
 sersic3 / : (  603.65,   514.73)   20.09      1.08    5.51    0.69    89.78
             (    0.01,     0.01)    0.10      0.01    0.04    0.00     0.15
 radial2    : [3] [0]  (  602.00,   514.70)  167.45  440.96    0.58    -9.96
                       (  0.07,     0.54)    2.55    6.11    0.01    0.21
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2120730.64495,  ndof = 1006974
 Chi^2/nu = 2.106

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.41
Output image    : ngc3945.fits

 sersic    : (  604.70,   515.10)    8.63     72.21    1.49    0.65    -8.30
             (    0.01,     0.01)    0.00      0.09    0.00    0.00     0.03
 expdisk   : (  580.04,   520.28)    7.61   1058.02    0.42    -3.52
             (    1.06,     3.41)    0.06     71.23    0.02     0.29
 sersic3 / : (  603.73,   514.76)   18.37      3.18    8.07    0.79   -87.04
             (    0.01,     0.01)    0.02      0.03    0.04    0.00     0.14
 radial2    : [3] [0]  (  603.10,   516.58)   68.95  436.16    0.62   -10.72
                       (  0.05,     0.26)    0.68    1.77    0.00    0.12
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2095105.09224,  ndof = 1006974
 Chi^2/nu = 2.081

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```
Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.42
Output image    : ngc3945.fits

 sersic    : (  604.58,   515.02)    9.20     48.95    0.89    0.64    -8.14
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.04
 expdisk   : (  591.82,   519.82)    7.91    514.22    0.64    -5.55
             (    0.56,     1.00)    0.01      9.32    0.01     0.22
 sersic    : (  601.59,   514.54)    9.61    118.97    0.36    0.96   -26.31
             (    0.12,     0.10)    0.00      0.13    0.00    0.00     1.94
 sersic3 / : (  603.67,   514.77)   19.55      3.19    3.57    0.85   -82.51
             (    0.00,     0.01)    0.04      0.01    0.01    0.00     0.27
 radial2    : [4] [0]  (  601.04,   515.11)  164.14  403.10    0.75  -12.30
                       (  0.05,     0.19)    0.69    1.98    0.00    0.24
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2026558.89849,  ndof = 1006967
 Chi^2/nu = 2.013

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.43
Output image    : ngc3945.fits

 sersic    : (  604.18,   514.84)    8.24    104.16    3.54    0.72    -9.70
             (    0.01,     0.01)    0.00      0.42    0.01    0.00     0.05
 expdisk   : (  605.28,   513.84)    8.73    265.42    0.51    85.68
             (    0.41,     0.22)    0.00      1.42    0.00     0.11
 ferrer    : ( [591.82], [519.82]) [13.00] [200.00]  [4.00] [2.00] [0.15]  [84.00]
             (   [0.00],   [0.00]) [0.00]  [0.00]  [0.00] [0.00] [0.00]   [0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2892781.39911,  ndof = 1006987
 Chi^2/nu = 2.873

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.44
Output image    : ngc3945.fits

 sersic    : (  604.58,   515.02)    9.20     48.95    2.90    0.64    -8.14
             (    0.01,     0.02)    0.00      0.23    0.01    0.00     0.11
 expdisk   : (  591.82,   519.82)    7.91    514.22    0.64    -5.55
             (    1.04,     1.79)    0.01      7.70    0.00     0.50
 ferrer    : ( [591.82], [519.82])  9.00 [200.00]  [4.00] [2.00] [0.15]  [84.00]
             (   [0.00],   [0.00]) 1356379663106048.00   [0.00]  [0.00] [0.00] [0.00]
[0.00]
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10769517.26639,  ndof = 1006986
 Chi^2/nu = 10.695

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.45
Output image    : ngc3945.fits

 sersic    : (  604.60,   515.02)    9.18     49.00    0.91    0.64    -8.19
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.04
 expdisk   : (  592.35,   519.43)    7.94    495.90    0.65    -5.78
             (    0.57,     0.96)    0.01      8.46    0.01     0.22
 sersic    : (  601.66,   514.54)    9.61    119.50    0.37    0.98   -36.62
             (    0.14,     0.10)    0.00      0.15    0.00    0.00     4.09
 sersic3 / : (  603.67,   514.78)   19.68      3.02    3.64    0.84   -82.93
             (    0.00,     0.01)    0.05      0.01    0.01    0.00     0.27
 radial2    : [4] [0]  (  601.09,   515.26)  167.37  409.04    0.74  -11.73
                       (  0.06,     0.20)    0.97    2.48    0.00    0.25
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2026784.15204,  ndof = 1006967
 Chi^2/nu = 2.013
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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.46
Output image    : ngc3945.fits

 sersic    : (  604.36,   514.97)    9.28     47.20    0.89    0.64    -8.49
             (    0.01,     0.02)    0.01      0.11    0.00    0.00     0.04
 expdisk   : (  583.09,   511.00)    7.28    932.07    0.69    -6.00
             (    1.35,     2.80)    0.05     40.74    0.01     0.67
 expdisk   : (  607.15,   515.90)    9.71    108.63    0.62    -5.25
             (    0.15,     0.33)    0.02      2.06    0.00     0.13
 sersic    : (  593.67,   514.82)   10.06    136.42    0.31    0.76    87.47
             (    0.38,     0.20)    0.01      0.53    0.00    0.00     0.24
 sersic3 / : (  603.66,   514.76)   19.67      3.09    3.63    0.86   -80.32
             (    0.00,     0.01)    0.04      0.02    0.01    0.00     0.21
 radial2    : [5] [0]  (  600.24,   514.99)  169.29  413.03    0.75  -11.49
                       (  0.07,     0.18)    0.86    2.01    0.00    0.21
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2016976.02746,  ndof = 1006961
 Chi^2/nu = 2.003

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.47
Output image    : ngc3945.fits

 sersic    : (  604.47,   515.01)    9.40     45.97    0.84    0.64    -8.40
             (    0.01,     0.02)    0.01      0.10    0.00    0.00     0.04
 expdisk   : (  585.65,   514.59)    6.29   1999.48    0.50    -1.99
             (    2.22,     7.10)    0.14    210.77    0.03     0.50
 expdisk   : (  604.43,   515.20)    9.38     94.91    0.65    -6.29
             (    0.11,     0.20)    0.01      1.07    0.00     0.12
 sersic    : (  591.73,   515.13)   10.29    152.78    0.28    0.64    85.45
```

```
             (    0.43,     0.23)    0.01       0.62    0.00    0.00     0.21
 sersic3 / : (  603.67,  [514.76])  20.28       3.52    3.73    0.91   -67.33
             (    0.00,    [0.00])   0.05       0.02    0.01    0.00     0.53
 radial2    : [5] [0]  (  600.30,   515.04)  174.87  463.24    0.68  -10.10
                       (  0.08,     0.11)    1.15    2.58    0.00    0.15
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2015690.74577,  ndof = 1006962
 Chi^2/nu = 2.002

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.48
Output image    : ngc3945.fits

 sersic    : (  604.89,   514.93)    9.59     46.84    0.72    0.60    -6.56
             (    0.01,     0.02)    0.00      0.06    0.00    0.00     0.05
 sersic    : (  603.90,   514.77)   10.27     28.38    8.90    0.78   -64.84
             (    0.01,     0.00)    0.04      2.20    0.34    0.00     0.31
 expdisk   : (  574.05,   469.98)    6.28   2088.88    0.55   -5.85
             (    2.66,     9.01)    0.23    356.82    0.05    0.97
 expdisk   : (  604.32,   515.70)    9.08     94.46    0.75   -6.12
             (    0.07,     0.13)    0.01      0.62    0.00    0.12
 sersic    : (  599.06,   514.69)   10.54    176.45    0.23    0.50    85.74
             (    0.62,     0.22)    0.01      0.62    0.00    0.00     0.12
 sersic3 / : (  603.38,  [514.76])  19.67      0.72    6.66    0.92   -75.01
             (    0.16,    [0.00])   0.04      0.09    0.15    0.00     1.13
 radial2    : [6] [0]  (  602.38,   517.24)  206.08  444.88    0.62   -7.61
                       (  0.12,     0.54)    1.77    1.81    0.00    0.14
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2000483.96438,  ndof = 1006955
 Chi^2/nu = 1.987

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
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```
Init. par. file : input.txt
Restart file    : galfit.49
Output image    : ngc3945.fits

 sersic    : (  614.31,   516.00)    9.88     49.51    1.09    0.55    -5.55
             (    0.03,     0.02)    0.00      0.11    0.00    0.00     0.04
 expdisk   : (  599.16,   449.60)    5.29   2790.86    0.83   20.06
             (    4.64,     8.55)    0.22    356.28    0.02    4.92
 expdisk   : (  591.32,   513.10)   10.40     27.01    0.51   -5.41
             (    0.04,     0.03)    0.00      0.04    0.00    0.05
 expdisk   : (  600.91,   516.05)    9.18     93.78    0.77  -10.06
             (    0.11,     0.13)    0.00      0.47    0.00    0.26
 sersic    : (  597.00,   514.37)   10.36    193.07    0.32    0.43   85.85
             (    0.43,     0.17)    0.01      0.73    0.00    0.00    0.07
 sersic3 / : (  603.64,   514.76)   20.32      3.24    3.62    0.77  -12.74
             (    0.00,     0.01)    0.02      0.02    0.02    0.00    0.20
 radial2    : [6] [0]  (  600.60,   514.41)  221.45  513.30    0.59   -9.09
                       (  0.07,     0.15)    1.52    1.54    0.00    0.09
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1957850.11015,  ndof = 1006955
 Chi^2/nu = 1.944

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.50
Output image    : ngc3945.fits

 sersic    : (  604.14,   514.82)    7.44    291.59    5.38    0.81   -11.50
             (    0.01,     0.01)    0.00      0.79    0.01    0.00     0.07
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3111899.98582,  ndof = 1006993
 Chi^2/nu = 3.090

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.51
Output image    : ngc3945.fits

 sersic    : (  618.62,   515.71)   10.58     51.45    1.88    0.53    -3.96
             (    0.17,     0.07)    0.02      1.07    0.04    0.00     0.29
 expdisk   : (   59.09, *-146.52*)   6.60   5127.37    0.78   48.13
             (    9.98,   *29.76*)   0.67      8.76    0.57   22.89
 expdisk   : (  592.13,   513.07)    8.13     28.11    0.54   -5.61
             (    0.04,     0.01)    0.00      0.02    0.00    0.02
 expdisk   : (  603.45,   516.17)    7.14    104.96    0.87  -10.60
             (    0.05,     0.07)    0.00      0.32    0.00    0.23
 sersic    : ( *-25.93*,   43.26)  *88.57* 190582.61    5.56  *0.05*   39.80
             (   *0.00*,    0.00)   *0.00*     0.00    0.00  *0.00*    0.00
 sersic3 / : (  604.18,   514.75)   20.80      3.42    3.71    0.51   -10.90
             (    0.78,     0.85)    0.57      2.91    2.51    0.18    11.59
 radial2    : [6] [0]  (  601.79,   514.20)  228.06  503.95    0.99  -10.62
                       ( 56.74,    15.69)  140.87   82.08    1.60 2508.16
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 238296479.82192,  ndof = 1006955
 Chi^2/nu = 236.651

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.52
Output image    : ngc3945.fits

 sersic    : (  614.49,   516.04)    9.62     59.48    1.30    0.57    -5.87
             (    0.03,     0.02)    0.00      0.11    0.00    0.00     0.05
 expdisk   : (  590.76,   515.20)    7.40    846.79    0.64   -4.68
             (    1.17,     2.13)    0.04     28.62    0.01    0.45
 expdisk   : (  592.51,   513.54)   10.10     28.45    0.55   -5.98
             (    0.04,     0.03)    0.00      0.03    0.00    0.06
 sersic    : (  598.09,   514.78)    9.30    169.20    0.49    0.67    87.49
             (    0.19,     0.06)    0.00      0.35    0.00    0.00     0.09
 sersic3 / : (  603.63,   514.76)   19.56      2.90    3.33    0.75   -12.26
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```
             (    0.00,     0.01)    0.01      0.01    0.02    0.00     0.18
 radial2    : [5] [0]  (  600.67,   514.57)  211.70  440.30    0.68  -10.22
                       (  0.11,     0.15)    1.28    0.92    0.00    0.14
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1974299.78606,  ndof = 1006961
 Chi^2/nu = 1.961

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.53
Output image    : ngc3945.fits

 sersic     : (  604.58,   515.04)    9.23     48.87    0.90    0.63    -8.13
              (    0.01,     0.02)    0.00      0.05    0.00    0.00     0.04
 expdisk    : (  595.20,   548.56)    7.33    953.60    0.47    -5.02
              (    0.66,     2.05)    0.04     35.93    0.01     0.21
 expdisk    : (  519.75,    [1.00])  14.30    613.38   *0.01*  -11.42
              (    0.70,    [0.00])   0.14    102.39   *0.00*    0.07
 sersic     : (  601.21,   513.77)    9.32    129.24    0.52    0.97   -18.50
              (    0.12,     0.10)    0.00      0.20    0.00    0.00     1.75
 sersic3 / : (  603.66,   514.76)   21.17      3.27    3.65    0.87   -78.70
              (    0.00,     0.01)    0.09      0.02    0.01    0.00     0.38
 radial2    : [5] [0]  (  600.94,   514.82)  195.49  497.43    0.62   -9.57
                       (  0.06,     0.27)    1.98    4.60    0.01    0.15
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2028990.23124,  ndof = 1006962
 Chi^2/nu = 2.015

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.54
Output image    : ngc3945.fits
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```
 sersic    : (  604.59,   515.02)    9.20     49.10    0.91    0.63    -8.16
             (    0.01,     0.01)    0.00      0.05    0.00    0.00     0.04
 expdisk   : (  593.44,   522.26)    7.85    551.69    0.62    -5.99
             (    0.64,     1.13)    0.01      9.96    0.01     0.23
 sersic    : (  601.55,   514.23)    9.47    125.11    0.47    0.98   -38.74
             (    0.13,     0.11)    0.00      0.28    0.00    0.00     6.48
 sersic3 / : (  603.66,   514.77)   21.33      3.14    3.63    0.85   -80.17
             (    0.00,     0.01)    0.08      0.01    0.01    0.00     0.35
 radial2    : [4] [0]  (  600.92,   514.97)  199.92  498.12    0.61   -9.56
                       (  0.06,     0.28)    1.83    4.81    0.01    0.17
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2028409.20382,  ndof = 1006967
 Chi^2/nu = 2.014

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.55
Output image    : ngc3945.fits

 sersic    : (  604.59,   515.03)    9.20     49.14    0.91    0.63    -8.24
             (    0.01,     0.01)    0.00      0.06    0.00    0.00     0.04
 expdisk   : (  594.01,   524.37)    7.80    586.34    0.60    -6.41
             (    0.66,     1.20)    0.02     12.17    0.01     0.22
 sersic    : (  601.46,   514.09)    9.45    124.98    0.47    1.00   [85.45]
             (    0.14,     0.10)    0.00      0.51    0.00    0.00    [0.00]
 sersic3 / : (  603.66,   514.77)   21.38      3.11    3.64    0.86   -80.77
             (    0.00,     0.01)    0.09      0.01    0.01    0.00     0.35
 radial2    : [4] [0]  (  600.94,   515.14)  200.64  500.75    0.61   -8.37
                       (  0.07,     0.29)    2.12    5.14    0.01    0.14
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2028715.34619,  ndof = 1006968
 Chi^2/nu = 2.015

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.56
Output image    : ngc3945.fits

 sersic    : (  604.59,   515.03)    9.20     49.12    0.91    0.63    -8.16
             (    0.01,     0.01)    0.00      0.04    0.00    0.00     0.04
 expdisk   : (  593.39,   520.06)    7.93    494.55    0.66    -6.22
             (    0.60,     0.97)    0.01      6.19    0.00     0.17
 sersic    : (  601.56,   514.37)    9.52    123.47    0.44    0.98   -55.26
             (    0.14,     0.11)    0.00      0.28    0.00    0.00     8.65
 sersic3 / : (  603.65,   514.78)   21.14      3.15    3.51    0.86   -80.33
             (    0.00,     0.01)    0.08      0.01    0.01    0.00     0.34
 radial2    : [4] [0]  (  600.92,   515.32)  197.14  475.97    0.64   -9.88
                       (  0.06,     0.26)    1.69    4.28    0.01    0.19
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2027747.78045,  ndof = 1006967
 Chi^2/nu = 2.014

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.57
Output image    : ngc3945.fits

 sersic    : (  604.59,   515.03)    9.18     49.17    0.91    0.64    -8.18
             (    0.01,     0.01)    0.00      0.04    0.00    0.00     0.04
 expdisk   : (  593.63,   518.02)    8.01    438.42    0.69    -6.59
             (    0.55,     0.71)    0.01      5.75    0.00     0.23
 sersic    : (  601.67,   514.50)    9.58    123.33    0.42    0.97   -76.65
             (    0.15,     0.11)    0.00      0.39    0.00    0.00     3.25
 sersic3 / : (  603.65,   514.78)   21.18      3.04    3.46    0.85   -80.58
             (    0.00,     0.01)    0.08      0.01    0.01    0.00     0.26
 radial2    : [4] [0]  (  600.94,   515.38)  200.25  470.19    0.64   -9.99
                       (  0.06,     0.26)    1.63    4.12    0.01    0.18
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2027737.43792,  ndof = 1006967
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 Chi^2/nu = 2.014

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.58
Output image    : ngc3945.fits

 sersic    : (  604.38,   515.00)    9.30     46.97    0.88    0.64    -8.49
             (    0.01,     0.02)    0.01      0.08    0.00    0.00     0.04
 expdisk   : (  583.48,   513.15)    7.02   1138.70    0.64    -5.15
             (    1.40,     3.75)    0.07     62.20    0.01     0.60
 expdisk   : (  606.33,   515.45)    9.61    105.67    0.63    -5.53
             (    0.15,     0.31)    0.01      1.46    0.00     0.12
 sersic    : (  593.02,   515.04)   10.11    139.28    0.30    0.73    86.98
             (    0.42,     0.22)    0.01      0.54    0.00    0.00     0.23
 sersic3 / : (  603.66,   514.77)   19.77      3.16    3.64    0.87   -78.92
             (    0.00,     0.01)    0.03      0.02    0.01    0.00     0.27
 radial2    : [5] [0]  (  600.23,   515.18)  170.59  420.24    0.74  -11.20
                       (  0.08,     0.16)    0.83    1.65    0.00    0.22
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2016533.73709,  ndof = 1006961
 Chi^2/nu = 2.003

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.59
Output image    : ngc3945.fits

 sersic    : ( [604.38], [515.00])  [9.30]   [46.97]  [0.88]  [0.64]  [-8.49]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : (  606.64,   512.09)   10.54    219.28    0.95    0.42    18.26
             (    0.32,     0.83)    0.04      3.94    0.01    0.01     0.31
 expdisk   : (  566.29,   501.31)    6.33   1775.82    0.67    6.87
             (    2.57,     6.59)    0.12    150.47    0.02    1.38
```

```
 expdisk   : (  606.94,   518.34)    9.98    139.05    0.48   -23.51
             (    0.31,     0.51)    0.03      1.78    0.01     0.28
 sersic    : (  593.31,   515.05)   10.06    137.29    0.32    0.73    87.49
             (    0.27,     0.11)    0.01      0.57    0.00    0.00     0.22
 sersic3 / : (  603.66,   514.77)   20.02      3.27    3.73    0.86   -81.45
             (    0.00,     0.01)    0.04      0.01    0.01    0.00     0.30
 radial2    : [6] [0]  (  600.19,   515.01)  174.15  445.24    0.70  -10.63
                       (  0.05,     0.18)    0.88    2.30    0.00    0.17
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2012083.04154,  ndof = 1006961
 Chi^2/nu = 1.998

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.60
Output image    : ngc3945.fits

 sersic    : ( [604.38], [515.00])  [9.30]   [46.97]  [0.88]  [0.64]  [-8.49]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : (  605.94,   513.51)   10.24    217.77    0.98    0.46    15.23
             (    0.31,     0.56)    0.03      3.27    0.01    0.01     0.27
 expdisk   : (  562.85,   495.67)    6.30   1784.75    0.70    8.81
             (    2.89,     6.59)    0.12    151.51    0.02    1.57
 expdisk   : (  607.94,   519.77)   10.18    148.09    0.44   -26.57
             (    0.39,     0.62)    0.03      1.87    0.01    0.25
 sersic    : (  593.27,   515.02)   10.06    136.95    0.32    0.73    87.47
             (    0.26,     0.14)    0.01      0.58    0.00    0.00     0.23
 sersic3 / : (  603.66,   514.78)   20.03      3.29    3.74    0.86   -81.26
             (    0.00,     0.01)    0.04      0.01    0.01    0.00     0.29
 radial2    : [6] [0]  (  600.20,   515.52)  174.11  447.23    0.70  -10.62
                       (  0.05,     0.19)    0.85    2.30    0.00    0.17
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2011899.87530,  ndof = 1006961
 Chi^2/nu = 1.998

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.61
Output image    : ngc3945.fits

 sersic    : (  604.29,   515.00)    9.35     46.16    0.87    0.64    -9.16
             (    0.01,     0.02)    0.00      0.08    0.00    0.00     0.08
 sersic    : (  607.38,   513.84)   10.15    201.50    1.16    0.46    13.56
             (    0.19,     0.53)    0.04      4.22    0.02    0.01     0.28
 expdisk   : (  569.44,   508.73)    6.31   1782.16    0.67    5.17
             (    2.44,     6.68)    0.13    160.00    0.02    1.39
 expdisk   : (  605.70,   516.74)   10.23    137.07    0.44  -26.68
             (    0.31,     0.48)    0.03      1.90    0.01    0.21
 sersic    : (  592.77,   515.54)   10.04    139.08    0.32    0.71    87.25
             (    0.34,     0.14)    0.01      0.49    0.00    0.00     0.15
 sersic3 / : (  603.66,   514.79)   20.03      3.30    3.74    0.87   -79.61
             (    0.00,     0.01)    0.03      0.02    0.01    0.00     0.27
 radial2    : [6] [0]  (  600.20,   515.59)  173.88  446.66    0.70  -11.01
                       (  0.07,     0.16)    0.70    1.85    0.00    0.14
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2011555.20152,  ndof = 1006954
 Chi^2/nu = 1.998

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.62
Output image    : ngc3945.fits

 sersic    : (  617.53,   516.41)    9.30    198.54   [2.90]   0.56    -5.19
             (    0.04,     0.05)    0.00      1.10   [0.00]   0.00     0.12
 expdisk   : (  562.86,   503.38)    7.14   1017.91    0.83    -8.55
             (    2.10,     2.70)    0.06     43.22    0.01     1.49
 expdisk   : (  600.39,   514.47)    9.43     28.87    0.63    -7.88
             (    0.02,     0.02)    0.00      0.03    0.00     0.04
 sersic    : (  590.75,   515.39)    9.72    160.60    0.39    0.64    86.52
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```
             (    0.29,     0.10)    0.00      0.37    0.00    0.00     0.13
 sersic3 / : (  603.73,   514.76)   20.08      2.30    3.81    0.90   -25.99
             (    0.00,     0.01)    0.02      0.01    0.02    0.00     0.54
 radial2    : [5] [0]  (  600.03,   514.85)  192.50  434.14    0.70   -9.56
                       (  0.10,     0.21)    0.76    1.05    0.00    0.14
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1989719.26652,  ndof = 1006962
 Chi^2/nu = 1.976

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.63
Output image    : ngc3945.fits

 sersic    : (  605.34,   515.98)    8.63    141.05   [2.90]   0.74   -10.16
             (    0.03,     0.02)    0.01      0.88   [0.00]   0.00     0.16
 sersic    : (  590.26,   512.11)   10.72     48.29    0.95    0.44    -4.19
             (    0.04,     0.06)    0.01      0.12    0.00    0.00     0.05
 expdisk   : (  558.84,   513.32)    5.59   2941.88    0.63    6.39
             (    5.52,    10.75)    0.24    458.94    0.04    1.49
 expdisk   : (  618.02,   515.61)   10.73     30.18    0.43   -4.42
             (    0.05,     0.05)    0.01      0.07    0.00    0.06
 sersic    : (  594.04,   515.20)   10.16    179.47    0.35    0.50    85.67
             (    0.41,     0.12)    0.00      0.49    0.00    0.00     0.08
 sersic3 / : (  603.58,   514.68)   20.26      1.61    4.06    0.87   -18.67
             (    0.01,     0.01)    0.01      0.01    0.02    0.00     0.46
 radial2    : [6] [0]  (  601.21,   517.43)  212.21  445.36    0.65   -9.36
                       (  0.09,     0.33)    0.83    1.31    0.00    0.10
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1950576.93002,  ndof = 1006955
 Chi^2/nu = 1.937

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
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```
Init. par. file : input.txt
Restart file    : galfit.64
Output image    : ngc3945.fits

 sersic    : (  605.35,   515.87)    8.63    138.19   [2.90]   0.74   -10.28
             (    0.03,     0.02)    0.01      0.84   [0.00]   0.00     0.16
 sersic    : (  590.24,   512.14)   10.74     48.31    0.94    0.43    -4.15
             (    0.05,     0.06)    0.01      0.12    0.00    0.00     0.05
 expdisk   : (  561.01,   510.87)    5.72   2763.51    0.61    5.76
             (    5.00,    10.01)    0.22    401.73    0.04    1.66
 expdisk   : (  618.14,   515.69)   10.76     30.31    0.42   -4.34
             (    0.05,     0.06)    0.01      0.07    0.00    0.06
 sersic    : (  594.38,   515.15)   10.17    179.75    0.35    0.50    85.63
             (    0.41,     0.12)    0.00      0.49    0.00    0.00     0.08
 sersic3 / : (  603.57,   514.67)   20.26      1.52    4.09    0.87   -18.79
             (    0.01,     0.01)    0.02      0.01    0.02    0.00     0.46
 radial2    : [6] [0]  (  601.29,   516.93)  213.60  444.63    0.65   -9.35
                       (  0.09,     0.34)    1.02    1.56    0.00    0.10
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1950321.17779,  ndof = 1006955
 Chi^2/nu = 1.937

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.65
Output image    : ngc3945.fits

 sersic    : (  604.58,   514.97)    9.41     45.74    0.85    0.64    -8.40
             (    0.01,     0.02)    0.01      0.09    0.00    0.00     0.04
 expdisk   : (  584.37,   503.34)    6.59   1623.97    0.57   -0.93
             (    2.22,     5.72)    0.12    151.13    0.03    0.62
 expdisk   : (  603.66,   515.46)    9.30     93.72    0.66   -6.30
             (    0.09,     0.13)    0.01      0.83    0.00    0.12
 sersic    : (  592.83,   514.85)   10.42    164.13    0.27    0.57    84.38
             (    0.46,     0.24)    0.01      0.66    0.00    0.00     0.13
 sersic3 / : (  603.68,   514.76)   22.73      3.48    4.09    0.91   -61.14
             (    0.00,     0.00)    0.06      0.02    0.02    0.00     0.77
```

```
 radial2    : [5] [0]  (  600.42,   514.80)  173.35  506.88    0.63   -8.89
                       (  0.08,     0.19)    1.44    3.70    0.00    0.12
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2016865.44338,  ndof = 1006961
 Chi^2/nu = 2.003

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.66
Output image    : ngc3945.fits

 sersic     : (  604.57,   514.98)    9.40     45.77    0.85    0.64    -8.39
              (    0.01,     0.02)    0.01      0.09    0.00    0.00     0.04
 expdisk    : (  584.56,   504.58)    6.56   1656.60    0.56    -0.95
              (    2.24,     5.86)    0.12    157.39    0.03     0.62
 expdisk    : (  603.68,   515.36)    9.30     93.88    0.66    -6.31
              (    0.09,     0.13)    0.01      0.85    0.00     0.12
 sersic     : (  592.76,   514.98)   10.41    163.57    0.27    0.58    84.41
              (    0.46,     0.24)    0.01      0.66    0.00    0.00     0.13
 sersic3 //: (  603.68,   514.76)   22.72      3.49    4.08    0.91   -61.24
              (    0.00,     0.00)    0.06      0.02    0.02    0.00     0.76
 radial2    : [5] [0]  (  600.44,   514.84)  173.31  506.00    0.63   -8.92
                       (  0.08,     0.19)    1.43    3.67    0.00    0.13
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2016782.23005,  ndof = 1006961
 Chi^2/nu = 2.003

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.67
Output image    : ngc3945.fits

 sersic     : (  604.57,   514.98)    9.44     44.93    0.85    0.64    -8.72
```

```
            (    0.01,     0.02)    0.01      0.08    0.00    0.00     0.05
 expdisk   : (  580.14,   497.85)    6.45   1894.66    0.51    6.15
            (    2.44,     7.24)    0.15    223.38    0.03    0.80
 expdisk   : (  603.38,   519.69)   11.20    153.15    0.29  -35.45
            (    0.79,     1.06)    0.04      4.51    0.01    0.15
 expdisk   : (  604.08,   514.45)    9.52     93.30    0.59    3.27
            (    0.10,     0.15)    0.01      0.90    0.00    0.25
 sersic    : (  593.31,   515.39)   10.32    159.64    0.29    0.58    85.77
            (    0.44,     0.17)    0.01      0.68    0.00    0.00     0.11
 sersic3 //: (  603.68,   514.76)   22.43      3.52    4.32    0.89   -71.17
            (    0.00,     0.00)    0.05      0.02    0.02    0.00     0.47
 radial2    : [6] [0]  (  600.33,   514.89)  161.49  503.15    0.63   -9.73
                       (  0.08,     0.18)    1.10    3.73    0.00    0.15
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2012837.23032,  ndof = 1006955
 Chi^2/nu = 1.999

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.68
Output image    : ngc3945.fits

 sersic    : (  604.57,   514.98)    9.41     45.74    0.85    0.64    -8.42
            (    0.01,     0.02)    0.01      0.09    0.00    0.00     0.04
 expdisk   : (  581.68,   497.76)    6.56   1657.89    0.56   -3.13
            (    2.22,     5.84)    0.12    156.98    0.03    0.65
 expdisk   : (  603.73,   515.45)    9.30     93.57    0.66   -6.17
            (    0.09,     0.13)    0.01      0.84    0.00    0.12
 sersic    : (  592.83,   514.96)   10.41    163.53    0.27    0.58    84.49
            (    0.46,     0.24)    0.01      0.67    0.00    0.00     0.13
 sersic3 //: (  603.68,   514.76)   22.73      3.49    4.08    0.91   -61.47
            (    0.00,     0.00)    0.06      0.02    0.02    0.00     0.77
 radial2    : [5] [0]  (  600.42,   514.81)  173.27  506.02    0.63   -8.90
                       (  0.08,     0.19)    1.43    3.68    0.00    0.13
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2013249.88805,  ndof = 1002997
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 Chi^2/nu = 2.007

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.69
Output image    : ngc3945.fits

 sersic    : (  604.56,   514.98)    9.41     45.77    0.85    0.64    -8.42
             (    0.01,     0.02)    0.01      0.09    0.00    0.00     0.04
 expdisk   : (  581.69,   498.16)    6.53   1691.39    0.55    -3.19
             (    2.23,     5.99)    0.12    163.42    0.03     0.63
 expdisk   : (  603.75,   515.44)    9.31     93.70    0.66    -6.17
             (    0.09,     0.13)    0.01      0.85    0.00     0.12
 sersic    : (  592.76,   514.97)   10.41    163.13    0.27    0.58    84.51
             (    0.46,     0.24)    0.01      0.67    0.00    0.00     0.12
 sersic3 //: (  603.68,   514.76)   22.72      3.50    4.07    0.91   -61.64
             (    0.00,     0.00)    0.06      0.02    0.02    0.00     0.76
 radial2    : [5] [0]  (  600.41,   514.82)  173.24  505.22    0.63   -8.90
                       (  0.08,     0.19)    1.43    3.66    0.00    0.13
 sky       : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2013180.94925,  ndof = 1002997
 Chi^2/nu = 2.007

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.70
Output image    : ngc3945.fits

 sersic    : (  604.56,   515.00)    9.38     45.63    0.85    0.64    -8.43
             (    0.01,     0.02)    0.01      0.09    0.00    0.00     0.04
 expdisk   : (  582.16,   502.02)    6.49   1712.01    0.54    -3.31
             (    2.20,     6.04)    0.12    167.39    0.03     0.55
 expdisk   : (  603.75,   515.40)    9.27     92.66    0.66    -6.17
             (    0.09,     0.13)    0.01      0.81    0.00     0.12
```

```
 sersic    : (  592.60,   515.10)   10.37    163.25    0.27    0.58    84.53
             (    0.46,     0.24)    0.01      0.67    0.00    0.00     0.13
 sersic3 //: (  603.68,   514.78)   22.69      3.51    4.06    0.91   -61.26
             (    0.00,     0.00)    0.05      0.02    0.02    0.00     0.78
 radial2    : [5] [0]  (  600.44,   515.39)  173.28  504.55    0.63   -8.82
                       (  0.08,     0.19)    1.39    3.62    0.00    0.13
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2013129.00768,  ndof = 1002997
 Chi^2/nu = 2.007

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Input image     : ngc3945_drz.fits[1][1:1060,1:950]
Init. par. file : input.txt
Restart file    : galfit.71
Output image    : ngc3945.fits

 sersic    : (  604.55,   514.98)    9.37     45.83    0.85    0.64    -8.40
             (    0.01,     0.02)    0.01      0.09    0.00    0.00     0.04
 expdisk   : (  581.44,   498.26)    6.37   1845.86    0.53    -3.06
             (    2.33,     6.67)    0.14    194.43    0.03     0.64
 expdisk   : (  603.78,   515.43)    9.28     94.09    0.66    -6.19
             (    0.09,     0.14)    0.01      0.86    0.00     0.12
 sersic    : (  592.49,   515.01)   10.36    162.15    0.27    0.58    84.57
             (    0.46,     0.24)    0.01      0.66    0.00    0.00     0.14
 sersic3 //: (  603.68,   514.77)   22.66      3.55    4.03    0.91   -61.61
             (    0.00,     0.00)    0.05      0.02    0.02    0.00     0.74
 radial2    : [5] [0]  (  600.37,   514.91)  173.23  502.14    0.63   -9.03
                       (  0.08,     0.17)    1.40    3.55    0.00    0.14
 sky        : [530.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2012916.74932,  ndof = 1002997
 Chi^2/nu = 2.007

--------------------------------------------------------------------------------
```

8.4 Output Log of NGC 3998

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc3998.fits

 sersic    : (  595.72,   519.53)    7.71    103.04    5.13    0.82   -26.91
             (    0.00,     0.00)    0.00      0.32    0.01    0.00     0.05
 expdisk   : (  607.81,   568.36)    7.96    656.70    0.54    -6.61
             (    0.71,     1.49)    0.01     10.88    0.01     0.22
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 880081.50024,  ndof = 949987
 Chi^2/nu = 0.926

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc3998.fits

 sersic    : (  595.72,   519.53)    7.71    102.93    5.13    0.82   -26.91
             (    0.00,     0.00)    0.00      0.32    0.01    0.00     0.05
 expdisk   : (  607.67,   567.81)    7.96    653.35    0.54    -6.63
             (    0.70,     1.47)    0.01     10.75    0.01     0.22
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 880081.08536,  ndof = 949987
 Chi^2/nu = 0.926

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.03
```

```
Output image    : ngc3998.fits

 sersic    : (  595.84,   519.57)    8.57     30.38   [2.00]   0.82   -28.47
             (    0.00,     0.00)    0.00      0.02   [0.00]   0.00     0.07
 expdisk   : (  596.66,   522.03)    8.05    167.83    0.79   -18.22
             (    0.09,     0.12)    0.00      0.21    0.00     0.14
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1249179.84665,  ndof = 949988
 Chi^2/nu = 1.315

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc3998.fits

 sersic    : (  596.13,   519.62)    7.90     78.72    4.01    0.81   -26.52
             (     nan,      nan)     nan       nan     nan     nan      nan
 expdisk   : (  604.25,   542.49)    7.93    451.01    0.67   -9.83
             (     nan,      nan)     nan       nan     nan      nan
 gaussian  : (  595.25,   519.40)   11.63     *0.01*   0.61     3.20
             (     nan,      nan)     nan      *nan*    nan      nan
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 754892.74760,  ndof = 949981
 Chi^2/nu = 0.795

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc3998.fits

 sersic    : (  596.27,   519.70)    8.00     65.54    3.45    0.81   -26.89
             (     nan,      nan)     nan       nan     nan     nan      nan
 expdisk   : (  596.01,   538.84)    7.94    426.20    0.67   -10.83
```

```
             (     nan,      nan)     nan       nan     nan      nan
 gaussian  : (  594.88,   519.30)   12.12     *0.01*   0.69     5.15
             (     nan,      nan)     nan      *nan*    nan      nan
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 770099.17002,  ndof = 949981
 Chi^2/nu = 0.811

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc3998.fits

 sersic    : (  595.94,   519.60)    8.37     44.04    2.24    0.81   -27.80
             (    0.00,     0.00)    0.00      0.04    0.00    0.00     0.05
 expdisk   : (  596.95,   525.14)    8.01    240.15    0.77   -15.76
             (    0.10,     0.16)    0.00      0.49    0.00     0.11
 gaussian  : ( [595.72], [519.53]) [11.63]    [2.00]  [0.80]   [3.20]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]   [0.00]
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 648644.88762,  ndof = 949987
 Chi^2/nu = 0.683

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc3998.fits

 sersic    : (  596.19,   519.66)    8.38     84.91    4.20    0.81   -26.56
             (     nan,      nan)     nan       nan     nan     nan      nan
 sersic    : (  596.19,   519.66)    8.38     84.91    4.20    0.81   -26.56
             (     nan,      nan)     nan       nan     nan     nan      nan
 expdisk   : (  602.98,   558.55)    7.86    605.42    0.60    -6.78
             (     nan,      nan)     nan       nan     nan      nan
```

```
 gaussian  : (  594.84,   519.29)   12.39     *0.01*   0.56    18.19
             (     nan,      nan)     nan      *nan*    nan      nan
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 2005259.26263,  ndof = 949974
 Chi^2/nu = 2.111

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc3998.fits

 sersic    : (  595.88,   519.69)    8.48    101.64    5.08    0.80   -16.12
             (    0.01,     0.00)    0.04      2.20    0.07    0.00     0.39
 sersic    : (  596.39,   519.62)    8.31     58.83    3.28    0.82   -35.40
             (    0.01,     0.00)    0.04      0.27    0.02    0.00     0.29
 expdisk   : (  603.39,   552.81)    7.94    539.12    0.64   -10.64
             (    0.01,     0.01)    0.00      0.30    0.00     0.02
 gaussian  : (  594.85,   519.30)   12.10     *0.01*   0.54     7.92
             (    0.15,     0.08)  112.58     *0.18*  16.44  2490.91
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3008786.82414,  ndof = 949974
 Chi^2/nu = 3.167

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc3998.fits

 sersic    : (  596.67,   519.91)    8.81     41.91    1.40    0.78   -25.86
             (    0.01,     0.01)    0.01      0.06    0.01    0.00     0.07
 sersic    : (  595.39,   519.42)    9.04    130.73  *20.00*   0.91   -52.20
             (    0.00,     0.00)    0.10     33.69   *0.91*   0.00     0.87
 expdisk   : (  594.16,   522.76)    8.09    210.65    0.76   -16.19
```

```
             (    0.10,     0.14)    0.01       0.34    0.00     0.11
 sky        : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 639496.80801,  ndof = 949980
 Chi^2/nu = 0.673

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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.10
Output image    : ngc3998.fits

 sersic     : (  595.70,   519.52)    7.21    254.19    7.31    0.81    -23.98
              (    0.00,     0.00)    0.00      0.58    0.01    0.00      0.04
   power    :     34.60     34.42   172.75     [0.00]  [0.00]   [0.00]
            :     0.02      0.05     0.12      [0.00]  [0.00]   [0.00]
 sky        : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 937244.44470,  ndof = 949990
 Chi^2/nu = 0.987

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.11
Output image    : ngc3998.fits

 expdisk    : ( [604.25], [542.49])   7.12   1990.64    0.33   -10.31
              (   [0.00],   [0.00])   0.10    170.42    0.02     0.58
 sersic     : ( [595.70], [519.52])   7.47    157.82    6.18    0.81   -20.41
              (   [0.00],   [0.00])   0.00      0.53    0.01    0.00     0.08
   power    :     86.09     86.09   171.31     [0.00]  [0.00]   [0.00]
            :    12.94    127.37     0.11     [0.00]  [0.00]   [0.00]
 sky        : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 885108.28674,  ndof = 949988
 Chi^2/nu = 0.932
```

```
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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.12
Output image    : ngc3998.fits

 expdisk   : (  971.26, *4420.75*)   5.92   2833.04   *0.09*   -5.46
             (   40.53,  *422.36*)   0.12     51.49   *0.00*    0.22
 sersic    : (  595.72,   519.53)    7.62    118.28    5.42    0.82   -26.63
             (    0.00,     0.00)    0.00      0.29    0.01    0.00     0.05
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 880692.92554,  ndof = 949987
 Chi^2/nu = 0.927

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.13
Output image    : ngc3998.fits

 expdisk   : ( [604.25], [542.49])   8.02    608.98    0.56    -6.72
             (   [0.00],   [0.00])   0.01      8.07    0.00     0.25
 sersic    : ( [595.70], [519.52])   7.72    101.67    5.10    0.82   -26.90
             (   [0.00],   [0.00])   0.00      0.28    0.01    0.00     0.05
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 880429.58779,  ndof = 949991
 Chi^2/nu = 0.927

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.14
```

```
Output image    : ngc3998.fits

 expdisk   : ( [604.25], [542.49])   7.10   1005.91    0.34    -7.48
             (   [0.00],   [0.00])   0.01     14.16    0.00     0.10
 sersic    : ( [595.70], [519.52])   8.38     63.48    2.33    0.78   -23.47
             (   [0.00],   [0.00])   0.01      0.14    0.01    0.00     0.09
 sersic    : ( [595.70], [519.52])   8.82    286.20  *20.00*   0.86   -66.71
             (   [0.00],   [0.00])   0.07     47.53   *0.49*   0.00     0.76
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 758498.62247,  ndof = 949986
 Chi^2/nu = 0.798

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.15
Output image    : ngc3998.fits

 expdisk   : ( [604.25], [542.49])   7.94    371.66    0.68   -12.77
             (   [0.00],   [0.00])   0.01      1.55    0.00     0.15
 sersic    : (  596.53,   519.83)    8.44     58.68    2.22    0.77   -26.08
             (    0.01,     0.01)    0.01      0.15    0.01    0.00     0.09
 sersic    : (  595.31,   519.40)    9.00    189.37  *20.00*   0.96   -78.72
             (    0.00,     0.00)    0.09     44.77   *0.73*   0.00     2.65
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 694753.74728,  ndof = 949982
 Chi^2/nu = 0.731

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.16
Output image    : ngc3998.fits

 expdisk   : ( [604.25], [542.49])   7.76    679.06    0.65    -9.39
```

```
             (   [0.00],   [0.00])   0.04     32.15    0.01     0.53
 sersic    : (  595.40,   519.42)    8.96    155.71  *20.00*   0.89   -51.02
             (    0.00,     0.00)    0.10     43.11   *0.97*   0.00     0.65
 sersic    : (  596.63,   519.94)    8.70     45.89    1.49    0.78   -24.64
             (    0.01,     0.01)    0.01      0.07    0.00    0.00     0.07
 sersic    : (  593.37,   520.33)    9.18    242.90    0.38    0.78   -20.13
             (    0.13,     0.27)    0.02      0.61    0.00    0.00     0.22
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 636661.08513,  ndof = 949975
 Chi^2/nu = 0.670

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.17
Output image    : ngc3998.fits

 expdisk   : (  582.31,   537.40)    7.79    680.30    0.62    -6.73
             (    1.62,     3.59)    0.05     36.22    0.01     0.45
 sersic    : (  595.39,   519.42)    8.96    156.30  *20.00*   0.89   -50.88
             (    0.00,     0.00)    0.10     43.91   *0.99*   0.00     0.67
 sersic    : (  596.66,   519.94)    8.70     45.96    1.49    0.78   -24.69
             (    0.01,     0.01)    0.01      0.07    0.00    0.00     0.07
 sersic    : (  598.32,   521.49)    9.18    243.46    0.38    0.79   -21.62
             (    0.38,     0.59)    0.02      0.56    0.00    0.00     0.24
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 636393.22802,  ndof = 949973
 Chi^2/nu = 0.670

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.18
Output image    : ngc3998.fits
```

```
 expdisk   : (  607.33,   566.56)    7.97    645.86    0.54    -6.69
             (    0.70,     1.45)    0.01     10.46    0.01     0.22
 sersic    : (  595.72,   519.53)    7.71    102.72    5.13    0.82   -26.91
             (    0.00,     0.00)    0.00      0.32    0.01    0.00     0.05
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 880081.99657,  ndof = 949987
 Chi^2/nu = 0.926

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.19
Output image    : ngc3998.fits

 expdisk   : (  594.64,   522.84)    8.02    209.42    0.79   -16.93
             (    0.09,     0.12)    0.00      0.26    0.00     0.11
 sersic    : (  595.25,   519.39)   11.31     *0.05*  [5.13]   0.29   -62.63
             (    0.02,     0.05)    0.05     *0.01*  [0.00]   0.30     7.40
 sersic    : (  596.30,   519.72)    8.49     39.78    1.89    0.81   -27.90
             (    0.00,     0.00)    0.00      0.02    0.00    0.00     0.04
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 590751.99142,  ndof = 949981
 Chi^2/nu = 0.622

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.20
Output image    : ngc3998.fits

 expdisk   : ( [607.33], [566.56])   7.89   [645.86]  [0.54]  [-6.69]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]   [0.00]
 sersic    : ( [595.72], [519.53])   7.77   [102.72]  [5.13]  [0.82] [-26.91]
             (   [0.00],   [0.00])   0.00     [0.00]  [0.00]  [0.00]   [0.00]
 sersic    : (  599.66,   521.56)   11.55     45.36    0.34    0.64   -33.92
```

```
             (    0.06,     0.09)    0.01       0.12    0.00    0.00      0.23
 sky        : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 837132.08777,  ndof = 949991
 Chi^2/nu = 0.881

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.21
Output image    : ngc3998.fits

 expdisk    : ( [607.33], [566.56])   7.88    [645.86]   [0.54]   [-6.69]
              (   [0.00],   [0.00])   0.00      [0.00]   [0.00]    [0.00]
 sersic     : ( [595.72], [519.53])   7.77    [102.72]   [5.13]   [0.82] [-26.91]
              (   [0.00],   [0.00])   0.00      [0.00]   [0.00]   [0.00]    [0.00]
 sersic     : ( [599.66], [521.56]) [11.55]    [45.36]   [0.34]   [0.64] [-33.92]
              (   [0.00],   [0.00])  [0.00]     [0.00]   [0.00]   [0.00]    [0.00]
 sersic3 /\: (  593.40,   516.90)   16.68      69.24    *0.02*    0.31    -43.55
              (    0.30,     0.33)  456.11 12112988890726400.00    *0.00*    0.01      0.32
 radial     : [4] [0]    [45.00] [43.00]
                          [0.00]    [0.00]
 radial     : [0] [4]    [66.00] [68.00]
                          [0.00]    [0.00]
 sky        : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                  [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 835401.30187,  ndof = 949991
 Chi^2/nu = 0.879

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Input image     : ngc3998_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.22
Output image    : ngc3998.fits

 expdisk    : (  594.14,   522.93)    8.18     208.75    0.76    -15.85
              (    0.11,     0.15)    0.01       0.35    0.00      0.09
```

```
 sersic    : (  595.42,   519.43)    8.46    369.54  *20.00*   0.91   -42.95
             (    0.00,     0.00)    0.07     67.73   *0.56*   0.00     0.73
 sersic    : (  596.79,   519.96)    8.93     41.56    1.31    0.77   -26.04
             (    0.01,     0.01)    0.01      0.06    0.00    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 648128.62411,  ndof = 949980
 Chi^2/nu = 0.682

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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.23
Output image    : ngc3998.fits

 expdisk   : (  594.27,   522.69)    8.18    209.76    0.76   -15.99
             (    0.11,     0.15)    0.01      0.34    0.00     0.09
 sersic    : (  595.42,   519.43)    8.45    376.92  *20.00*   0.91   -42.27
             (    0.00,     0.00)    0.07     66.22   *0.53*   0.00     0.76
 sersic    : (  596.78,   519.96)    8.93     41.63    1.31    0.77   -25.97
             (    0.01,     0.01)    0.01      0.06    0.00    0.00     0.07
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 780095.36042,  ndof = 1030926
 Chi^2/nu = 0.757

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.24
Output image    : ngc3998.fits

 expdisk   : (  603.24,   554.71)    8.05    574.08    0.57    -7.25
             (    0.58,     1.15)    0.01      7.36    0.00     0.17
 sersic    : (  595.73,   519.53)    7.74     98.03    5.02    0.82   -26.83
             (    0.00,     0.00)    0.00      0.30    0.01    0.00     0.05
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 1018673.81165,  ndof = 1030933
 Chi^2/nu = 0.988

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.25
Output image    : ngc3998.fits

 sersic    : (  595.70,   519.52)    7.20    260.29    7.38    0.81   -25.52
             (    0.00,     0.00)    0.00      0.59    0.01    0.00     0.05
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 1090270.85213,  ndof = 1030939
 Chi^2/nu = 1.058

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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.26
Output image    : ngc3998.fits

 expdisk   : (  603.55,   767.31)    9.70    288.18    0.51   -80.85
             (    0.89,     0.58)    0.01      1.72    0.00     0.21
 expdisk   : (  590.07,   264.65)    9.48    333.90    0.53   -78.83
             (    1.06,     0.70)    0.01      2.28    0.00     0.26
 sersic    : (  595.73,   519.53)    7.67    107.79    5.18    0.82   -27.79
             (    0.00,     0.00)    0.00      0.22    0.01    0.00     0.05
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 996715.68092,  ndof = 1030927
 Chi^2/nu = 0.967

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```

```
Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.27
Output image    : ngc3998.fits

 expdisk   : (  603.35,   555.56)    8.06    578.25    0.57    -7.56
             (    0.59,     1.19)    0.01     10.01    0.01     0.24
 sersic    : (  595.75,   519.54)    7.75     99.51    4.91    0.82   -26.35
             (    0.00,     0.01)    0.02      0.68    0.04    0.00     0.30
 sersic    : (  595.68,   519.50)   12.25     42.34  *20.00*   0.72   -77.50
             (    0.08,     0.09)    1.33    130.08   *7.87*   0.08     4.71
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 998615.07215,  ndof = 1030926
 Chi^2/nu = 0.969

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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.28
Output image    : ngc3998.fits

 expdisk   : ( [603.24], [554.71])   8.36   1290.13    0.99    43.57
             (   [0.00],   [0.00])   0.70    414.28    0.07   881.33
 sersic    : ( [595.73], [519.53])   7.67    106.03    5.02    0.82   -26.65
             (   [0.00],   [0.00])   0.00      0.31    0.01    0.00     0.05
 sersic3 //: ( [595.73], [519.53])  17.26    115.58  *19.98*   0.75   -17.20
             (   [0.00],   [0.00])   0.01    168.58  *36.74*   0.00     0.22
 radial2    : [3] [0]   116.32  317.39    0.80  -31.75
                         0.90    1.54    0.00    0.33
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 962110.27104,  ndof = 1030928
 Chi^2/nu = 0.933

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
```

```
Init. par. file : input.txt
Restart file    : galfit.29
Output image    : ngc3998.fits

 expdisk   : ( [603.24], [554.71])   8.03    367.66    0.71    -9.30
             (   [0.00],   [0.00])   0.00      1.92    0.00     0.21
 sersic    : ( [595.73], [519.53])   8.20     53.09    2.31    0.81   -27.39
             (   [0.00],   [0.00])   0.00      0.07    0.00    0.00     0.04
 sersic3 //: ( [595.73], [519.53])  18.17     *0.49*   7.07    0.79   -34.12
             (   [0.00],   [0.00])   0.01     *0.01*   0.05    0.00     0.32
 radial2    : [3] [0]   129.28  346.17    0.78  -36.38
                         0.88    0.64    0.00    0.25
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 759469.20621,  ndof = 1030928
 Chi^2/nu = 0.737

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.30
Output image    : ngc3998.fits

 expdisk   : ( [603.24], [554.71])   8.05    379.78    0.70    -8.88
             (   [0.00],   [0.00])   0.00      2.18    0.00     0.22
 sersic    : ( [595.73], [519.53])   8.20     53.41    2.31    0.81   -27.40
             (   [0.00],   [0.00])   0.00      0.07    0.00    0.00     0.04
 sersic3 //: ( [595.73], [519.53])  18.08      0.51    7.73    0.79   -33.90
             (   [0.00],   [0.00])   0.01      0.01    0.05    0.00     0.32
 radial2    : [3] [0]   118.25  348.68    0.78  -36.84
                         0.94    0.68    0.00    0.25
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 758618.58966,  ndof = 1030928
 Chi^2/nu = 0.736

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```

```
Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.31
Output image    : ngc3998.fits

 expdisk   : (  593.99,   524.61)    8.11    258.97    0.79   -11.70
             (    0.15,     0.21)    0.00      0.90    0.00     0.21
 sersic    : (  596.33,   519.73)    8.31     47.19    2.09    0.81   -27.38
             (    0.00,     0.00)    0.00      0.11    0.00    0.00     0.04
 sersic3 //: (  595.26,   519.39)   18.46     *0.40*   7.54    0.74   -32.69
             (    0.01,     0.01)    0.02     *0.01*   0.16    0.00     0.35
 radial2    : [3] [0]  ( [595.73], [519.53]) 126.46  350.83    0.77  -36.04
                       ( [0.00],    [0.00])    2.18    0.85    0.00    0.33
 sky        : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 724180.08420,  ndof = 1030922
 Chi^2/nu = 0.702

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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.32
Output image    : ngc3998.fits

 expdisk   : (  593.78,   524.44)    8.10    256.13    0.79   -11.84
             (    0.15,     0.21)    0.00      0.85    0.00     0.21
 sersic    : (  596.32,   519.73)    8.31     47.06    2.11    0.81   -27.39
             (    0.00,     0.00)    0.00      0.10    0.00    0.00     0.04
 sersic3 //: (  595.24,   519.41)   18.45     *0.31*   7.61    0.74   -31.95
             (    0.01,     0.01)    0.02     *0.01*   0.16    0.00     0.34
 radial2    : [3] [0]   133.55  348.35    0.77  -34.98
                         2.04    0.78    0.00    0.32
 sky        : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 721670.28334,  ndof = 1030922
 Chi^2/nu = 0.700

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.33
Output image    : ngc3998.fits

 expdisk   : (  594.65,   523.14)    7.97    224.43    0.78   -16.50
             (    0.10,     0.14)    0.00      0.38    0.00     0.11
 sersic    : (  596.30,   519.73)    8.41     41.73    1.99    0.81   -27.65
             (    0.00,     0.00)    0.00      0.03    0.00    0.00     0.05
 psf       : (  595.22,   519.39)   11.39
             (    0.00,     0.00)    0.00
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 720842.12281,  ndof = 1030930
 Chi^2/nu = 0.699

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.34
Output image    : ngc3998.fits

 expdisk   : (  593.12,   525.17)    8.23    279.35    0.81   -11.15
             (    0.21,     0.27)    0.00      1.49    0.00     0.27
 sersic    : (  596.49,   519.80)    8.23     50.97    2.32    0.81   -26.50
             (    0.00,     0.00)    0.00      0.08    0.00    0.00     0.04
 psf       : (  595.18,   519.38)   11.42
             (    0.00,     0.00)    0.00
 sersic3 //: (  583.39,   514.90)   17.95     [3.00]  [7.54]   0.73   -26.53
             (    0.04,     0.05)    0.01     [0.00]  [0.00]   0.00     0.28
 radial2    : [4] [0]   106.28  350.64    0.77  -32.35
                        0.20    0.56    0.00    0.22
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 703266.27062,  ndof = 1030921
 Chi^2/nu = 0.682

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.35
Output image    : ngc3998.fits

 expdisk   : (  622.62,   551.48)    7.65    667.87    0.72    -9.49
             (    1.77,     2.18)    0.04     27.54    0.01     0.46
 sersic    : (  597.27,   519.98)    8.32     50.61    2.31    0.81   -25.20
             (    0.01,     0.00)    0.00      0.07    0.00    0.00     0.03
 psf       : (  595.13,   519.37)   11.37
             (    0.00,     0.00)    0.00
 sersic3 //: (  585.27,   516.84)   18.92     30.08    2.41    0.79   -25.09
             (    0.03,     0.04)    0.03      0.41    0.02    0.00     0.17
 radial2    : [4] [0]    70.65  478.97    0.79  -30.03
                         2.37    1.08    0.00    0.25
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 696996.46985,  ndof = 1030919
 Chi^2/nu = 0.676

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.36
Output image    : ngc3998.fits

 expdisk   : (  622.57,   551.44)    7.65    668.26    0.72    -9.49
             (    1.77,     2.18)    0.04     27.59    0.01     0.46
 sersic    : (  597.27,   519.98)    8.32     50.62    2.31    0.81   -25.20
             (    0.01,     0.00)    0.00      0.07    0.00    0.00     0.03
 psf       : (  595.13,   519.37)   11.37
             (    0.00,     0.00)    0.00
 sersic3 //: (  585.28,   516.84)   18.92     30.07    2.41    0.79   -25.11
             (    0.03,     0.04)    0.03      0.41    0.02    0.00     0.17
 radial2    : [4] [0]    70.67  478.90    0.79  -30.05
                         2.37    1.08    0.00    0.25
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 696996.39481,  ndof = 1030919
 Chi^2/nu = 0.676

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.37
Output image    : ngc3998.fits

 expdisk   : (  621.80,   547.98)    7.72    614.53    0.76   -14.75
             (    1.74,     1.77)    0.03     21.97    0.00     0.50
 sersic    : (  597.29,   519.99)    8.33     50.53    2.31    0.81   -25.28
             (    0.01,     0.00)    0.00      0.08    0.00    0.00     0.04
 psf       : (  595.13,   519.37)   11.36
             (    0.00,     0.00)    0.00
 sersic3 //: (  585.25,   516.82)   18.95     29.50    2.38    0.78   -21.34
             (    0.04,     0.04)    0.03      0.40    0.02    0.00     0.06
 radial2    : [4] [0]    74.34  477.68    0.79 [-25.09]
                         2.41    1.06    0.00   [0.00]
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 697168.01980,  ndof = 1030920
 Chi^2/nu = 0.676

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.38
Output image    : ngc3998.fits

 expdisk   : (  607.78,   539.28)    7.86    509.22    0.72    -8.24
             (    0.62,     0.90)    0.02     12.46    0.00     0.31
 sersic    : (  597.31,   520.00)    8.33     50.27    2.30    0.81   -24.14
             (    0.01,     0.00)    0.00      0.08    0.00    0.00     0.05
 psf       : (  595.13,   519.37)   11.36
             (    0.00,     0.00)    0.00
```

```
 sersic3 //: (  585.29,   516.70)   19.26     25.32    2.23    0.79  [-25.09]
             (    0.04,     0.04)    0.03      0.30    0.01    0.00    [0.00]
 radial2    : [4] [0]    97.84  467.37    0.79 [-25.09]
                         2.21    1.01    0.00   [0.00]
 sky        : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 698043.48885,  ndof = 1030921
 Chi^2/nu = 0.677

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--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.39
Output image    : ngc3998.fits

 expdisk    : (  625.43,   533.85)    7.75    605.69    0.75   -10.72
              (    1.72,     1.03)    0.03     22.15    0.00     0.56
 sersic     : (  597.25,   519.93)    8.30     51.34    2.33    0.81   -25.19
              (    0.01,     0.00)    0.00      0.06    0.00    0.00     0.04
 psf        : (  595.13,   519.38)   11.37
              (    0.00,     0.00)    0.00
 sersic3 //: (  585.30,   516.54)   18.85     28.55    2.48    0.78   -24.54
              (    0.04,     0.03)    0.03      0.43    0.02    0.00     0.16
 radial2    : [4] [0]  (  586.70,   515.20)   73.94  470.82    0.78  -29.49
                       (  0.09,     0.07)    2.38    1.00    0.00    0.24
 sky        : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 696631.38903,  ndof = 1030917
 Chi^2/nu = 0.676

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Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.40
Output image    : ngc3998.fits

 expdisk    : (  594.65,   523.14)    7.97    224.36    0.78   -16.50
```

```
             (    0.10,     0.14)    0.00      0.38    0.00     0.11
 sersic    : (  596.30,   519.73)    8.41     41.72    1.99    0.81   -27.65
             (    0.00,     0.00)    0.00      0.03    0.00    0.00     0.05
 psf       : (  595.22,   519.39)   11.39
             (    0.00,     0.00)    0.00
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 720842.10384,  ndof = 1030930
 Chi^2/nu = 0.699

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.41
Output image    : ngc3998.fits

 expdisk   : (  594.65,  [523.14])   7.97    224.42    0.78   -16.50
             (    0.11,    [0.00])   0.00      0.38    0.00     0.11
 sersic    : (  596.30,   519.73)    8.41     41.73    1.99    0.81   -27.65
             (    0.00,     0.00)    0.00      0.03    0.00    0.00     0.05
 psf       : (  595.22,   519.39)   11.39
             (    0.00,     0.00)    0.00
 sky       : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 720842.14094,  ndof = 1030931
 Chi^2/nu = 0.699

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc3998_drz.fits[1][1:1087,1:962]
Init. par. file : input.txt
Restart file    : galfit.42
Output image    : ngc3998.fits

 expdisk   : (  594.65,   523.14)    7.97    224.42    0.78   -16.50
             (    0.10,     0.14)    0.00      0.38    0.00     0.11
 sersic    : (  596.30,   519.73)    8.41     41.73    1.99    0.81   -27.65
             (    0.00,     0.00)    0.00      0.03    0.00    0.00     0.05
```

```
 psf        : (  595.22,   519.39)   11.39
              (    0.00,     0.00)    0.00
 sky        : [544.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 720842.13699,  ndof = 1030930
 Chi^2/nu = 0.699

--------------------------------------------------------------------------------
```

8.5 Output Log of NGC 4382

```
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc4382.fits

 sersic     : (  538.58,   556.66)    8.47     48.18   [2.00]   0.77    34.04
              (    0.01,     0.01)    0.00      0.08   [0.00]   0.00     0.14
 expdisk    : (  541.41,   558.11)    6.59    267.00    0.78    28.83
              (    0.19,     0.26)    0.00      0.64    0.00     0.23
 sky        : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                 [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4613510.24148,  ndof = 949988
 Chi^2/nu = 4.856

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc4382.fits

 sersic     : ( [538.58],   [0.00])  15.44     *0.01*   0.25   *0.04*   69.39
              (   [0.00],   [0.00])   0.00     *0.00*   0.00   *0.00*    0.00
 expdisk    : ( [541.41],   [0.00])   5.29    992.95    0.23    -9.61
              (   [0.00],   [0.00])   0.01      6.94    0.00     0.08
```

```
 sky       : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 25444832.76454,  ndof = 949991
 Chi^2/nu = 26.784

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.26    203.74    4.20    0.77    34.28
             (    0.01,     0.01)    0.01      3.29    0.02    0.00     0.13
 expdisk   : (  548.90,   569.92)    6.42    501.75    0.71    21.65
             (    0.61,     0.90)    0.01      5.56    0.00     0.43
 sky       : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 4491774.63281,  ndof = 949987
 Chi^2/nu = 4.728

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.26    203.76    4.20    0.77    34.28
             (    0.01,     0.01)    0.01      3.29    0.02    0.00     0.13
 expdisk   : (  548.89,   569.92)    6.42    501.80    0.71    21.65
             (    0.61,     0.90)    0.01      5.56    0.00     0.43
 sky       : [500.50, 475.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 4491774.70917,  ndof = 949987
 Chi^2/nu = 4.728

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

```
Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.26    203.91    4.20    0.77    34.28
             (    0.01,     0.01)    0.01      3.29    0.02    0.00     0.13
 expdisk   : (  548.90,   569.94)    6.42    502.04    0.71    21.64
             (    0.61,     0.90)    0.01      5.57    0.00     0.43
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4491774.62700,  ndof = 949987
 Chi^2/nu = 4.728

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.26    203.75    4.20    0.77    34.28
             (    0.01,     0.01)    0.01      3.29    0.02    0.00     0.13
 expdisk   : (  548.89,   569.93)    6.42    501.85    0.71    21.65
             (    0.60,     0.90)    0.01      5.54    0.00     0.42
 sersic    : (  542.25,   566.82)   19.71    300.23    1.13   *0.01*   22.23
             ( 1504.31,  3682.49)   34.65  14902.21   98.29   *0.44*   26.84
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4492215.70355,  ndof = 949980
 Chi^2/nu = 4.729

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc4382.fits
```

```
 sersic    : (  538.54,   556.65)    7.26    203.91    4.20    0.77    34.28
             (    0.01,     0.01)    0.01      3.29    0.02    0.00     0.13
 expdisk   : (  548.90,   569.94)    6.42    502.04    0.71    21.64
             (    0.61,     0.90)    0.01      5.57    0.00     0.43
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4491774.62700,  ndof = 949987
 Chi^2/nu = 4.728

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc4382.fits

 sersic    : (  538.57,   556.65)    7.26    204.18    4.19    0.77    34.22
             (    0.03,     0.02)    0.02      4.48    0.05    0.00     0.40
 sersic    : (  536.10,   558.59)   15.36     28.04  *19.99*   0.60    59.36
             (    1.68,     1.48)   32.49   2770.90 *506.79*   0.63    70.99
 expdisk   : (  548.74,   569.94)    6.42    502.99    0.71    21.62
             (    0.60,     0.68)    0.01      5.91    0.00     0.42
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4491400.79793,  ndof = 949980
 Chi^2/nu = 4.728

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.26    203.97    4.20    0.77    34.28
             (    0.01,     0.01)    0.01      3.30    0.02    0.00     0.13
 expdisk   : (  548.90,   569.95)    6.42    502.11    0.71    21.64
             (    0.61,     0.90)    0.01      5.57    0.00     0.43
```

```
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4491774.64870,  ndof = 949987
 Chi^2/nu = 4.728

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:965,1:965]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.27    201.64    4.19    0.77    34.18
             (    0.01,     0.01)    0.01      3.35    0.02    0.00     0.13
 expdisk   : (  549.27,   566.81)    6.44    489.83    0.73    22.70
             (    0.61,     0.88)    0.01      5.35    0.00     0.46
 sky       : [483.00, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4487388.71467,  ndof = 931212
 Chi^2/nu = 4.819

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1090,1:965]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.33    189.19    4.11    0.77    34.34
             (    0.01,     0.01)    0.01      2.84    0.02    0.00     0.12
 expdisk   : (  546.73,   565.99)    6.49    463.83    0.73    21.50
             (    0.52,     0.76)    0.00      4.06    0.00     0.38
 sky       : [545.50, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4734902.26423,  ndof = 1051837
 Chi^2/nu = 4.502

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

```
Input image     : ngc4382_drz.fits[1][1:1090,1:965]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.33    188.91    4.11    0.77    34.34
             (    0.01,     0.01)    0.01      2.83    0.02    0.00     0.12
 expdisk   : (  546.73,   565.97)    6.49    463.49    0.73    21.51
             (    0.52,     0.76)    0.00      4.05    0.00     0.38
 sky       : [545.50, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4734902.30741,  ndof = 1051837
 Chi^2/nu = 4.502

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1090,1:965]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.27    202.67    4.20    0.77    34.29
             (    0.01,     0.01)    0.01      3.08    0.02    0.00     0.12
 expdisk   : (  548.23,   568.02)    6.43    497.70    0.72    21.29
             (    0.56,     0.84)    0.00      4.91    0.00     0.39
 sky       : [545.50, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4739592.60847,  ndof = 1036436
 Chi^2/nu = 4.573

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1090,1:965]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.27    202.41    4.19    0.77    34.29
```

```
             (    0.01,     0.01)    0.01      3.08    0.02    0.00     0.12
 expdisk   : (  548.22,   567.99)    6.43    497.23    0.72    21.30
             (    0.56,     0.84)    0.00      4.89    0.00     0.39
 sky       : [545.50, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4739592.61207,  ndof = 1036436
 Chi^2/nu = 4.573

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1090,1:965]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.27    202.67    4.20    0.77    34.29
             (    0.01,     0.01)    0.01      3.08    0.02    0.00     0.12
 expdisk   : (  548.23,   568.02)    6.43    497.70    0.72    21.29
             (    0.56,     0.84)    0.00      4.91    0.00     0.39
 sky       : [545.50, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4739592.61602,  ndof = 1036436
 Chi^2/nu = 4.573

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4382_drz.fits[1][1:1090,1:965]
Init. par. file : input.txt
Restart file    : galfit.10
Output image    : ngc4382.fits

 sersic    : (  538.54,   556.65)    7.23    202.67    4.20    0.77    34.29
             (    0.01,     0.01)    0.01      3.08    0.02    0.00     0.12
 expdisk   : (  548.23,   568.02)    6.40    497.70    0.72    21.29
             (    0.56,     0.84)    0.00      4.91    0.00     0.39
 sky       : [545.50, 483.00]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4739592.61173,  ndof = 1036436
 Chi^2/nu = 4.573
```

8.6 Output Log of NGC 4472

```
Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc4472.fits

 sersic    : (  593.57,   522.04)    7.31     95.86    1.68    0.88     6.56
             (    0.03,     0.04)    0.01      0.92    0.01    0.00     0.39
 expdisk   : (  589.52,   520.30)    5.96    331.17    0.84     0.23
             (    0.52,     0.63)    0.00      3.73    0.00     0.62
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10175955.81662,  ndof = 949987
 Chi^2/nu = 10.712
```

```
Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc4472.fits

 sersic    : (  593.43,   521.99)    5.54    500.76    3.24    0.87     4.54
             (    0.03,     0.03)    0.00      2.94    0.01    0.00     0.32
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10298167.82501,  ndof = 949993
 Chi^2/nu = 10.840
```

```
Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc4472.fits

 sersic    : (  593.13,   522.00)    5.43    633.52    3.05    0.84     2.29
             (    0.05,     0.06)    0.01      5.80    0.01    0.00     0.24
 sersic3 / : (  504.68,   619.26)   17.01     26.40    1.32    0.41    43.44
             (    2.99,     4.07)    0.26      2.25    0.07    0.01     0.53
 radial2    : [2] [0]  (  446.44,   667.62)  149.18  252.53    0.69   51.85
                       (  8.63,     6.13)   10.29   10.58    0.02    1.93
 sky        : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10171086.16358,  ndof = 949980
 Chi^2/nu = 10.707

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc4472.fits

 sersic    : (  597.39,   522.15)    8.67     53.80    1.30    0.92    12.63
             (    0.13,     0.12)    0.02      0.57    0.01    0.00     1.95
 sersic    : (  589.22,   521.77)    5.33    777.58    2.88    0.83     2.86
             (    0.09,     0.15)    0.01     14.74    0.03    0.00     0.34
 sky        : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                                [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10162915.58915,  ndof = 949986
 Chi^2/nu = 10.698

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc4472.fits
```

```
 sersic    : (  593.37,   521.94)    8.73     36.49    1.03    0.94     7.55
             (    0.04,     0.04)    0.03      0.50    0.01    0.00     1.18
 sersic    : (  594.88,   523.01)    7.51    140.64    0.81    0.80     6.13
             (    0.18,     0.22)    0.04      1.12    0.03    0.00     0.34
 expdisk   : (  586.54,   516.77)    5.81    388.36    0.88    -2.82
             (    1.05,     1.11)    0.01      9.59    0.00     1.08
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10143606.21263,  ndof = 949980
 Chi^2/nu = 10.678

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc4472.fits

 sersic    : (  593.57,   522.04)    7.31     95.85    1.68    0.88     6.56
             (    0.03,     0.04)    0.01      0.92    0.01    0.00     0.39
 expdisk   : (  589.52,   520.30)    5.96    331.16    0.84     0.23
             (    0.52,     0.63)    0.00      3.73    0.00     0.62
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 10175955.73735,  ndof = 949987
 Chi^2/nu = 10.712

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc4472.fits

 sersic    : (  593.57,   522.04)    7.31     95.85    1.68    0.88     6.56
             (    0.03,     0.04)    0.01      0.92    0.01    0.00     0.39
 expdisk   : (  589.52,   520.30)    5.96    331.15    0.84     0.23
             (    0.52,     0.63)    0.00      3.73    0.00     0.62
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 10175955.75187,  ndof = 949987
 Chi^2/nu = 10.712

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc4472.fits

 sersic    : (  593.51,   522.02)    9.09     32.75    0.99    0.96    12.37
             (    0.04,     0.04)    0.05      0.43    0.01    0.00     2.17
 sersic    : (  593.27,   521.86)    6.78    185.87    1.27    0.83     4.88
             (    0.09,     0.10)    0.06      5.85    0.06    0.00     0.20
 expdisk   : (  610.24,   531.61)    5.02   1009.06    0.73     7.85
             (    2.63,     3.26)    0.16    140.18    0.02     1.06
 psf       : (  238.02,   359.52)   10.50
             (    0.00,     0.00)    0.00
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3781214.62381,  ndof = 949977
 Chi^2/nu = 3.980

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc4472.fits

 sersic    : (  593.37,   521.94)    8.96     33.62    1.00    0.95     9.65
             (    0.00,     0.00)    0.00      0.03    0.00    0.00     0.13
 sersic    : (  593.93,   522.32)    7.17    153.39    1.04    0.82     5.21
             (    0.01,     0.01)    0.00      0.18    0.00    0.00     0.02
 expdisk   : (  591.41,   519.49)    5.67    500.30    0.85     2.16
             (    0.07,     0.09)    0.00      1.42    0.00     0.05
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
 Chi^2 = 25785.66402,  ndof = 949260
 Chi^2/nu = 0.027

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.10
Output image    : ngc4472.fits

 sersic    : (  593.51,   522.02)    9.08     32.84    0.99    0.96    12.14
             (    0.04,     0.04)    0.05      0.43    0.01    0.00     2.07
 sersic    : (  593.27,   521.86)    6.79    184.79    1.26    0.83     4.88
             (    0.09,     0.10)    0.06      5.67    0.06    0.00     0.20
 expdisk   : (  609.80,   531.25)    5.05    984.45    0.73     7.79
             (    2.49,     3.14)    0.15    130.99    0.02     1.05
 psf       : (  238.02,   359.52)   10.50
             (    0.00,     0.00)    0.00
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 3781214.85821,  ndof = 949977
 Chi^2/nu = 3.980

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.11
Output image    : ngc4472.fits

 sersic    : (  593.51,   522.02)    9.08     32.83    0.99    0.96    12.19
             (    0.04,     0.04)    0.05      0.43    0.01    0.00     2.10
 sersic    : (  593.27,   521.86)    6.79    184.91    1.26    0.83     4.87
             (    0.09,     0.10)    0.06      5.70    0.06    0.00     0.20
 expdisk   : (  609.75,   531.26)    5.05    985.39    0.73     7.81
             (    2.49,     3.15)    0.15    131.67    0.02     1.05
 psf       : (  238.02,   359.52)   10.50
             (    0.00,     0.00)    0.00
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 3781214.35562,  ndof = 949977
 Chi^2/nu = 3.980

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.12
Output image    : ngc4472.fits

 sersic    : (  593.41,   521.92)    9.14     32.38    0.98    0.97    11.82
             (    0.04,     0.04)    0.05      0.42    0.01    0.00     2.44
 sersic    : (  593.57,   522.24)    6.75    189.85    1.33    0.83     5.39
             (    0.08,     0.09)    0.06      6.28    0.06    0.00     0.18
 expdisk   : (  600.78,   516.53)    5.23    878.06    0.79     2.18
             (    1.73,     2.32)    0.12     98.50    0.01     1.09
 psf       : (  238.03,   359.52)   10.52
             (    0.00,     0.00)    0.00
 sky       : [544.50, 481.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 4169071.79226,  ndof = 1046633
 Chi^2/nu = 3.983

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.13
Output image    : ngc4472.fits

 sersic    : (  593.36,   521.89)    9.01     33.20    1.00    0.96    10.74
             (    0.00,     0.00)    0.01      0.06    0.00    0.00     0.29
 sersic    : (  593.89,   522.56)    7.05    162.30    1.12    0.82     5.21
             (    0.01,     0.02)    0.01      0.45    0.01    0.00     0.03
 expdisk   : (  591.08,   515.00)    5.59    555.35    0.87    0.67
             (    0.15,     0.20)    0.01      3.69    0.00    0.17
 sky       : [544.50, 481.50]   [0.00e+00]   [0.00e+00]   [0.00e+00]
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
```

```
 Chi^2 = 111704.60142,  ndof = 1034151
 Chi^2/nu = 0.108

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.14
Output image    : ngc4472.fits

 sersic    : (  593.37,   521.89)    9.03     33.04    1.00    0.96    11.09
             (    0.00,     0.00)    0.01      0.06    0.00    0.00     0.30
 sersic    : (  593.83,   522.51)    7.01    165.02    1.14    0.82     5.16
             (    0.01,     0.02)    0.01      0.50    0.01    0.00     0.03
 expdisk   : (  592.00,   515.14)    5.56    581.17    0.87     1.19
             (    0.16,     0.21)    0.01      4.27    0.00     0.17
 psf       : (  237.68,   360.50)   12.27
             (    0.07,     0.08)    0.02
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109091.72622,  ndof = 1033629
 Chi^2/nu = 0.106

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.15
Output image    : ngc4472.fits

 sersic    : (  593.36,   521.89)    9.02     33.11    1.00    0.96    10.94
             (    0.00,     0.00)    0.01      0.06    0.00    0.00     0.29
 sersic    : (  593.85,   522.53)    7.03    163.88    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.48    0.01    0.00     0.03
 expdisk   : (  591.62,   515.08)    5.57    570.21    0.87    0.98
             (    0.16,     0.21)    0.01      4.00    0.00    0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.30598,  ndof = 1033632
```

```
 Chi^2/nu = 0.106

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.16
Output image    : ngc4472.fits

 sersic    : (  593.50,   521.96)    9.09     32.82    0.99    0.97    12.23
             (    0.04,     0.04)    0.05      0.40    0.01    0.00     2.27
 sersic    : (  593.32,   522.12)    6.73    192.18    1.30    0.83     5.03
             (    0.08,     0.09)    0.06      5.72    0.06    0.00     0.18
 expdisk   : (  612.74,   520.90)    4.90   1081.27    0.78     6.35
             (    3.30,     3.22)    0.17    146.01    0.01     1.30
 psf       : (  238.03,   359.52)   10.52
             (    0.00,     0.00)    0.00
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 4091027.93250,  ndof = 1034793
 Chi^2/nu = 3.953

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.17
Output image    : ngc4472.fits

 sersic    : (  593.27,   522.11)    9.22     31.31    0.97    0.99   -26.10
             (    0.05,     0.08)    0.09      0.65    0.02    0.00    27.72
 sersic    : (  594.25,   523.06)    6.99    166.95    1.27    0.82     2.35
             (    0.10,     0.20)    0.08      6.35    0.09    0.00     1.20
 expdisk   : (  582.45,   509.34)    5.63    547.20    0.91   -12.87
             (    1.22,     1.75)    0.04     36.51    0.01     4.04
 sersic    : (  593.99,   513.61)   10.20    295.01    2.75    0.46    40.19
             (    1.19,     1.74)    0.74    231.54    0.81    0.10     2.76
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
 Chi^2 = 10544469.38110,  ndof = 1034789
 Chi^2/nu = 10.190

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.18
Output image    : ngc4472.fits

 sersic    : (  593.45,   521.99)    5.54    507.06    3.26    0.87     5.14
             (    0.00,     0.00)    0.00      0.43    0.00    0.00     0.05
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 286533.16020,  ndof = 1033645
 Chi^2/nu = 0.277

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.19
Output image    : ngc4472.fits

 sersic    : (  593.36,   521.89)    9.02     33.11    1.00    0.96    10.94
             (    0.00,     0.00)    0.01      0.06    0.00    0.00     0.29
 sersic    : (  593.85,   522.53)    7.03    163.87    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.48    0.01    0.00     0.03
 expdisk   : (  591.62,   515.09)    5.57    570.08    0.87     0.98
             (    0.16,     0.21)    0.01      4.00    0.00     0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.30753,  ndof = 1033632
 Chi^2/nu = 0.106

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
```

```
Init. par. file : input.txt
Restart file    : galfit.20
Output image    : ngc4472.fits

 sersic    : (  593.36,   521.89)    9.02     33.11    1.00    0.96    10.94
             (    0.00,     0.00)    0.01      0.06    0.00    0.00     0.29
 sersic    : (  593.85,   522.53)    7.03    163.88    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.48    0.01    0.00     0.03
 expdisk   : (  591.62,   515.08)    5.57    570.20    0.87     0.98
             (    0.16,     0.21)    0.01      4.00    0.00     0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.30727,  ndof = 1033632
 Chi^2/nu = 0.106

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.21
Output image    : ngc4472.fits

 sersic    : (  593.36,   521.89)    9.02     33.11    1.00    0.96    10.94
             (    0.00,     0.00)    0.01      0.06    0.00    0.00     0.29
 sersic    : (  593.85,   522.53)    7.03    163.88    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.48    0.01    0.00     0.03
 expdisk   : (  591.62,   515.09)    5.57    570.20    0.87     0.98
             (    0.16,     0.21)    0.01      4.00    0.00     0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.30780,  ndof = 1033632
 Chi^2/nu = 0.106

-------------------------------------------------------------------------------
-------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.22
Output image    : ngc4472.fits
```

```
 expdisk   : (  593.37,   521.89)    9.01     19.78    0.96    10.83
             (    0.00,     0.00)    0.00      0.02    0.00     0.28
 sersic    : (  593.86,   522.54)    7.03    163.70    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.43    0.00    0.00     0.03
 expdisk   : (  591.62,   515.11)    5.57    568.29    0.87     1.00
             (    0.16,     0.21)    0.00      3.39    0.00     0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.45810,  ndof = 1033633
 Chi^2/nu = 0.106

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.23
Output image    : ngc4472.fits

 expdisk   : (  593.37,   521.89)    9.01     19.78    0.96    10.83
             (    0.00,     0.00)    0.00      0.02    0.00     0.28
 sersic    : (  593.86,   522.54)    7.03    163.70    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.43    0.00    0.00     0.03
 expdisk   : (  591.62,   515.11)    5.57    568.29    0.87     1.00
             (    0.16,     0.21)    0.00      3.39    0.00     0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.45779,  ndof = 1033633
 Chi^2/nu = 0.106

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4472_drz.fits[1][1:1088,1:962]
Init. par. file : input.txt
Restart file    : galfit.24
Output image    : ngc4472.fits

 expdisk   : (  593.37,   521.89)    8.98     19.78    0.96    10.83
             (    0.00,     0.00)    0.00      0.02    0.00     0.28
```

```
 sersic    : (  593.86,   522.54)    7.00    163.70    1.13    0.82     5.18
             (    0.01,     0.02)    0.01      0.43    0.00    0.00     0.03
 expdisk   : (  591.62,   515.11)    5.54    568.28    0.87     1.00
             (    0.16,     0.21)    0.00      3.39    0.00     0.17
 sky       : [544.50, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 109439.45810,  ndof = 1033633
 Chi^2/nu = 0.106

--------------------------------------------------------------------------------
```

8.7 Output Log of NGC 4596

```
--------------------------------------------------------------------------------

Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.01
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   5.75   6963.20  *10.79*   0.84   -51.23
             (   [0.00],   [0.00])   0.02    213.21   *0.06*   0.00     0.25
 expdisk   : ( [594.76], [522.39])   8.77    528.73    0.14   -75.97
             (   [0.00],   [0.00])   0.01      7.62    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6873900.15633,  ndof = 949991
 Chi^2/nu = 7.236

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.02
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   9.52    [50.00]   4.68    0.75   -53.25
             (   [0.00],   [0.00])   0.00     [0.00]   0.01    0.00     0.26
```

```
 expdisk   : ( [594.76], [522.39])   8.15   [100.00]   0.90   -71.76
             (   [0.00],   [0.00])   0.00     [0.00]   0.00     0.48
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 9337745.63523,  ndof = 949993
 Chi^2/nu = 9.829

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.03
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   7.83    303.92    5.94    0.85   -44.66
             (   [0.00],   [0.00])   0.02      6.92    0.04    0.00     0.29
 sersic    : ( [594.76], [522.39])   9.41    303.34    0.43    0.28   -75.79
             (   [0.00],   [0.00])   0.00      1.34    0.00    0.00     0.07
 expdisk   : ( [594.76], [522.39])   4.63   2993.17    0.62   -81.41
             (   [0.00],   [0.00])   0.14    284.16    0.02     1.91
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6694168.56627,  ndof = 949986
 Chi^2/nu = 7.047

--------------------------------------------------------------------------------
--------------------------------------------------------------------------------

Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.04
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   7.87    342.25    6.53    0.85   -32.58
             (   [0.00],   [0.00])   0.00      0.09    0.01    0.00     0.10
 sersic    : ( [594.76], [522.39])   8.29    501.85    0.06    1.00   -50.79
             (   [0.00],   [0.00])   0.01      0.05    0.00    0.01  4958.45
 expdisk   : ( [594.76], [522.39])   8.89    205.59    0.31   -75.58
             (   [0.00],   [0.00])   0.00      1.11    0.00    0.08
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 6725109.05655,  ndof = 949986
 Chi^2/nu = 7.079

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.05
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   7.15   1021.25    8.39    0.86   -37.21
             (   [0.00],   [0.00])   0.03     43.25    0.07    0.00     0.32
 sersic    : ( [594.76], [522.39])   5.71   2827.55    0.16    0.45     5.37
             (   [0.00],   [0.00]) 117.35 215780.53    4.85   19.12   379.52
 expdisk   : ( [594.76], [522.39])   9.05    229.99    0.26   -75.82
             (   [0.00],   [0.00])   0.01      1.54    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6730317.30547,  ndof = 949986
 Chi^2/nu = 7.085

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.06
Output image    : ngc4596.fits

 sersic    : (  594.85,   522.39)    6.84    720.34    5.41    0.76   -49.11
             (     nan,      nan)     nan       nan     nan     nan      nan
   power   : 39317266432.00    190.24    -0.21     *6.53*  *0.00*  -17.00
           :       nan       nan      nan      *nan*   *nan*     nan
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 7695441.98549,  ndof = 949987
 Chi^2/nu = 8.101

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.07
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   7.15    951.11    8.08    0.82   -46.70
             (   [0.00],   [0.00])   0.01     21.48    0.04    0.00     0.22
 expdisk   : ( [594.76], [522.39])   8.13   1497.07   *0.06*  -72.56
             (   [0.00],   [0.00])   0.06     92.29   *0.00*    0.08
 sersic    : ( [594.76], [522.39])  [9.00]  [350.34]  [0.50]  [0.45] [-30.00]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
   power   :   324.06    324.06   113.44       2.71   *1.59*  -51.74
           :      0.07      0.10     0.34       0.01   *3.49*    0.18
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 7261316.36617,  ndof = 949985
 Chi^2/nu = 7.644

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.08
Output image    : ngc4596.fits

 sersic    : ( [594.76], [522.39])   8.39    126.49    4.26    0.84   -55.48
             (   [0.00],   [0.00])   0.00      0.99    0.02    0.00     0.24
 expdisk   : ( [594.76], [522.39])   4.66  10487.89   *0.03*  -76.81
             (   [0.00],   [0.00])   0.31   2975.24   *0.01*    0.09
 sersic    : ( [594.76], [522.39])  [9.00]  [350.34]  [0.50]  [0.45] [-30.00]
             (   [0.00],   [0.00])  [0.00]    [0.00]  [0.00]  [0.00]   [0.00]
   power   :  [324.00]  [400.00]  [90.00]    [0.29] [10.00] [-30.00]
           :    [0.00]    [0.00]   [0.00]    [0.00]  [0.00]   [0.00]
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 7193842.15104,  ndof = 949991
 Chi^2/nu = 7.573
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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.09
Output image    : ngc4596.fits

 sersic    : (  594.73,   522.38)    5.36  13667.19  *11.97*   0.84   -51.80
             (    0.01,     0.01)    0.02    479.65   *0.07*   0.00     0.23
 expdisk   : (  638.45,   532.94)    8.91    520.82    0.13   -75.96
             (    2.06,     0.51)    0.01      8.04    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6851591.59143,  ndof = 949987
 Chi^2/nu = 7.212

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.10
Output image    : ngc4596.fits

 sersic    : (  594.67,   522.42)    7.06   2814.52    9.27    0.84   -52.16
             (    0.74,     0.75)    8.59  47890.84   24.95    0.23    53.14
 sersic    : (  594.82,   522.34)    7.06   2815.99    9.26    0.84   -52.31
             (    0.50,     0.75)    8.60  47927.94   24.88    0.23    53.51
 expdisk   : (  664.58,   538.90)    8.22    708.70    0.15   -76.25
             (    2.77,     0.67)    0.01     13.86    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6908548.67009,  ndof = 949980
 Chi^2/nu = 7.272

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
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```
Restart file    : galfit.11
Output image    : ngc4596.fits

 sersic    : (  594.78,   522.39)    7.67    388.98    6.35    0.84   -45.71
             (    0.01,     0.01)    0.02      9.72    0.04    0.00     0.28
 sersic    : (  600.00,   524.14)    9.45    311.37    0.42    0.27   -75.87
             (    0.86,     0.20)    0.00      1.41    0.00    0.00     0.06
 expdisk   : (  590.60,   487.72)    3.85   4918.96    0.54   -85.15
             (   27.32,     7.57)    0.27    924.36    0.06     2.30
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6690965.75462,  ndof = 949980
 Chi^2/nu = 7.043

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.12
Output image    : ngc4596.fits

 sersic    : (  594.30,   522.37)    8.94   1841.19  *20.00*   0.74   -43.41
             (    0.02,     0.01)    1.10   4299.15   *5.45*   0.01     1.03
 sersic    : (  584.47,   520.61)    9.36    294.94    0.40    0.31   -75.72
             (    1.33,     0.31)    0.01      1.13    0.00    0.00     0.07
 sersic    : (  595.84,   522.44)    8.79    103.50    2.53    0.88   -46.80
             (    0.08,     0.03)    0.09      4.34    0.07    0.01     0.85
 expdisk   : (*1064.98*,  624.67)    4.12   4187.13    0.39   -74.96
             ( *127.68*,   31.00)    0.14    482.98    0.04     1.35
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6630365.29250,  ndof = 949973
 Chi^2/nu = 6.980

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.13
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```
Output image    : ngc4596.fits

 sersic    : (  594.78,   522.39)    7.61    425.67    6.51    0.84   -45.92
             (    0.01,     0.01)    0.02     11.25    0.04    0.00     0.28
 sersic    : (  599.35,   523.87)    9.44    314.22    0.42    0.27   -75.91
             (    0.89,     0.21)    0.00      1.44    0.00    0.00     0.07
 expdisk   : (  687.40,   483.27)    2.01  14260.91    0.38   -86.54
             (  116.12,    18.56)    0.84   8736.07    0.17     3.35
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6689111.03234,  ndof = 949980
 Chi^2/nu = 7.041

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.14
Output image    : ngc4596.fits

 sersic    : (  594.77,   522.39)    7.40    582.74    7.03    0.85   -45.41
             (    0.01,     0.01)    0.02     17.28    0.05    0.00     0.28
 sersic    : (  607.11,   525.58)    9.50    304.69    0.41    0.27   -75.89
             (    0.90,     0.22)    0.01      1.13    0.00    0.00     0.07
 expdisk   : (  184.37,   459.92)    7.96   1300.87    0.18    1.11
             (    2.03,    12.64)    0.17    125.98    0.01    0.33
 sky       : [500.50, 475.50]     1.04  1.67e-03  -7.64e-05
                                  0.04  6.12e-05  1.48e-05
 Chi^2 = 6670702.85016,  ndof = 949977
 Chi^2/nu = 7.022

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--------------------------------------------------------------------------------

Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.15
Output image    : ngc4596.fits

 sersic    : (  594.77,   522.39)    7.40    582.74    7.03    0.85   -45.41
```

```
             (    0.01,     0.01)    0.02     17.28    0.05    0.00     0.28
 sersic    : (  607.11,   525.58)    9.50    304.69    0.41    0.27   -75.89
             (    0.90,     0.22)    0.01      1.13    0.00    0.00     0.07
 expdisk   : (  184.37,   459.92)    7.96   1300.87    0.18     1.11
             (    2.03,    12.64)    0.17    125.98    0.01     0.33
 sky       : [500.50, 475.50]     1.04  1.67e-03  -7.64e-05
                                  0.04  6.12e-05  1.48e-05
 Chi^2 = 6670702.85016,  ndof = 949977
 Chi^2/nu = 7.022

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.16
Output image    : ngc4596.fits

 sersic    : (  594.77,   522.39)    7.46    538.11    6.91    0.84   -46.85
             (    0.01,     0.01)    0.03     21.74    0.07    0.00     0.27
 sersic    : (  601.82,   524.39)    9.47    321.47    0.41    0.26   -75.98
             (    0.79,     0.21)    0.00      1.38    0.00    0.00     0.06
 expdisk   : ( [594.77], [522.39])   4.05   6829.94    0.57    84.14
             (   [0.00],   [0.00])  55.95 121599.77    0.13    10.70
 sky       : [500.50, 475.50]  9.59e-01  -2.03e-05  -1.03e-04
                               1.46e+01  1.41e-05  1.48e-05
 Chi^2 = 6689454.52657,  ndof = 949979
 Chi^2/nu = 7.042

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.17
Output image    : ngc4596.fits

 sersic    : (  594.77,   522.39)    7.52    489.44    6.74    0.84   -46.45
             (    0.01,     0.01)    0.03     18.78    0.06    0.00     0.28
 sersic    : (  600.67,   524.09)    9.44    319.53    0.42    0.26   -75.96
             (    0.84,     0.21)    0.01      1.23    0.00    0.00     0.06
```

```
 expdisk   : ( [594.77], [522.39])   4.08   9829.18    0.40    82.02
             (   [0.00],   [0.00])  75.10 235191.55    0.29    11.88
 sky       : [500.50, 475.50]     1.27  9.05e-06  -9.11e-05
                                 13.23  1.41e-05  1.48e-05
 Chi^2 = 6688605.22647,  ndof = 949979
 Chi^2/nu = 7.041

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.18
Output image    : ngc4596.fits

 sersic    : (  594.78,   522.39)    7.59    436.46    6.55    0.84   -45.97
             (    0.01,     0.01)    0.02     11.72    0.04    0.00     0.28
 sersic    : (  599.86,   523.68)    9.43    315.61    0.42    0.27   -75.92
             (    0.74,     0.19)    0.00      1.37    0.00    0.00     0.07
 expdisk   : ( [594.77], [522.39])   0.87  26323.50    0.33    88.93
             (   [0.00],   [0.00])   1.53  29437.94    0.27     6.25
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6688790.22047,  ndof = 949982
 Chi^2/nu = 7.041

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.19
Output image    : ngc4596.fits

 sersic    : (  594.78,   522.39)    7.63    409.08    6.44    0.84   -45.83
             (    0.01,     0.01)    0.02      9.63    0.04    0.00     0.28
 sersic    : (  599.57,   523.61)    9.44    313.68    0.42    0.27   -75.91
             (    0.74,     0.20)    0.00      1.44    0.00    0.00     0.07
 expdisk   : ( [594.77], [522.39])   3.13  [6829.94]   0.57   -84.98
             (   [0.00],   [0.00])   0.09     [0.00]   0.05     3.81
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
                                [0.00e+00]   [0.00e+00]   [0.00e+00]
 Chi^2 = 6690196.97277,  ndof = 949983
 Chi^2/nu = 7.042

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--------------------------------------------------------------------------------

Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.20
Output image    : ngc4596.fits

 sersic    : (  594.77,   522.39)    7.45    542.55    6.93    0.84   -46.93
             (    0.00,     0.00)    0.00      0.03    0.00    0.00     0.00
 sersic    : (  600.47,   523.81)    9.48    319.27    0.41    0.26   -75.98
             (    0.00,     0.00)    0.00      0.07    0.00    0.00     0.00
 expdisk   : ( [594.77], [522.39])   3.88  [6829.94]   0.53   -85.17
             (   [0.00],   [0.00])   0.06     [0.00]   0.01     0.43
 sersic    : (  554.38,   496.18)    9.30    547.61    0.05    0.83    -2.80
             (    0.10,     0.48)    0.06      0.00    0.01    0.02     2.15
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6689671.20001,  ndof = 949976
 Chi^2/nu = 7.042

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.21
Output image    : ngc4596.fits

 sersic    : (  594.78,   522.39)    7.60    408.99    6.44    0.84   -45.83
             (    0.01,     0.01)    0.02      9.63    0.04    0.00     0.28
 expdisk   : ( [594.77], [522.39])   3.10  [6829.94]   0.57   -84.59
             (   [0.00],   [0.00])   0.08     [0.00]   0.05     3.75
 sersic    : (  599.57,   523.61)    9.40    313.61    0.42    0.27   -75.91
             (    0.74,     0.20)    0.00      1.44    0.00    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
```

```
 Chi^2 = 6690196.77596,  ndof = 949983
 Chi^2/nu = 7.042

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Input image     : ngc4596_drz.fits[1][1:1000,1:950]
Init. par. file : input.txt
Restart file    : galfit.22
Output image    : ngc4596.fits

 sersic    : (  594.77,   522.39)    7.48    490.14    6.76    0.84   -46.55
             (    0.01,     0.01)    0.02     14.40    0.05    0.00     0.28
 expdisk   : ( [594.77], [522.39])   3.10   6148.33    0.74   -88.62
             (   [0.00],   [0.00])   0.40   1423.57    0.08     7.92
 sersic    : (  600.17,   523.74)    9.43    319.20    0.42    0.26   -75.96
             (    0.77,     0.20)    0.00      1.44    0.00    0.00     0.07
 sky       : [500.50, 475.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6690936.31533,  ndof = 949982
 Chi^2/nu = 7.043

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Input image     : ngc4596_drz.fits[1][1:1089,1:962]
Init. par. file : input.txt
Restart file    : galfit.23
Output image    : ngc4596.fits

 sersic    : (  594.79,   522.39)    7.69    354.42    6.19    0.85   -46.05
             (    0.01,     0.01)    0.01      6.76    0.03    0.00     0.25
 expdisk   : ( 1005.57,   605.93)    3.05   8530.57    0.35   -73.12
             (   96.84,    26.60)    0.20   1295.66    0.04     1.32
 sersic    : (  589.68,   521.58)    9.42    298.63    0.42    0.28   -75.83
             (    0.56,     0.17)    0.00      0.78    0.00    0.00     0.06
 sky       : [545.00, 481.50]  [0.00e+00]  [0.00e+00]  [0.00e+00]
                               [0.00e+00]  [0.00e+00]  [0.00e+00]
 Chi^2 = 6917590.27009,  ndof = 1033845
 Chi^2/nu = 6.691
```

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