STUDY OF CIRCUMNUCLEAR DUST IN AGN THROUGH MODELS AND OBSERVATIONS

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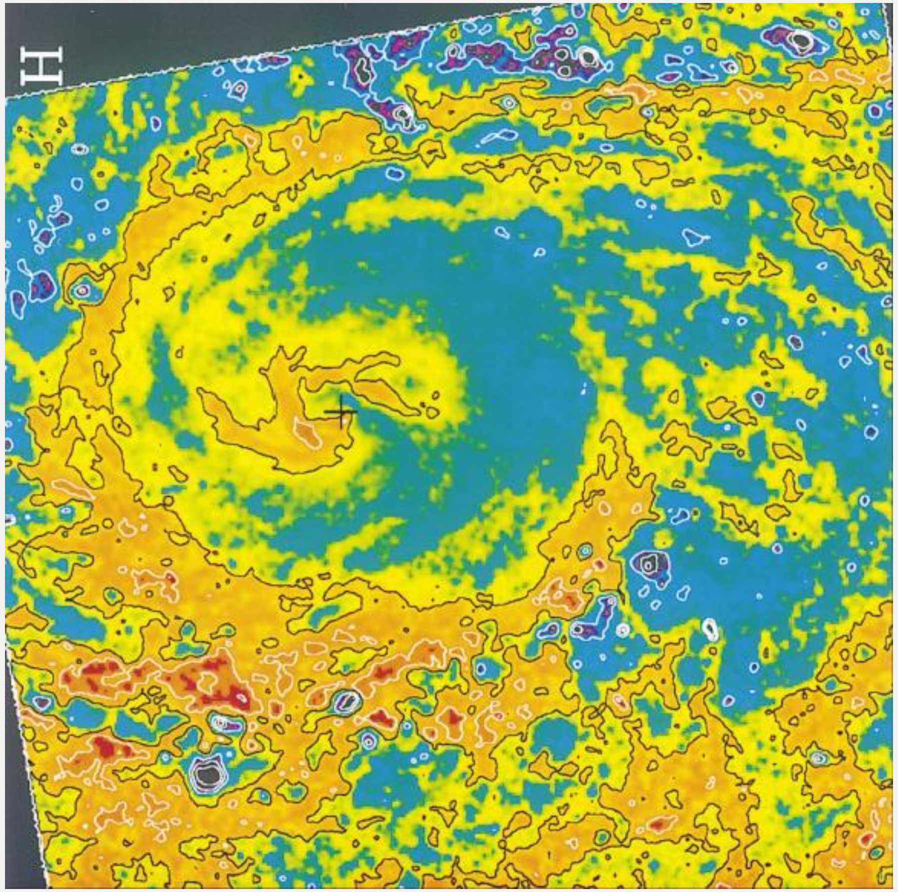
INTRODUCTION

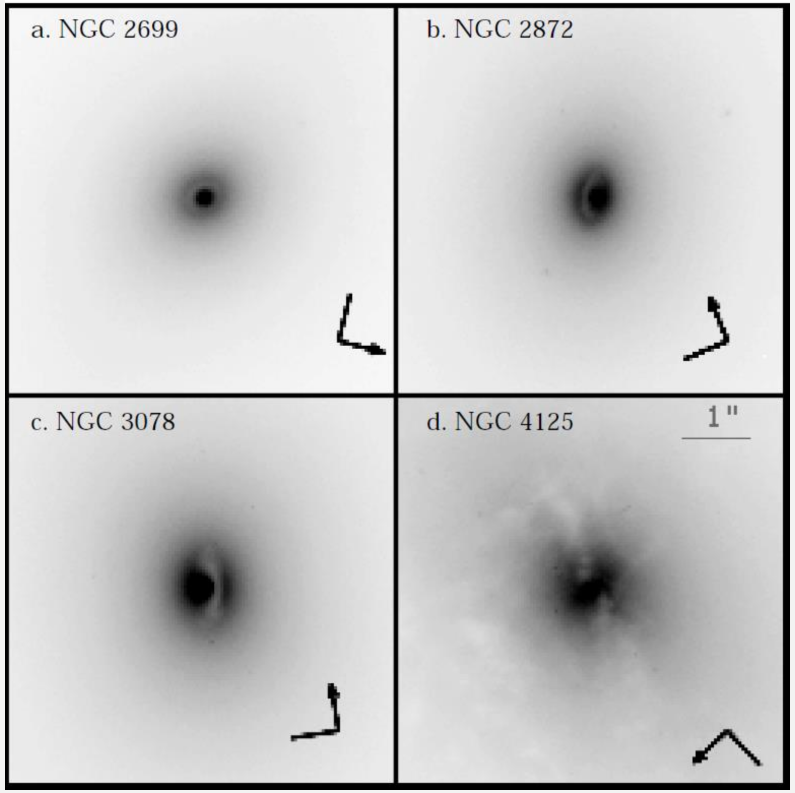
- One of the motivations for studying circumnuclear dust in active galaxies has been the AGN fueling.
- Shocks and gravitational torques caused by bar-like gravitational potentials have been proposed by Shlosman et al. [1989].
- The dust lanes along the leading edge of the bar are always very straight in strongly barred galaxies (Athanassoula [1992]; Piner et al. [1995]).
- Classifications have been made of the morphology of the dust structures observed in images of galaxies obtained with the HST: barred, spiral, ringlike, or amorphous (Regan & Mulchaey [1999]).



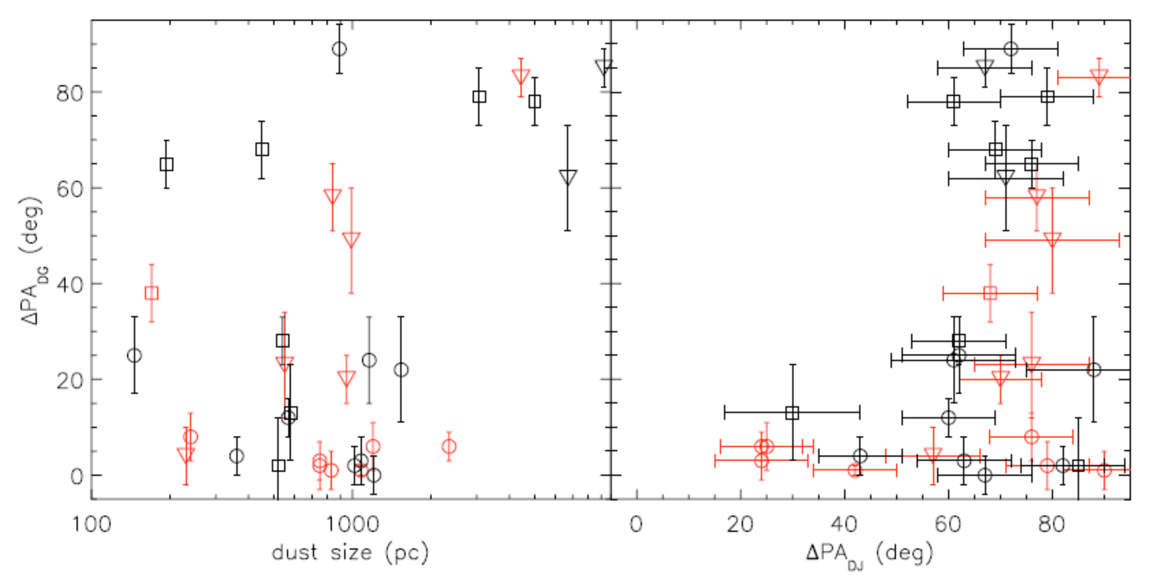
NGC 1667

INTRODUCTION

- Tran et al. [2001] studied the dust properties of a sample of elliptical galaxies and how they are related to other global properties of the parent galaxies as a whole. They grouped the morphology of dust in two categories: filamentary and disky.
- HST studies have lead to propose a new candidate for AGN fueling: nuclear dust spirals (Regan and Mulchaey [1999]; Pogge and Martini [2002]).
- Martini et al. [2003b] examined the host galaxy properties in order to investigate any correlation between the circumnuclear dust structure and the host galaxy.



INTRODUCTION

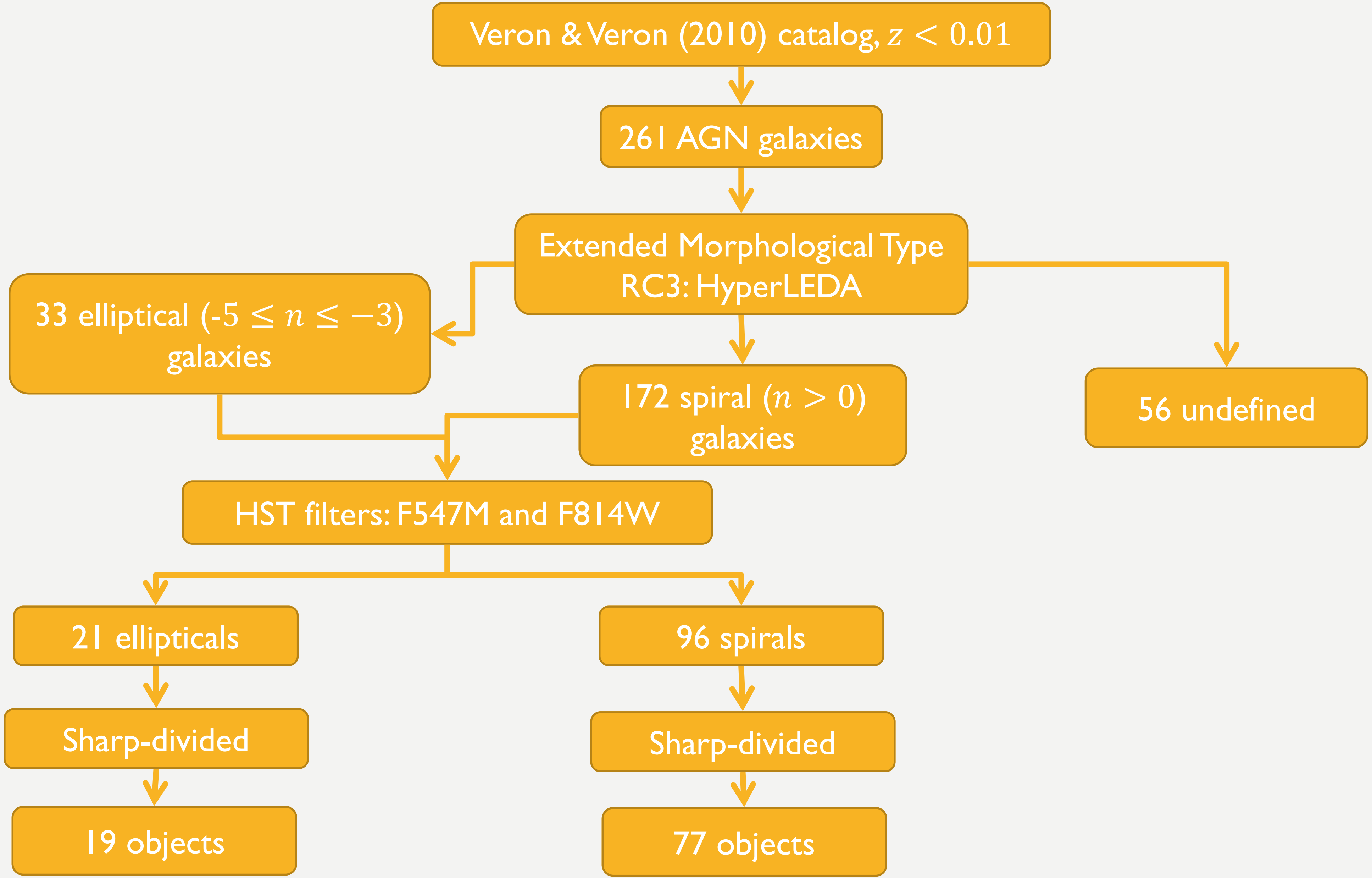


- Verdoes Kleijn et al. (1999) studied a sample of FR-I radio galaxies, which contain "elliptical" and "lanes" dust structures.
- Ellipses turn out to be aligned with the galaxy major axis while the lanes show no relation to galaxy orientation. Furthermore, most lanes (but only some ellipses) are perpendicular to jets in the sky plane.

OBJECTIVE

- Study properties of circumnuclear dust in to a sample of AGN (spirals and ellipticals) through surface brightness profile models (GALFIT) and radiative transfer simulations (SKIRT).
- Calculate the dust mass of the circumnuclear structures in order to examine a scaling relation between circumnuclear dust mass and nuclear dust mass (of the torus).

SAMPLE SELECTION



SHARP-DIVIDED

Test Galaxy: NGC4261

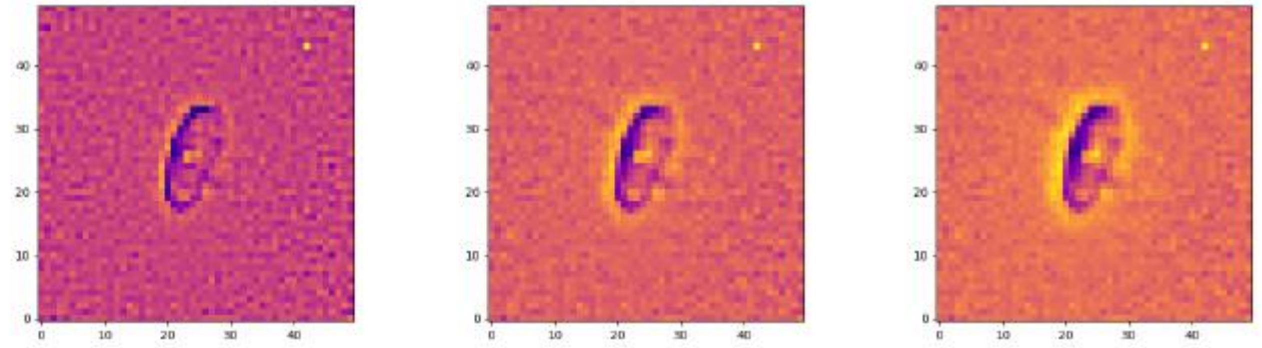


Figure 7: Imágenes del centro de NGC4261 suavizadas con Box2DKernel. De izquierda a derecha, los valores del kernel son: 3,5 y 7, respectivamente.

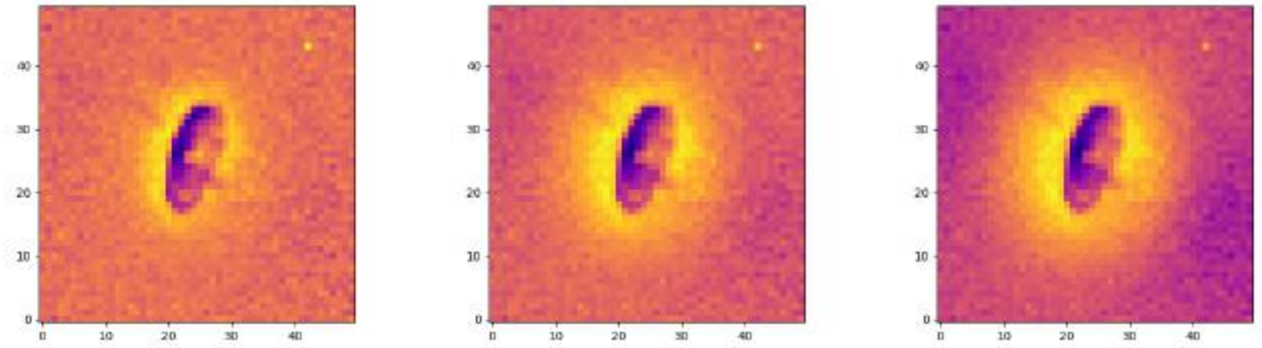


Figure 8: Imágenes del centro de NGC4261 suavizadas con Gaussian2DKernel. De izquierda a derecha, los valores del kernel son: 3,5 y 7, respectivamente.

SHARP-DIVIDED

Test Galaxy: NGC4261

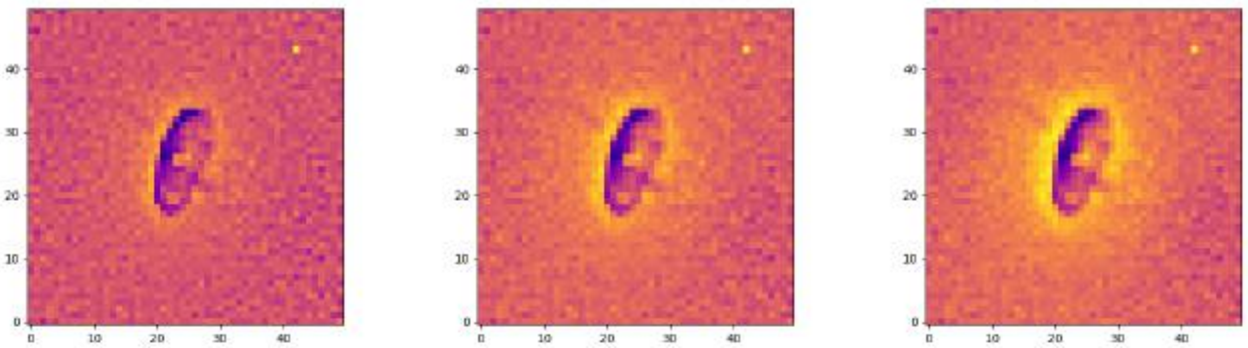


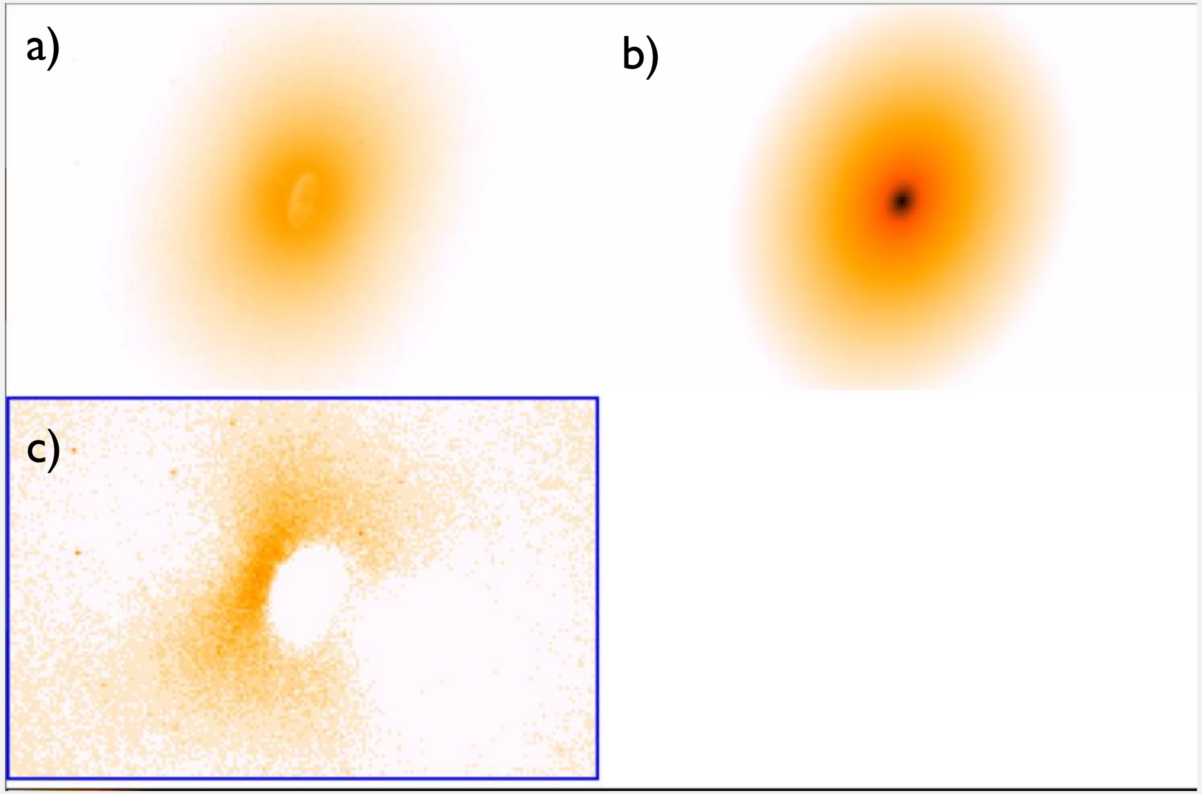
Figure 9: Imágenes del centro de NGC4261 suavizadas con AiryDisk2DKernel. De izquierda a derecha, los valores del kernel son: 3,5 y 7, respectivamente.

HST IMAGES CALIBRATION FOR GALFIT

- A Python code was developed in order to calibrate the images of the 19 elliptical galaxies for the GALFIT requirements.
- Keywords in the header: EXPTIME, GAIN, NCOMBINE, ZEROPT (calculated).
- Transform the pixels unit to counts.

SURFACE BRIGHTNESS PROFILE MODELS

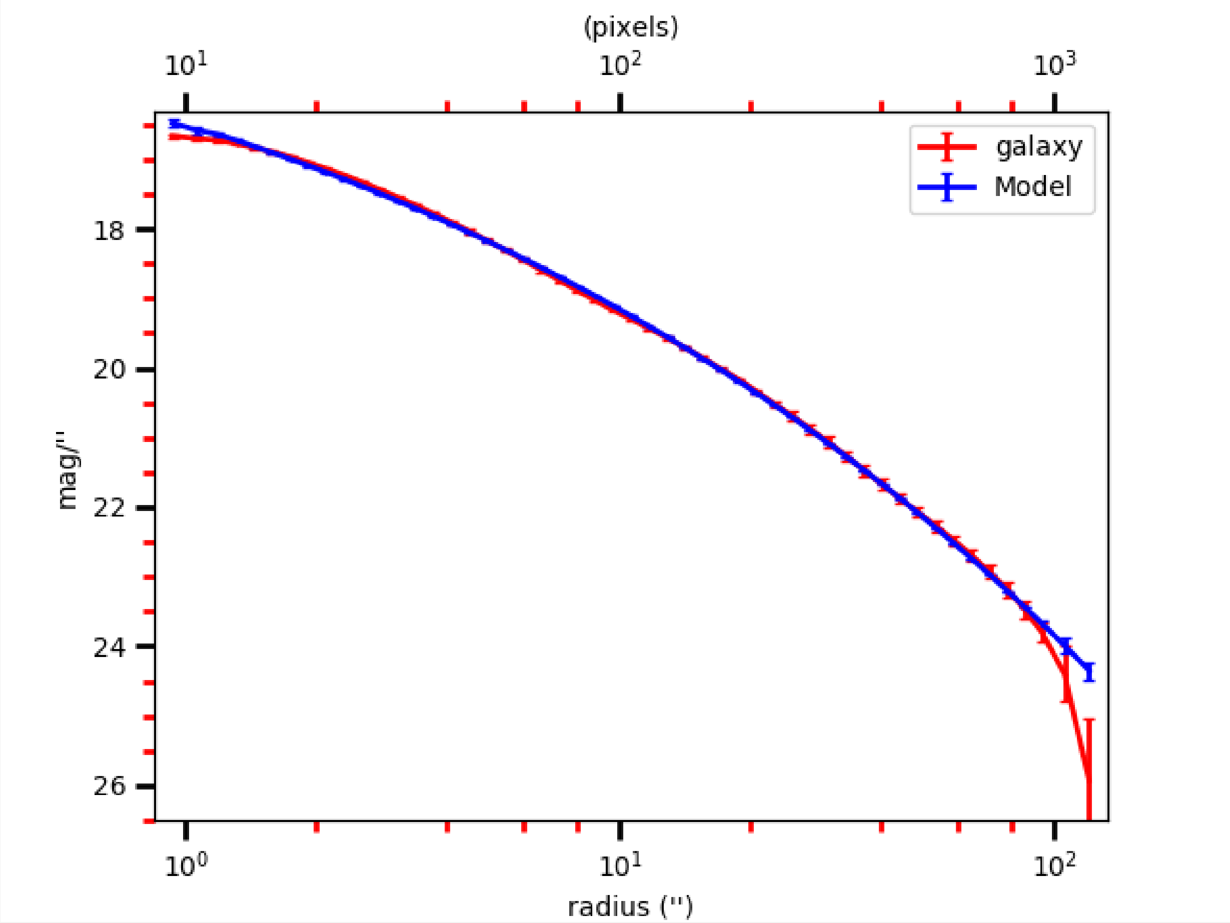
- GALFIT.
- NGC4261.
- Parameters for the stellar components: Sérsic (in this case).
- $r_e = 5601.9739$ pc
- $n = 4.13$



Output files by GALFIT. a) Observed. b) Model. c) Residual.

SURFACE BRIGHTNESS PROFILE MODELS

- The developing code ElipSec.py was used to obtain the 1-D profiles, and another useful parameters like Luminosity and Distance.

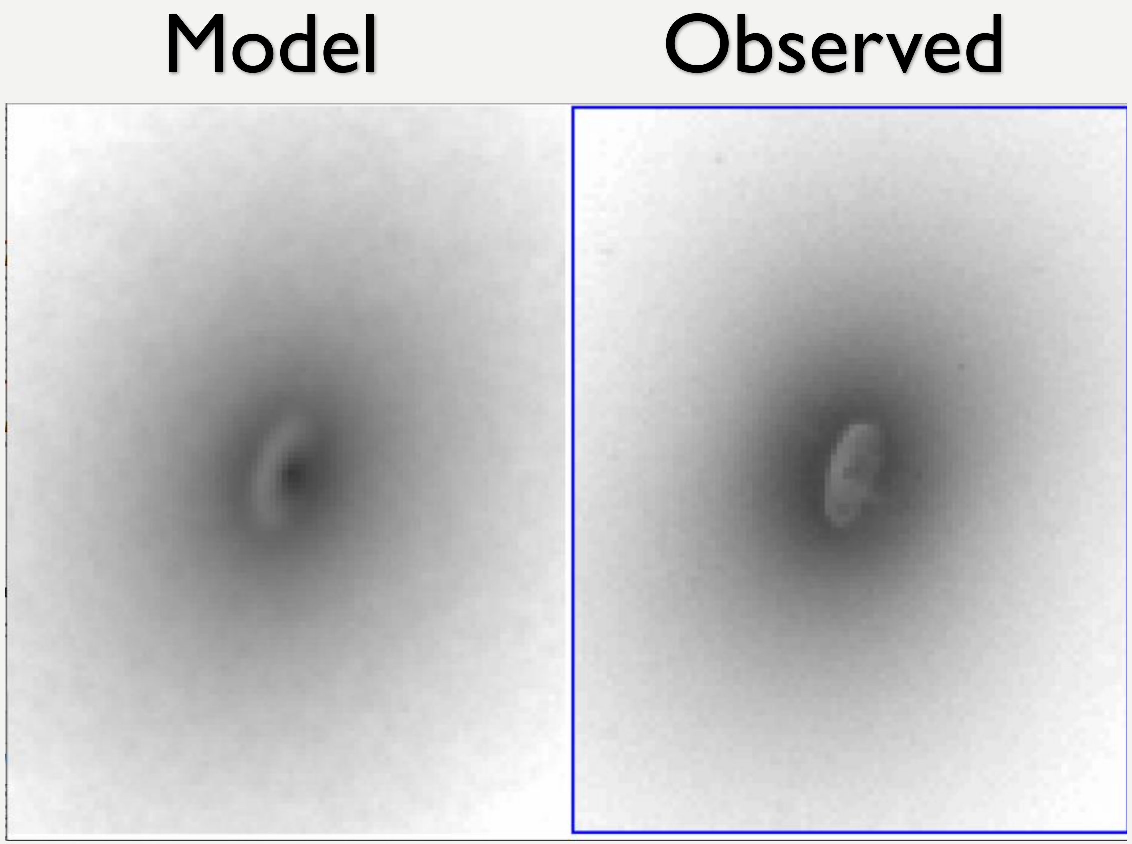


RADIATIVE TRANSFER SIMULATION

- SKIRT.
- Simulations for modeling the stellar and dust systems of NGC426.
- Dust Ring geometry.

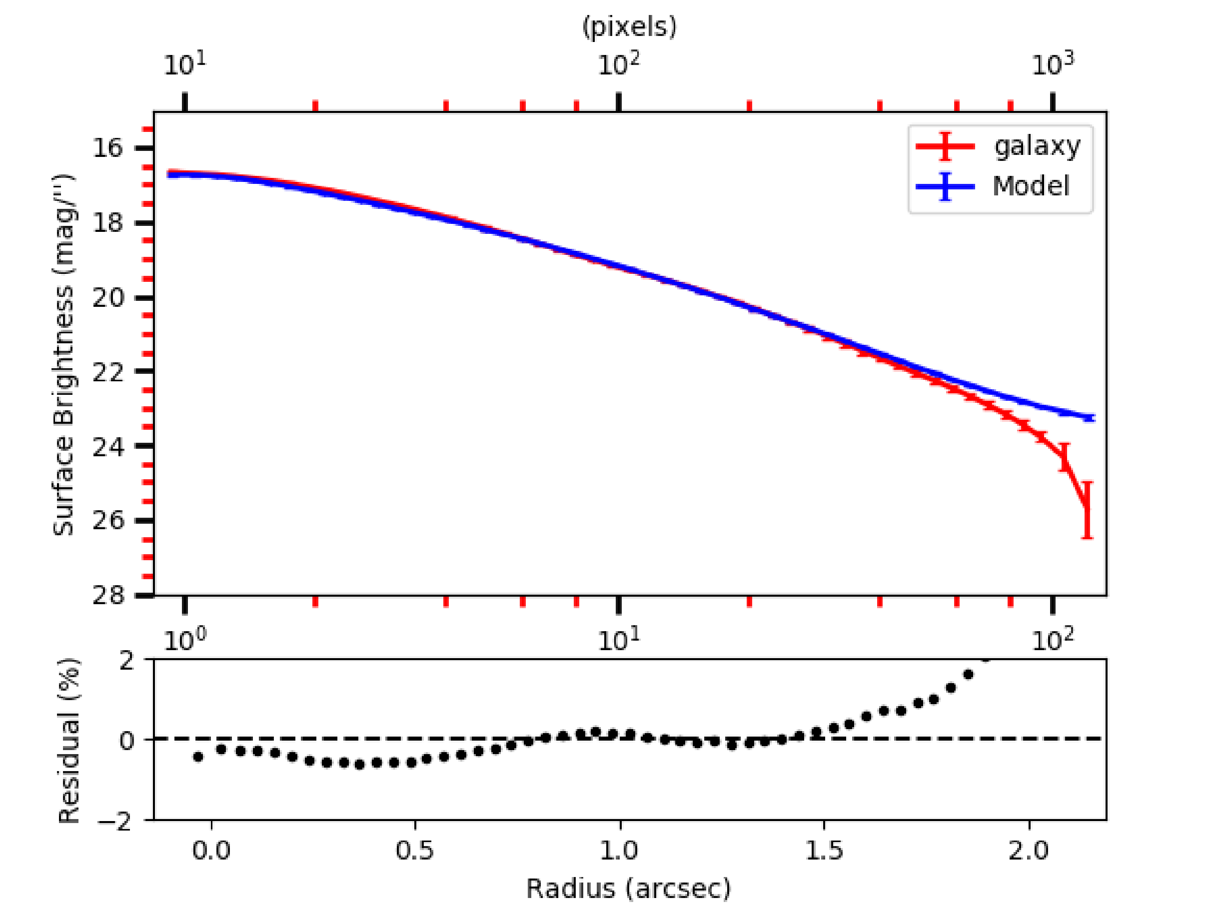
$$\rho(R,z) = A \exp\left[-\frac{(R-R_0)^2}{2w^2}\right] \exp\left(-\frac{|z|}{h_z}\right).$$

- $R_0 = 0.1$ pc
- $w = 55$ pc
- $h_z = 5$ pc
- $M_d = 10^5 M_{sun}$

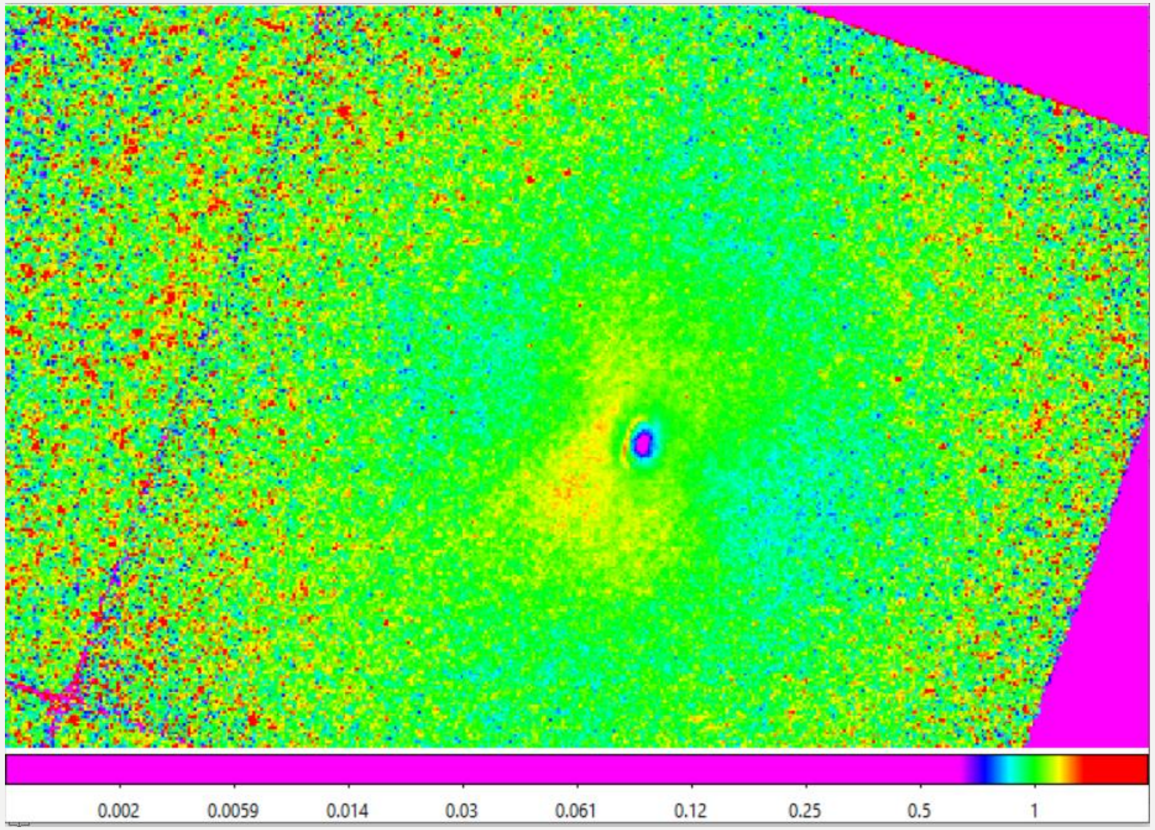


RADIATIVE TRANSFER SIMULATION

- 1-D and 2-D residuals



Observed/Model



PENDING WORK

- Obtain models for NGC4261 in the other available HST filters.
- Create models for the 18 remain elliptical galaxies.
- These models will be less detailed because the structure is much more complex to model due to its morphology.
- Calculate the dust mass of the circumnuclear structure through SKIRT simulations and other methods (extinction and FIR flux).
- Compare the dust mass among the different methods.
- Looking for a scaling relation between the dust mass of the circumnuclear structure and the nuclear dust mass (of the torus) obtained by IR spectroscopy

THANKS FOR YOUR ATENTION

Any question or comment?