GALFIT

GALFIT is a two-dimensional fitting algorithm designed to extract structural components from galaxy images, with emphasis on closely modeling light profiles of spatially well-resolved, nearby galaxies observed with the Hubble Space Telescope. Two-dimensional models such as the Nuker law, the Sersic (de Vaucouleurs) profile, an exponential disk, and Gaussian or Moffat functions are used. The azimuthal shapes are generalized ellipses that can fit disky and boxy components. Even simple looking galaxies generally require at least three components to be modeled accurately, rather than the one or two components more often employed. Many galaxies with complex isophotes, ellipticity changes, and position angle twists can be modeled accurately in two dimensions (Peng et al. 2002, 2010).

1 Applications

- Standard modeling of global galaxy profiles.
- Extracting bars, stellar disks, double nuclei, and compact nuclear sources.
- Measuring absolute dust extinction or surface brightness fluctuations after removing the galaxy model.

2 Download and Installation

Download a galfit version compatible to your system from http://www.ociw.edu/peng/work/galfit/galfit.html.
Untar it using:
$ tar -zxvf galfit3-debian32.tar.gz (For linux-32bit)
This will create an executable file in the current directory.
To run an example of the program, download galfit-ex.tar.gz and untar it using
$ tar -zxvf galfit-ex.tar.gz $ vi .bashrc
Add the following lines in the .bashrc file.
 # alias for galfit
alias galfit=‘/home/fedora/Documents/GALFIT/galfit-example/EXAMPLE/galfit’
$ source /.bashrc
$ cd galfit-example $ cd EXAMPLE $ galfit galfit.feedme

Input files necessary are:

- gal.fits: An input image.
- psf.fits: A psf image to fit to the galaxy.

Output files created are:

- fit.log containing the fit parameters
- galfit.01 containing the model.
- Imgblock.fits containing the image cube: an original image, a model and the residual.

3 Working with GALFIT

In the terminal,
$ ds9 J01565070p1452241.fits

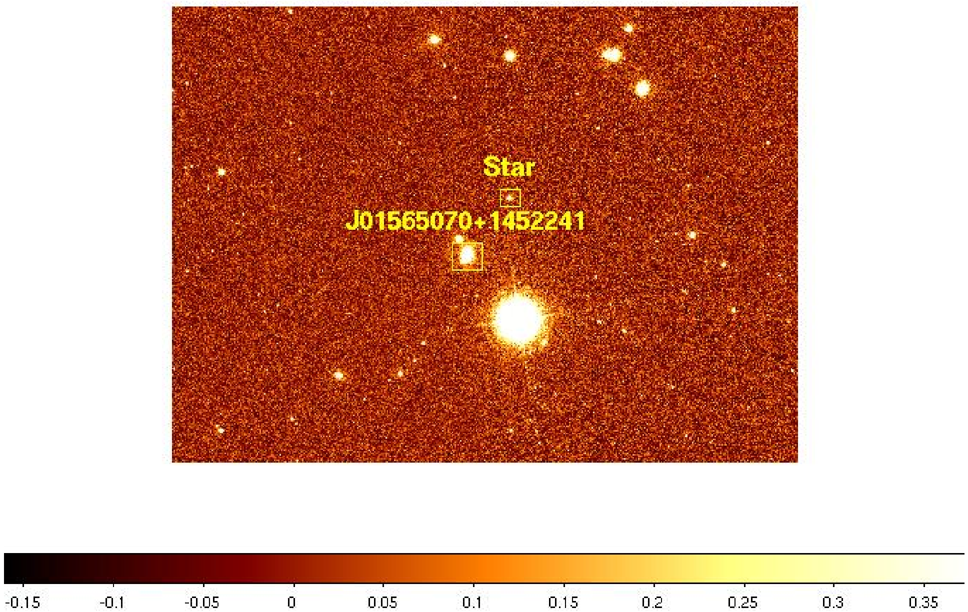
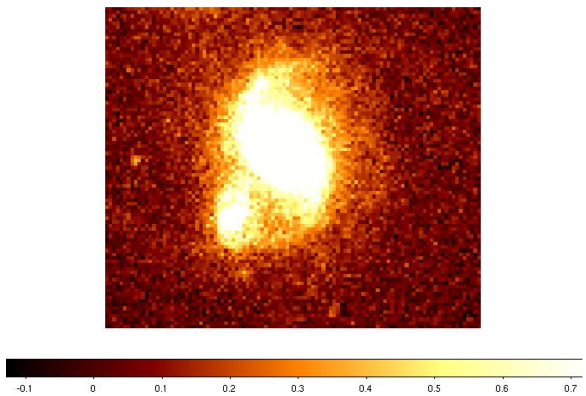


Figure 1: The original image: this file as image.fits

The star selected to create a psf image and the galaxy image are shown above. This file is named as image.fits

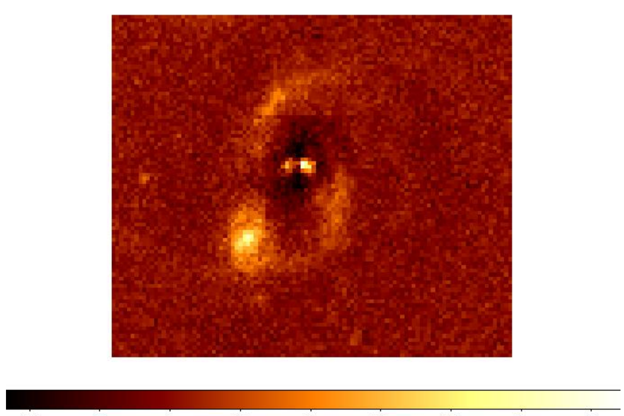
Extract the Galaxy fits image and psf fits image as follows:

- In the ds9 window, in the menu bar, go to Region → Shape → Box
- Carefully draw a box around the galaxy you want to study. The box should be sufficiently big to accomodate the whole galaxy.
- Note down the co-ordinates of opposite diagonals of this box. Call these $(x_1, y_1) and (x_2, y_2)$
- Now go to a new window and type the following commands:
  $ ipython –pylab You see: In [1] Then type:
  In [1]: from astropy.io import fits as f
  In [2]: hdu = f.open('image.fits')
  In [3]: dat = hdu[0].data
  In [4]: gal = dat[y1:y2,x1:x2]
  In [5]: f.PrimaryHDU(gal).writeto('gal.fits')
  This creates a gal.fits file which looks like the following:



Follow the same procedure to create psf.fits file for a nearby star.
Sometimes, there will be a star very close to the object of interest that needs to be masked. In this case, go to the menu bar, choose
$Region \rightarrow Shape \rightarrow polygon$
Draw a square around the object you want to mask. Double click to create a point, drag to change its position. Hover the mouse point and hit delete to delete a point.
In menu bar, go to $Region \rightarrow SaveRegions$ and save the image as 'MaskVertices.reg'. To create a list of pixels to be masked, run the ds9poly.c and fillpoly.f files to create a mask.fits file. Now, we have all the input files to run GALFIT.

In the galfit.feedme, modify the input and output filenames. Modify the fitting parameters to best fit the morphology of galaxies. Then, in the terminal,
./galfit galfit.feedme.
All the input files should be in the current folder. A data cube with an original file, model and the residual image will be created. The residue image will look like the following.



References

Peng, C. V. et al., 2002, AJ, 124, 266.
Peng, C. V. et al., 2010, AJ, 139, 2097.