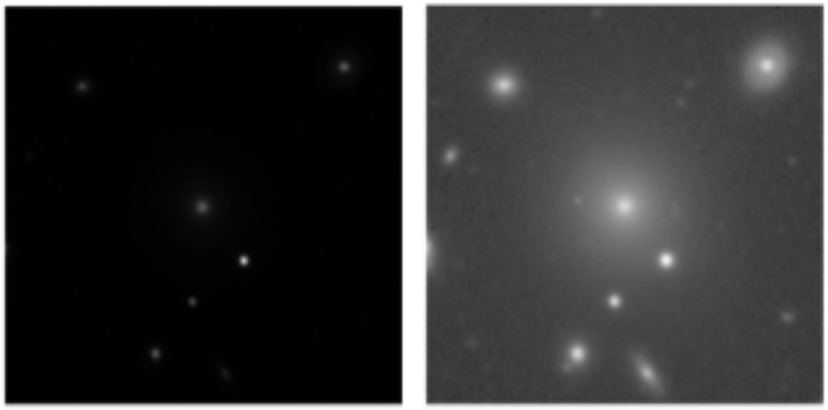
The overall goal of this project is to analyze the relation between the merger axis of two merging clusters and the position angle of the BCGs of each cluster. In order to do so, closeups of the BCGs needed to be modeled to get this position angle. That is what this part of the project looks at.

Galfit is a software program that can create a model of various types of galaxies. In this case it was used on to model the BCG in a merging cluster. For the purpose of this summary I will use the BCG in Abell 115. A picture of the BCG can be seen below.



Left: Abell 115. Right: Abell 115 on a Logarithmic Scale

First, the BCG was fit as is, without masking out any of the other objects in the image. This gave the following model and values for parameters

Left: Abell 115. Middle: The model of Abell 115 created by Galfit. Right: Residual (All on Log Scale)

Parameter	Value
Center Position	(117.5740,117.1999)
Integrated Magnitude	-2.6987
Effective Radius (Pixels)	37.8991
Sersic Index	2.9566
Axis Ratio	0.8771
Position Angle	15.3700

This gave a position angle of about 15° (As measured counter-clockwise from the positive y-direction). However, this model does not mask out any of the other objects in the image which would throw of this angle. Therefore, in order to improve the accuracy of this measurement, the other objects needed to be masked out. This was done using a python code that can be found in the Masks folder.

Here is a quick review of that code:

1. Search the image for any pixels above a certain cutoff and mark them as potentially bad pixels.

2. For each pixel identified in Step 1, check each pixel in a straight line to the center of the BCG. If that path increases in brightness monotonically then the pixel is good, if not it is bad.

3. This leaves some small patches of pixels that need to be smoothed out. Remove anybody pixels with less than two neighbors that are also bad.

4. For all bad pixels, add a buffer of extra bad pixels around it.

For Abell 115 this code gave the sequence of images seen below.

Left: After Step 2. Middle: After Step 3. Right: After Step 4.

Now, using this mask to block out the other objects in the image, Galfit was rerun on Abell 115, giving the following results.

Left: Abell 115. Middle: The new model of Abell 115 created by Galfit. Right: Residual (All on Log Scale)

Parameter	Value
Center Position	(117.5688,117.2562)
Integrated Magnitude	-2.6967
Effective Radius (Pixels)	37.8809
Sersic Index	2.9822
Axis Ratio	0.8829
Position Angle	14.1681

The most considerable change in the model comes from the position angle, indicating that the mask has significant effects on the result. This was done for the rest of the BCGs. The resulting fits (using the masks) can be seen in the repository.

Notes on Specific BCGs

A1300: Has two objects in middle. The mask does not generate properly
A2034: Parts of the BCG are included in the mask. Possible due to brighter core?
A2061:Parts of the BCG are included in the mask. Possible due to brighter core?
A2255: Parts of the BCG are included in the mask. Possible due to brighter core?
A2443: Fits file has image in 3d. Need to find a way to work with this
CIZAJ2242: Pixels (17,190-192) were off. Replaced with 0
MACSJ1149: Image is very noisy. Increasing the cutoff may improve?
MACSJ1752: Fits file has image in second header. Need to find a way to use this in Galfit
PSZG108: Image is too small and noisy. Probably won't be able to mask
RXCJ1314: Image is very crowded in middle. Hard to mask
ZwCl0008: Fits file has image in second header. Need to find a way to use this in Galfit