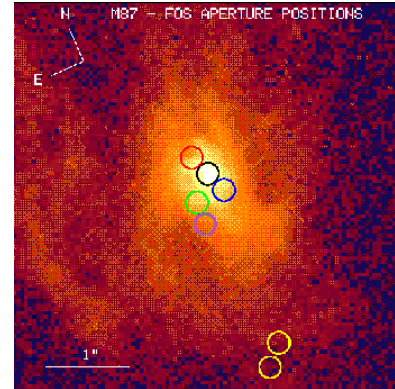


PHYS4000 Introduction to Astrophysics HW #5 Due 14 Apr 2017

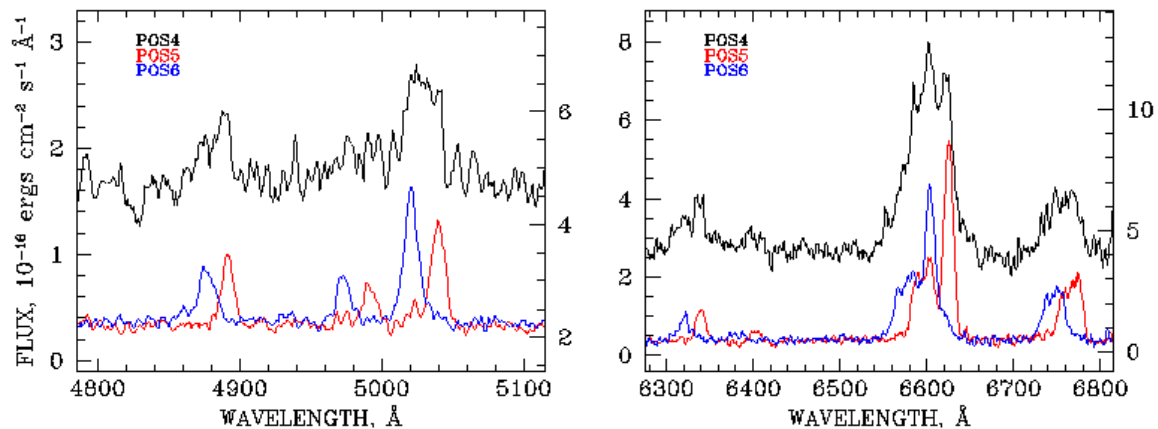
(1) Maoz, Problem 7.3

(2) Maoz, Problem 7.6

(3) M87 is a giant elliptical galaxy, also known as the radio source Virgo A. It is 16 Mpc distant from Earth. The image on the right was taken by the Hubble Space Telescope, of the very central region of M87. The scale of one second of arc is noted, as well as several circular targets on or near the central “disk” of the galaxy.



Consider the three targets in a row that cover the midline of the disk. They are color coded to the following spectra of particular emission lines:



That is, the red, blue, and black spectra correspond to the red, blue, and black targets. Use this information to determine the mass of the object in the center of M87. You might want to check your answer by looking the paper by Harms, et al, Ap.J. **435**(1994)L35.

(4) Although it was suspected for a number of years, it was finally proven that quasars are just exceptionally bright active galactic nuclei by J. Bahcall, et al., Ap.J. **479**(1997)642. These researchers used the Hubble Space Telescope to obtain images of 20 quasars, many of which have very clear galactic structure around an extremely bright nucleus.

What makes it hard to see the galactic structure around the active nucleus? Why did it require the HST to take these images?

Look up this paper, and pick one of the images, perhaps the one you find most striking, and discuss the features of the nucleus and the galactic structure.