Astronomy C: Sample Questions, in order of increasing difficulty

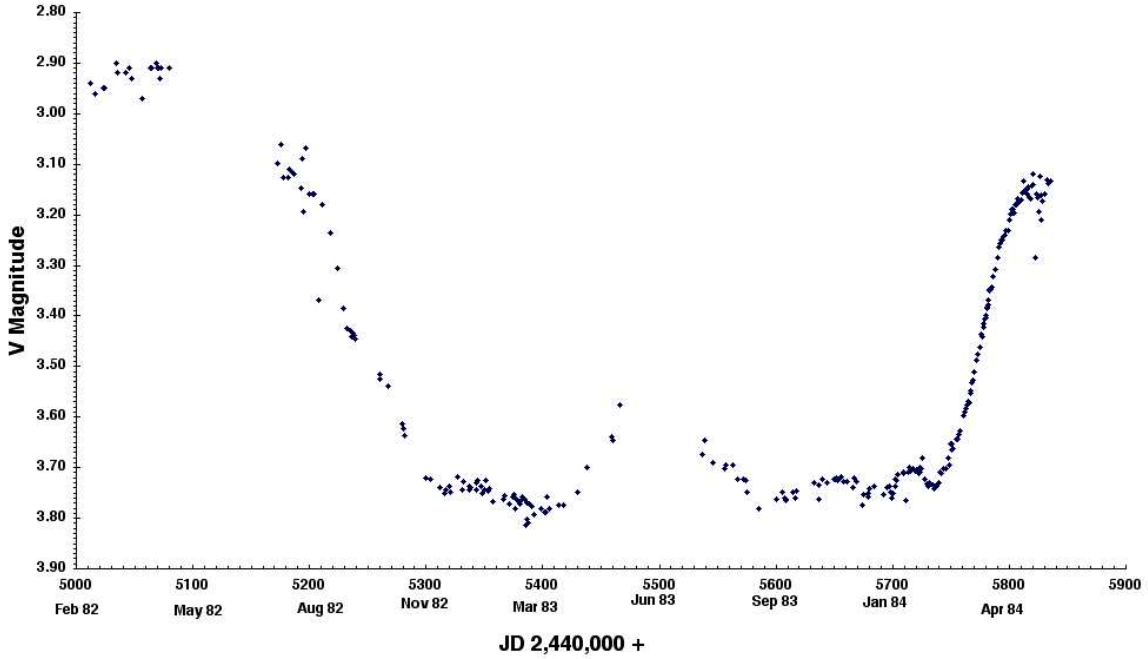
1. An eclipsing binary light curve is shown below.

a) What is the name of this deep sky object?

b) What is the period of this binary, in years?

c) How many components are in the system?

d) What causes the brightening seen in the middle of the eclipse?

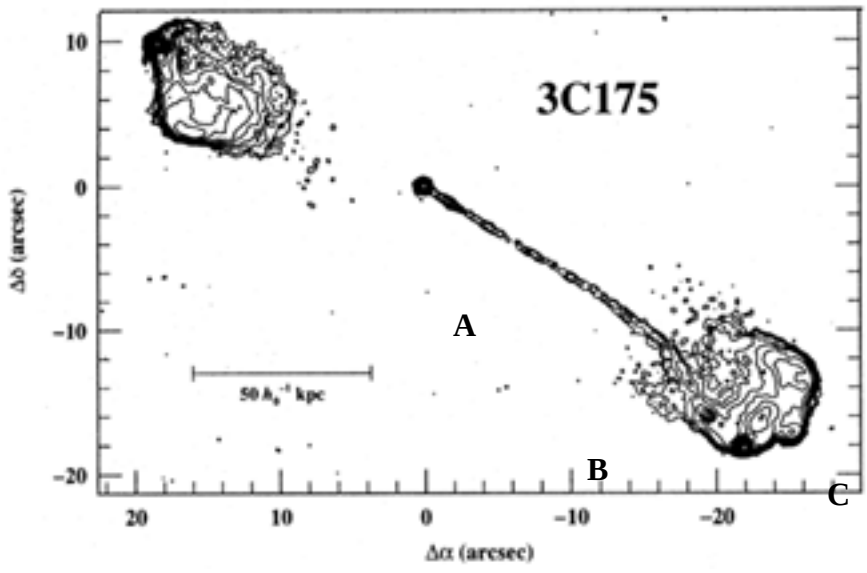


2. A radio image of quasar 3C175 made by the Very Large Array at the Radio frequency of 4.9GHz is shown below.

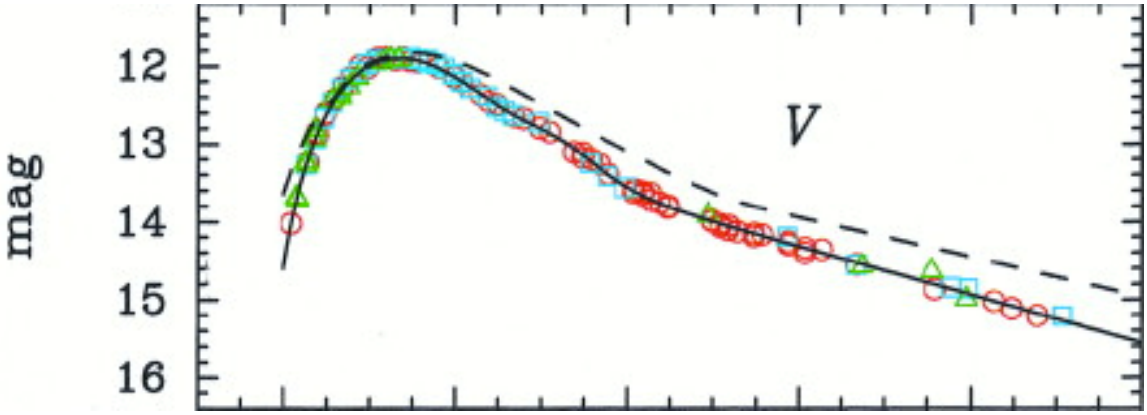
a) The Active Galactic Nucleus is seen at point A in the image below. What process causes the formation of such a bright nucleus?

b) The radio lobe at point C in the image is brightest at its edges. What process causes this occur?

c) What is the most plausible explanation as to why there is only one "jet" observed from the nucleus, seen at point B, while there are two radio lobes?



3. The optical light curve for an object in the galaxy NGC 4526 is shown below. The Y-axis shows apparent magnitude. What is the distance to NGC 4526, in Megaparsec?



4. A table of data from two galaxies in a nearby cluster is shown below.

	Rotational Velocity (km/s)	Luminosity (Solar Units)	Luminosity (Watts)	Flux at Earth (W/m^2)
Galaxy 1	100	1.4×10^{8}	5.39×10^{34}	5×10^{-13}
Galaxy 2	150	7.0875×10^{8}	2.73×10^{35}	2.54×10^{-12}

a) What is the distance to the cluster, in Megaparsec?
b) If a third galaxy in the cluster has a rotational velocity of 250 km/s, what would its luminosity be, in Solar Units?

5. Sagitarrius A has a maximum diameter of 16 parsecs that is split into two different rings—the inner and outer ring. The inner ring has a semi-major radius of 2 pc, and a thickness of .5 pc. The outer radius extends 8 pc from the center, and has a thickness of 2 pc.

a) Assuming the density within Sagitarrius A's inner ring is 4.77×10^{-15} kg/m^3 and the density within the outer ring is 4.01×10^{-16} kg/m^3, and mass is distributed evenly throughout Sagitarrius A, what is the total mass of Sagitarrius A in solar masses?
b) Using your answer from part b, what is the velocity of a 10 solar mass gas cloud that is 0.5 parsec from the edge of Sagitarrius A as it orbits the galactic center, in km/s?
c) What part of the electromagnetic spectrum does Sagittarius A radiate the strongest in?

Answers:
1. a) Epsilon Aurigae
b) 27.12 years
c) 3
d) There is a central hole in the disk that blocks the light from the companion star, and this disk is tilted with respect to Earth so in the middle of the eclipse the companion star is visible and a brightening of the system is observed

2. a) Material accreting onto a supermassive black hole
b) Heating due to interaction with the intergalactic medium
c) The jet labeled point B is pointed towards Earth, and so is brighter because the particles emitting the radiation are moving towards Earth. The other jet is pointed away from Earth, and is therefore not as easily visible.

3. 20 Megaparsec

4. a) 3 Megaparsec
b) 5.47×10^9 Solar Luminosities

5. a) 3.7×10^6 solar masses
b) 179 km/s
c) radio