

Homework 9, Astro 1

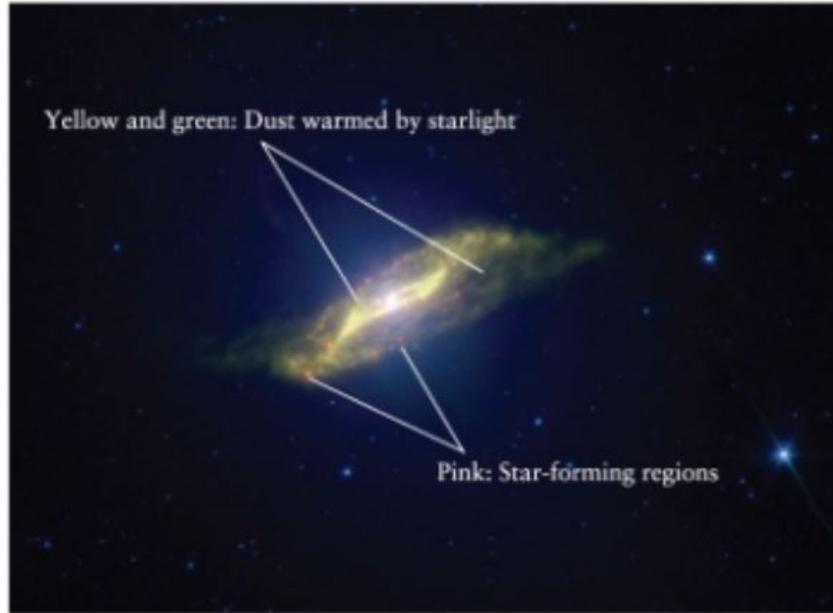
Due December 6th, 2019

1. (U11-23.29) **Box 23-2 in U11** In the spectrum of the galaxy NGC 4839, the K line of singly ionized calcium has a wavelength 403.2 nm. (a) What is the redshift of this galaxy? (*Hint: See Box 23-2*) (b) Determine the distance to this galaxy using the Hubble law with $H_0 = 73$ km/s/Mpc.

2. (U11-23.55) It is estimated that the Coma Cluster (see Figure 23-21 in U11) contains about $10^{13} M_{\odot}$ of intracluster gas. (a) Assuming that this gas is made of hydrogen atoms, calculate the total number of intracluster gas atoms in the Coma Cluster. (b) The Coma Cluster is roughly spherical in shape, with a radius of about 3 Mpc. Calculate the number of intracluster gas atoms per cubic centimeter in the Coma Cluster. Assume that the gas fills the cluster uniformly. (c) Compare the intracluster gas in the Coma Cluster with the gas in our atmosphere (3^{19} molecules per cubic centimeter, temperature 300 K); a typical gas cloud within our own galaxy (a few hundred molecules per cubic centimeter, temperature 50 K or less); and the corona of the Sun (10^5 atoms per cubic centimeter, temperature 10^6 K).

3. (U11-23.41) The accompanying images show the unusual elliptical galaxy NGC 5128 in visible and infrared wavelengths. Explain how the properties of this galaxy seen in the infrared image can be explained in NGC 5128 is the result of a merger of an elliptical galaxy and a spiral galaxy. (NGC 5128 is an elliptical galaxy with a dark dust lane)





4. (U11-23.47) Figure 23-31 in U11 shows the rotation curve of the Sa galaxy NGC 4378. Using data from that graph, calculate the orbital period of stars 20 kpc from the galaxy's center. How much mass lies within 20 kpc of the center of NGC 4378?