

Astro 480 Homework 3 Due April 4

1) Define the Schwarzschild radius, calculate its value for a black hole mass of $10M$ and calculate the gravitational redshift at a radius of 10 Schwarzschild radii. 10pts

2) a) Describe the shape of the spectrum emitted from a 'standard' Shakura-Sunyaev accretion disk and why it is the particular shape. 5 pts

b) In an accretion disk how does the temperature change with mass, accretion rate and radius, please give a quantitative answer (e.g. a functional form). What is the highest temperature in an accretion disk (numerical value in any relevant unit) for stellar mass black holes and supermassive black holes? 10pts

c)

1) How does the actual spectral data for a accreting neutron star compare to the theoretical predictions? 5 pts

2) What additional "term" (spectral component, physical process) is necessary to explain the spectra? 5 pts

3) Compare the available energy due to the spin of a neutron star to the luminosity of x-ray binaries and the energy available from accretion . (This requires knowing the moment of inertia of a NS-see class notes or Melia e.g 9.1). 10pts

4) Briefly describe why the periods of neutron stars are in the milli-second-seconds range. 10pts

5) What are the two main modes of accretion and how are they related to the nature of the x-ray binary? 10pts