Black holes

(a) If the Sun were replaced by a black hole, what would happen?

(b) Per general relativity: gravity affects both light and mass. If you were standing on a neutron star and pointed a flashlight upward, what happens to the photons? Do they continue on at the same speed? The same energy?

(c) Draw the anatomy of a black hole.

(d) Your friend falls into a black hole. Draw what you would see.

(e) You are standing, somehow, on the surface of a black hole with an accretion disk around it. Name three sources of **danger**.

(Challenge question) The "no-hair" theorem stipulates that black holes can only be characterized by their mass, angular momentum, and charge. But charges inside a black hole shouldn't affect charged bodies outside the black hole — wouldn't they do so via EM radiation, which can't "escape" a black hole? Try to resolve this conundrum.

Dark matter

a Assuming a flat rotation curve, compare the enclosed masses at radius R and radius 27R.

(Challenge question II) Could black holes "just"be dark matter? Why or why not?

(Challenge question III) Back to exoplanets (I forgot to ask this question earlier!). Say that we are observing a binary star system in which an exoplanet orbits one of the stars. Using the flux of each star, the size of one star, and the size of a planet, calculate the fractional dip in the total light that we measure.

(Challenge question IV) Another exoplanet question. If we are observing one planet transit a star, can we detect the presence of a non-transiting planet? If so, what property/properties of that non-transiting planet can we determine? How do those properties relate to the parameters of our observations?