**The Mass of the Galaxy’s Central Black Hole**

A year ago, Gillessen et al. (Nature, 481, 51, 2012) reported that a gas cloud is falling toward the supermassive black hole at the center of the Milky Way. The cloud has a mass of only about three times the mass of the Earth and is heading almost straight into the black hole (eccentricity = 0.94). It will pass within about 300 AU (36 light hours) of the black hole at pericenter passage in early July. By then, tidal forces will have shredded the cloud, and material from the cloud will probably be captured by the black hole.

The cloud’s orbit has a semi-major axis of 4300 AU and an orbital period of 137 years (well, of course, it won’t survive pericenter passage to orbit a second time...).

1. Use Kepler’s law (P2=a3/mass) to estimate the mass of the black hole in solar masses from the orbit of the cloud.

2. What fraction of the mass of the Milky Way does the central black hole comprise?

3. Does the black hole affect the orbits of stars at the Sun’s distance from the center of the Milky Way?