AST 250 – Spring 2019
Homework Due: Monday April 22

37.   In a quasar, a 10^8 M_{sun} supermassive black hole is actively accreting material and radiating significant energy. If over its accretion lifetime ($\sim 10^7$ yrs), the total momentum imparted by photons into gas in the galaxy is given by $\varepsilon M_{BH} c$, where $\varepsilon = 0.1$ is an efficiency factor, then calculate how much mass in gas could be driven out of the galaxy by the black hole. Assume the quasar has a total baryonic mass (stars plus gas) of 10^{11} M_{sun} and a radius of 3.5 kpc. The gas is $\sim 10\%$ of the total baryonic mass. Comment on whether active black holes (AGN) can have a significant impact on the evolution of star formation in galaxies. Hints: (1) assume that momentum is conserved. (2) What speed would the gas need to be moving at to be removed from the galaxy?
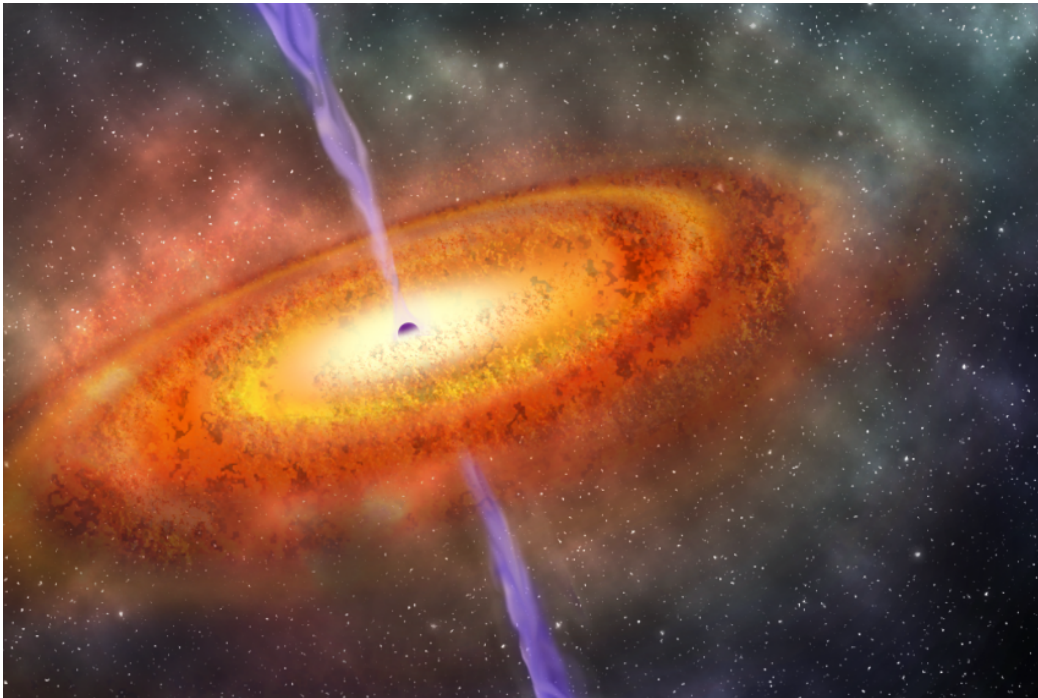

Figure 1: Artist rendition of the central region of a quasar.