AST 250 – Spring 2018
Homework Due: Wednesday April 4

30. The "Hill Radius" (r_H) is the maximum distance at which a moon could orbit a planet. At this distance, the differential acceleration of the moon away from the planet due to the Sun (given below by the blue equation) ***is equal*** to the acceleration of the moon toward the planet due to the planet's gravity. Using some simple approximations (i.e. assuming $r_H << a$, eccentricity of the orbit is negligible, etc.) the differential acceleration due to Sun on the moon is approximately

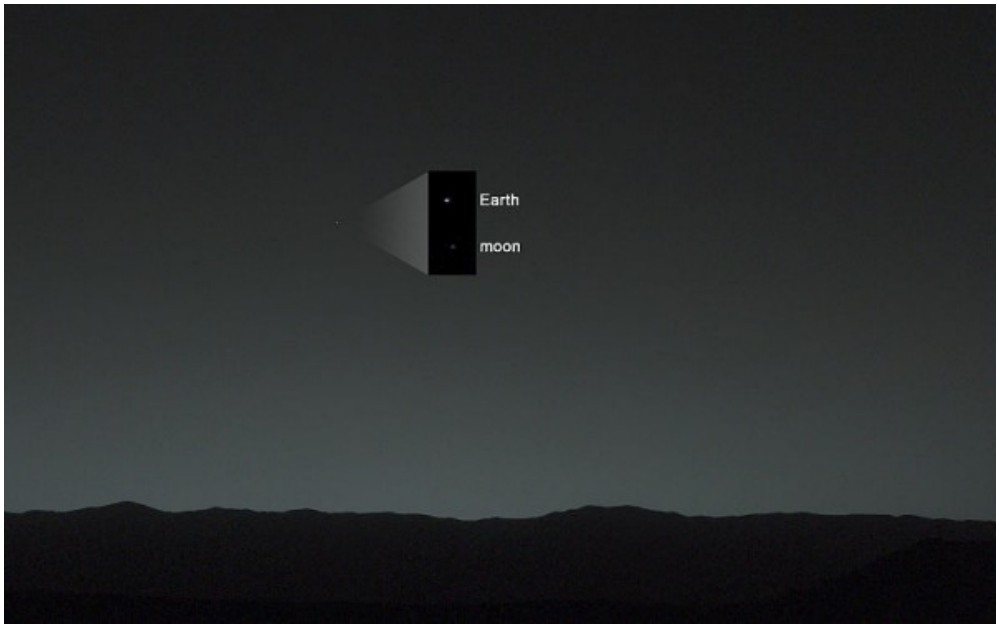
$$\Delta g \sim 3GM_{sun}\, r_H / a^3$$

where a is the semi-major axis of the planet's orbit about the Sun.

(a) What is the Hill Radius for the Earth? Quote your answer as a ratio to the Earth-Moon distance.

(b) If the Earth's moon were orbiting Mercury at the same radius that it orbits the Earth, would Mercury be able to hold on to the Moon? Quote Mercury's Hill Radius as a ratio to the Earth-Moon distance.

(N.B. due to perturbations, orbits right at the Hill radius are not stable over long periods of time. The "true" radius of stability is probably more like $<\sim 1/2 r_H$.)



Earth and Moon as seen from surface of Mars by Curiosity.