1. J. E. Keeler (1895, ApJ, 1, 416) measured the speed of Ring A of Saturn. The radius of the inner edge of Ring A 139Mm. A blow-up of his Figure 1 is shown.

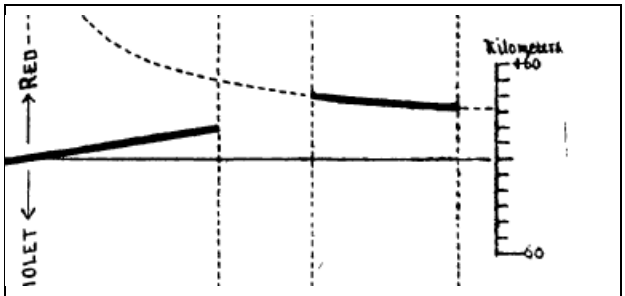

Figure 1 Rotation speed of Saturn and Ring A (Keeler 1895). The scale runs from -60 to +60km/s.

   a. (5 pts.) Find the mass of Saturn.

   b. (3 pts.) Assume the rings are solid (and not made of particles, which is the reality). Sketch the rotation speed on Keeler's graph. Explain.

2. (3 pts.) What is the difference between molecular hydrogen and metallic hydrogen? Write an explanation for a high school student.

3. Composition of Jupiter and Saturn

   a. (3 pts.) Explain the observational evidence that shows Jupiter and Saturn are made primarily of hydrogen and helium.

   b. (3 pts.) If Jupiter and Saturn were made of water, methane, and ammonia, how would they look different? Assume their masses are the same as their real masses.