ASTR1050
Fall 2025

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Due Date: 13 October, 11:59 PM

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1. **Suppose the Solar nebula began with a diameter of 10,000 AU and rotational period of 10^6 years. What would the rotational period of the nebula be when it had shrunk to Neptune's orbit ($D = 60$ AU)?**
2. **Why do the gas giants and their moons have different compositions than the terrestrial planets?**
3. **How do planets around other stars differ from planets in the Solar System?**
4. **How can we explain the presence of gas giants closer to their host star than Mercury is to the Sun?**
5. **Why do Earth, Mercury, and Mars show evidence for water, when these planets formed in regions that were too hot for ice to condense?**
6. **Describe the main differences between the composition of the Earth and the Sun.**
7. **What is the Zeeman effect, and how does it relate to the Sun?**
8. **The escape velocity of an astronomical body is $v_{\mathbf{esc}} = \sqrt{\frac{2GM}{R}}$. Find the escape velocity for the Sun at its surface. The Sun has mass 2×10^{30} kg and size 6.96×10^8 m.**
9. **Spectral analysis of the Sun shows that the two edges of the Sun differ by 4 km s^{-1}, meaning the Sun rotates at an equatorial rotation rate of 2 km s^{-1}. Find time it takes for the Sun to rotate once.**
10. **The Sun is made up mostly of hydrogen and helium. If the Sun is made up of 92.0 % hydrogen and 8 % helium by number, show that the Sun is approximately 74 % hydrogen by mass. Helium has a mass four times that of hydrogen.**