# Space: Its Light , Its Shape.
# Cosmology Part I: Curved Geometry

**Assignment: For Monday, March 28**

- Read Harrison's *Cosmology* chapter 10. Please read the whole chapter, including the notes at the end, particularly number 8. It is available on eReserves.
- Please feel free to bring up other issues you find interesting or puzzling. If at all possible send an email before seminar to me. I will present this topic as my assignment or open it up to discussion by the whole seminar.
- Some of these require additional reading for the presenting team. If I don't explicitly give the reference then the additional information is easy to find on the internet.
- Though everyone is responsible for reading all of the material and for working out all of the exercises, teams have been specific material and exercises for which they are responsible in class presentations. You may want to come to class early to firm up and smooth out the exercises with your teammates.

At the beginning of this chapter you will read some familiar material. This part summarizes a few chapters of Weeks.

**Team 1:** Tell us what a scalar and a vector are. Give an example of each.

**Team 2:** Explain what parallel transport is. Tell us about an example in flat space.

**Team 3:** Show us what the curvature angle is for the example given in Figure 10.10.

[ **Seth:** Derive 10.6 using Weeks-like reasoning. I welcome any help!]

**Team 4:** Choose a pair of coordinates systems as in Fig. 10.11 and show by example that the space interval doesn't change. To be concrete choose $(x', y')$ to be rotated clockwise $45^o$ and let the original interval be (0,0) to (2,2).

**Team 1:** Let's use Heather's balloon analogy from before break. Suppose she pulls her hands apart, what is changed in equation 10.9, $F, G, H$?

**Team 2:** Explain the surveyor's difficulty and resolution. What is Gauss's *theorema egregium*?

**Team 3:** What was Riemann's insight (in regard to the work of Gauss)?

**Seth:** Derive 10.14.