Space: Its Light , Its Shape.
Cosmology Part V: The Cosmic Box

Assignment: For Wednesday, April 13

- Read Harrison's *Cosmology* chapter 17 to "First law of thermodynamics" on page 346. (Of course you are welcome to read further but this is what we will focus on in seminar.) 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.

Team 3: Explain the idea of a partitioned universe. To illustrate this let's consider and expanding sphereland. Use our comoving coordinates (θ, ϕ) and sketch a partitioned sphereland. If the scale factor increases show, with another sketch on the board, the affect on your partitions.

Team 4: Harrison writes, "A partitioned universe behaves exactly as a universe without partitions." If the universe was not homogeneous would this be still true? What if it was not isotropic?

Team 1: We don't have to consider curved geometry?? Explain why this holds for "small partitions" by using or modifying Team 3's sphereland example.

Team 2: The walls of the cosmic box are moving. Harrison writes that the expansion redshift may be modeled by many Fizeau-Doppler redshifts. Where are these redshifts coming from?

Team 3: With a picture on the board illustrate what happens to a particle in an expanding box. If you wish, you can delve into the details given in Note 2.

Team 4: Summarize what happens to the energy of a particle in the two cases of 17.5 and 17.7.

Team 1: Present what happens to the wavelength of light in an expanding box, 17.8.

Team 2: Motivate and present equation 17.10.

Team 3: The cosmic microwave background is now at $T = 2.73$ K. Present the calculation of what the temperature was at redshift $z = 1000$. On what part of the spectrum would this appear? Could we see it? If so, what color would it be?