

# Physics 130 General Relativity Seminar

## Assignment 11 April 07, 2011

### Part 1: Readings

**Cheng:** Chapter 10 - Pages 205-236(The Expanding Universe and Thermal Relics)

**Amanda Peet GR Lectures** - Appropriate pages.

**Other sources** among references on website or books in my office.

### Part 2: Review Questions from Text

1. Cheng: 10-1, 10-3, 10-5, 10-6, 10-9, 10-10, 10-13, 10-14

**Part 3: Everyone Problems** Start to read Moffat's (easy) book. Finish by next week.

1. Cheng: 10-2 Newtonian interpretation of 2nd Friedmann equation
2. Cheng: 10-4 The empty universe
3. Cheng: 10-8 Scaling behavior of number density and Hubble's constant
4. Cheng: 10-9 Radiation and matter equality time
5. Cheng: 10-13 Cosmological limit of neutrino mass

### Part 4: Extra Problems

1. Cheng: 10-5 Hubble plot-flat matter-dominated universe \_\_\_\_\_
2. Cheng: 10-7 Distance to a light emitter at redshift  $z$  \_\_\_\_\_
3. Cheng: 10-10 Density and deceleration parameter \_\_\_\_\_
4. Cheng: 10-11 Temperature and redshift \_\_\_\_\_
5. Cheng: 10-12 Radius of the universe \_\_\_\_\_
6. EP #62 - Red Shift in Model Galaxy \_\_\_\_\_
7. EP #63 - Expanding Universe \_\_\_\_\_
8. EP #64 - Homogeneous, Isotropic Universe \_\_\_\_\_
9. EP #72 - Spaceship in Robertson-Walker Spacetime \_\_\_\_\_