Ph 136a: Applications of Classical Physics 23 May 2001

## CHAPTERS 26: GRAVITATIONAL WAVES and 27: COSMOLOGY

**Reading:**

Sections 26.3.1, 26.3.2, 26.3.3, 26.3.4, 26.3.7, 26.4 of Chapter 26 of Blandford & Thorne; also all of Chapter 27.

**TA:**

This problem set will probably be graded by Alexander Putilin.

### Problems

Work four of the following seven problems; at least one must be from Chapter 26 and at least one from Chapter 27. Pick problems that are appropriate for *you*—not too easy; not too hard.

A. Arm Waving. Wave your arms rapidly, and thereby try to generate gravitational waves.
   a. Compute in order of magnitude, using classical general relativity, the wavelength of the waves you generate and their dimensionless amplitude at a distance of one wavelength away from you.
   b. How many gravitons do you produce per second? Discuss the implications of your result.

B. Exercise 26.4 Behavior of $h_+$ and $h_\times$ under Rotations and Boosts

C. Exercise 26.6 Transformation to TT Gauge

D. Exercise 27.2 The 3-Sphere Geometry of a Closed Universe

E. Exercise 27.5 Einstein's Static Universe

F. Exercise 27.6 Cosmological Redshift

G. Exercise 27.9 Magnitude-Redshift Relation