

PHYSICS 406: PROBLEM SET 5

due: Thursday, March 30, 2006

Problems

- (1) On the surface of a two-sphere, the Euclidean metric is given by

$$ds^2 = d\theta^2 + \sin^2 \theta d\phi^2.$$

Suppose a vector $\vec{A} = \hat{e}_\theta$ at $(\theta = \theta_0, \phi = 0)$. What is \vec{A} after it is parallel transported around the circle at $\theta = \theta_0$? What is its magnitude?

- (2) Problem 11.7 of your book.
(3) [LONG PROBLEM] Compute the Riemann tensor for the following spacetime:

$$ds^2 = -dt^2 + a^2(t)d\vec{x}^2$$

where $a(t)$ is a function of t . Later you will learn that this plays an important role in the big bang theory.

- (4) Problem 10.17 of your book.