

Ph 161 Black Holes

Homework Assignment 2

Due Tuesday, February 7, 2006

This should be your own work; do not copy problem solutions.

- (1.) Write a few paragraphs discussing the Equivalence Principle and its relationship to geometry. Specifically, describe the experiments which test the relative acceleration of different bodies in a gravitational field (Eötvös experiments) and discuss what it is they measure, how they measure it, and their current precision. Then explain the *geometric* significance of the idea that “everything falls (accelerates) at the same rate in a gravitational field,” and the analogy to the geometry on a 2-dimensional curved surface.
- (2.) Give an argument as to why there can be no *global* inertial, Minkowski coordinate systems in the presence of a gravitational field.
- (3.) With a coordinate transformation from locally inertial (locally Minkowski) coordinates $\{\xi^\alpha\}$ to a laboratory coordinate system $\{x^\mu\}$ (i.e., one at rest on the surface of the earth) derive the geodesic equations. (This is indeed exactly what we did in class!)
- (4.) Hartle Chapter 7: problem 7.