

# Final exam notes

April 19, 2015

The second half of the course has covered applications of general relativity: the static, spherically symmetric (Schwarzschild) solutions and cosmology. The Schwarzschild solution describes solar system effects of general relativity, including the three classical tests:

1. Perihelion advance of Mercury
2. Deflection of light passing the sun
3. Gravitational redshift/time dilation

We have also made an extensive study of null and timelike geodesics near black holes.

In cosmology, we have derived the Friedmann equation and three drivers of spacetime curvature:

1. Normal and dark matter
2. Radiation
3. The cosmological constant

Together these comprise the  $\Lambda$ -CDM standard model.

For both the Schwarzschild and cosmological problems, we have used the idea of an effective potential to analyze the qualitative types of motion possible. You should be able to do this.

Some questions will test your ability to calculate fundamental geometric quantities from the metric:

1. The Christoffel connection
2. Geodesics
3. The Riemann curvature tensor

The test will not last forever, so a limited amount of this will appear.