4/01/05

Test 3, Chapter 6, sections 5, 6, Chapter 7, Chapter 8, sections 1, 2, 6, 7, 10, Chapter 9, sections 1 - 5.1 Friday, April 8.

Review sheet Monday. Office hours, make appointment.

News:

Pic of the day

Search for water on Mars

Geometry on the 2D surface of the balloon

Exercises of drawing straight lines

Embedding diagram - 2 D "shadow" of 3 D curved space, preserves basic aspects of geometry, whether curved or not, and, if curved, how.

Meaning of ***flat space*** in 3 (or higher) dimensions

If 3 D space is flat $C=2\pi r$; sum of angles of triangle $=180°$; parallel beams of light never cross ***in 3D***.

The embedding diagram of 3D flat space is a flat 2D plane

In curved 3D space, the flat space answers will be wrong: 2D embedding diagram will help to illustrate that.

Real 3 D curved space (for us!!) might curve in a 4 D "hyperspace," but we don't directly perceive that hyperspace.

Can determine curvature, shape of 3 D real space by doing 3 D geometry

Don't need to ask about 4 D (but will!)

Invert balloon - 2 D embedding diagram of curved 3 D space around gravitating object

Properties of this curved space that are preserved in the embedding diagram:

$C < 2\pi r$

Sum of angles of triangle not equal 180^o (can be > or <)

Parallel lines diverge or cross

Orbit - circle around “cone”

Moon is going as straight as it can in curved space around the Earth

This is how gravity works for Einstein - no Newtonian Force -

Gravitating objects curve the space around them - nearby objects move in that curved space

The parallel-propagated straight lines of their force-free motion are warped by the curved space.

3 D gravitating space is not a "cone;" that is just a property of the 2 D embedding diagram.

Real 3 D space around gravitating objects has the properties:

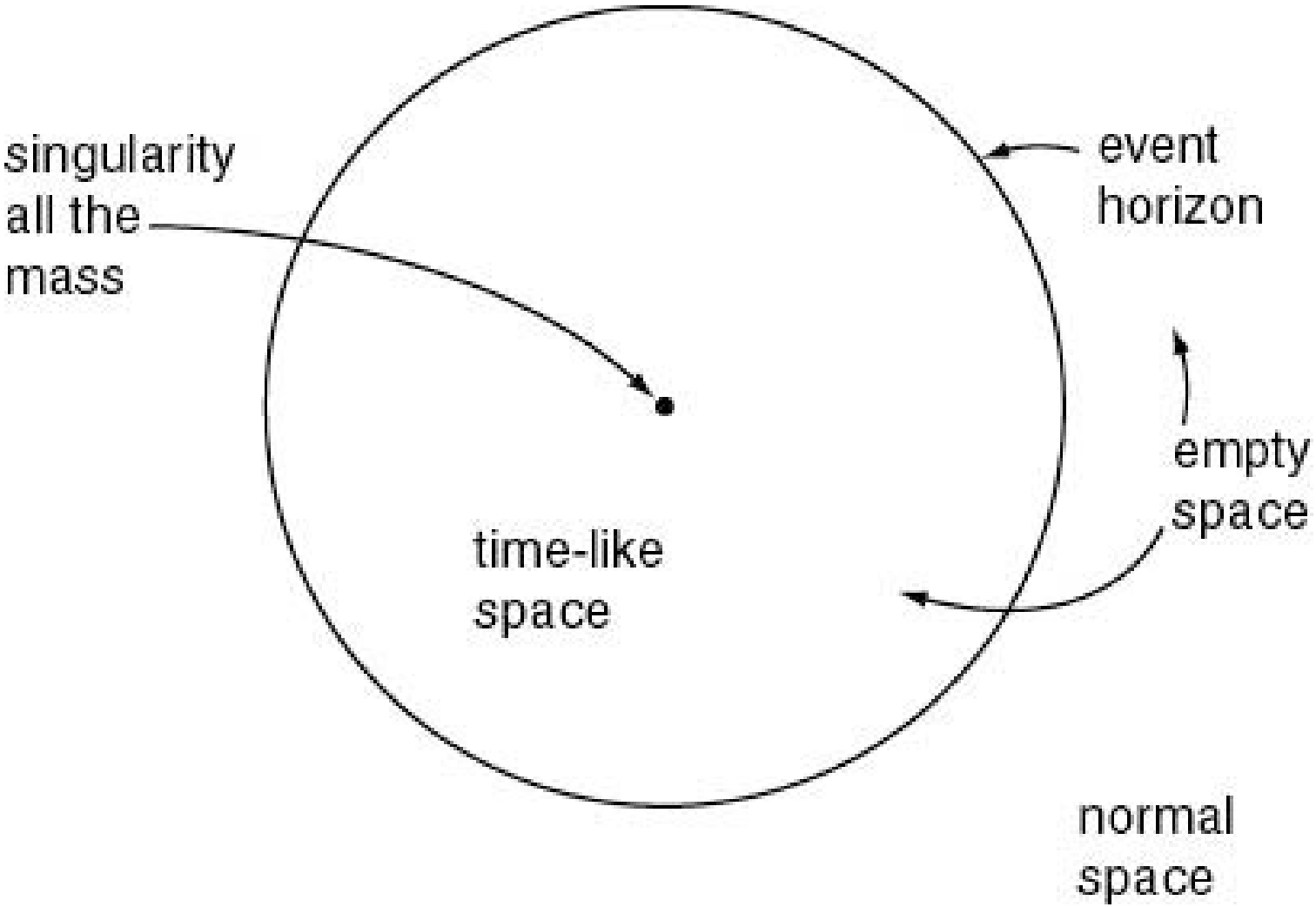
$C < 2\pi R$

Δ not equal 180^{o}

// lines cross

light is deflected (this one has been experimentally verified)

Figure 9.1



Basic properties of (non-rotating) black hole