Monday, April 4, 2016

Exam back Wednesday, key posted.

Exam 4, Skywatch 4, Friday, April 15.

Chapter 8 Neutron Stars - Sections 8.1, 8.2, 8.5, 8.6, 8.10

Chapter 9 Theory of Black Holes: 9.1 to 9.5 (update at end of week)

Astronomy in the news?

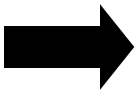
Goal:

To understand the nature of curved space, and hence of gravity, in the vicinity of a massive object, a planet, star, or black hole.

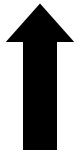
To understand the role of an “embedding diagram” in helping to explain that curved space.

One Minute Exam

In the corresponding two-dimensional embedding diagram, the interior volume of a real, three-dimensional planet would be represented as:

 A point

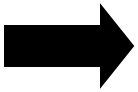
 A line

 An area

 A volume

One Minute Exam

In a two-dimensional embedding diagram of the Earth, the surface of the Earth would be represented by:

 A volume

 A surface

 A line

 A point

Goal:

To understand what Einstein means by an orbit.

Orbit - circle around “cone”

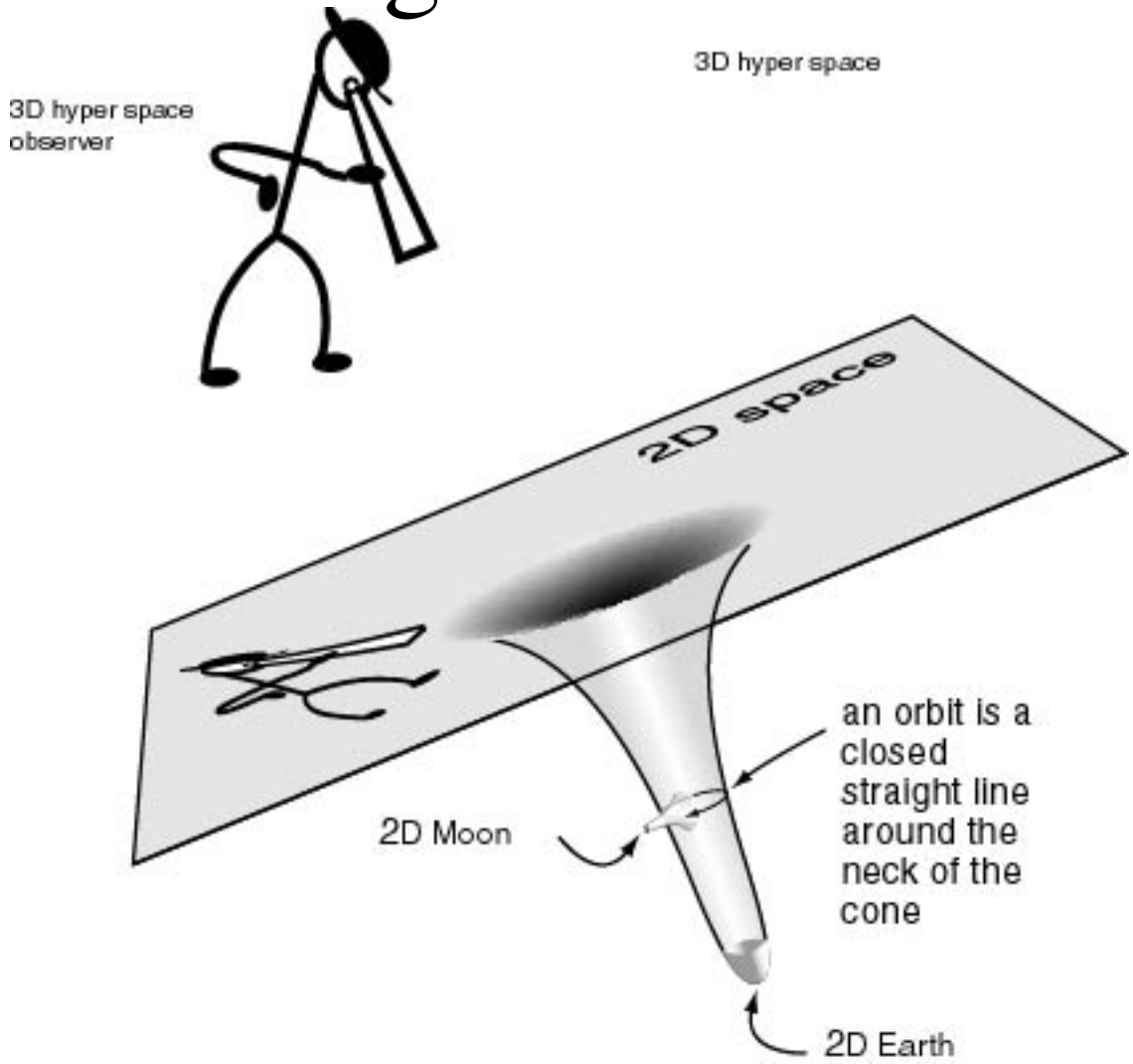
Moon is going as straight as it can in curved space around the Earth

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.

Figure 9.5



Orbits in curved 2D embedding diagram of gravitating space

3 D gravitating space is not a "cone;" that is just an artifact 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}

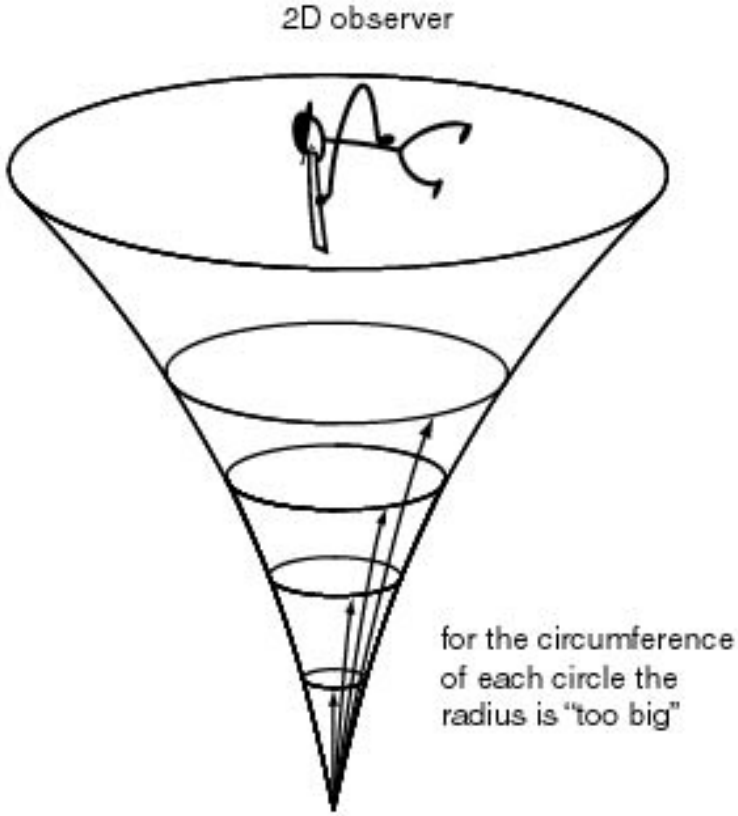
// lines cross or diverge

light is deflected (this one has been experimentally verified)

Goal:

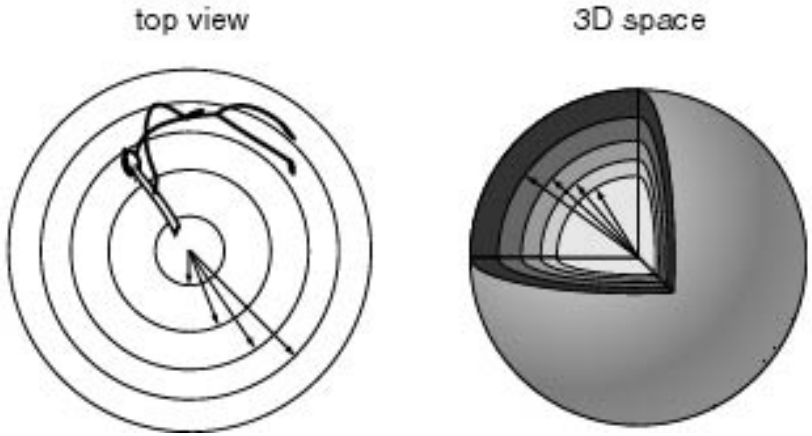
To understand the “real” curved space of a gravitating object in three dimensions

Fig 9.6



Curved 3D space

space around a black hole: each inner surface has a smaller circumference and area, but for each the radius is "too big"



First edition book cover…