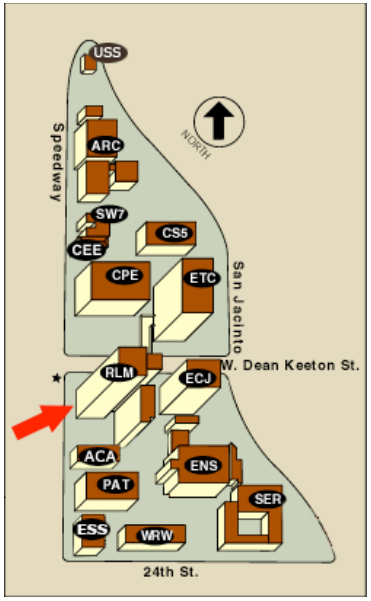
Monday, April 11, 2016

4th Exam, Skywatch, Friday, April 15

Review sheet posted

Review Session Thursday, 4:30 – 5:30 PM, RLM 15.216B



Reading for 4th exam:

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

No office hours today. Please see Brian.

Astronomy in the news?

The planet finding Kepler satellite has gone into emergency mode. NASA is working to figure out why.

Fifth exam and sky watch, FRIDAY, May 6.

Reading for Exam 5:

Chapter 9 – Sections 9.6.1, 9.6.2, 9.7, 9.8;

Chapter 10 - Sections 10.1-10.4, 10.9;

Chapter 11 - all except Section 11.6 (abbreviated, focus on lectures);

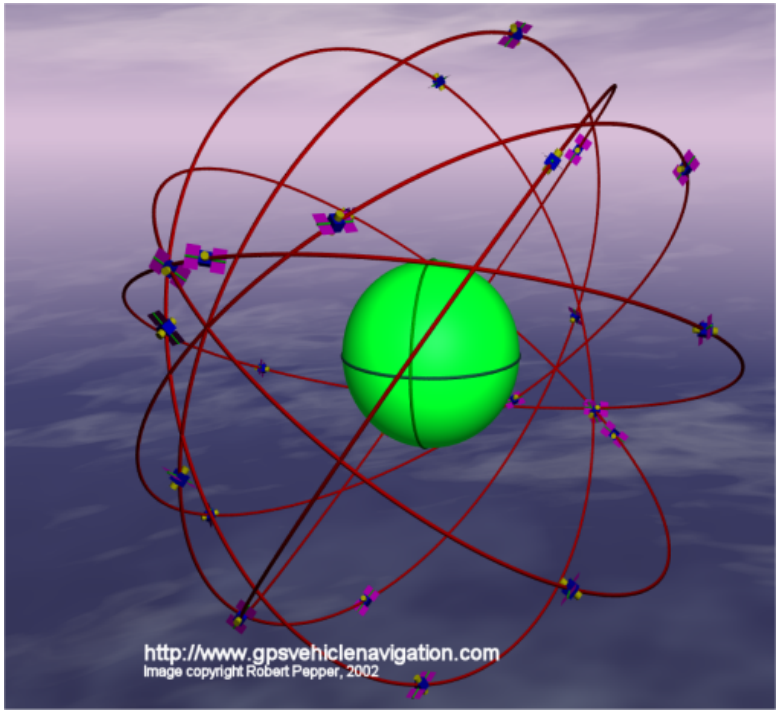
Chapter 12 - all;

Chapter 13 (TBD);

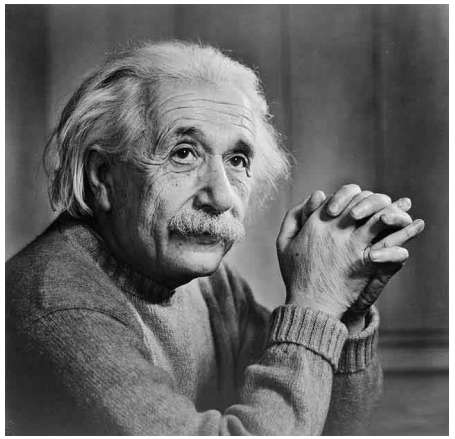
Chapter 14 - all

Device to measure the curvature of space and the different flow of time at various levels in a gravitational field.

One especially fascinating application: the Global Positioning System



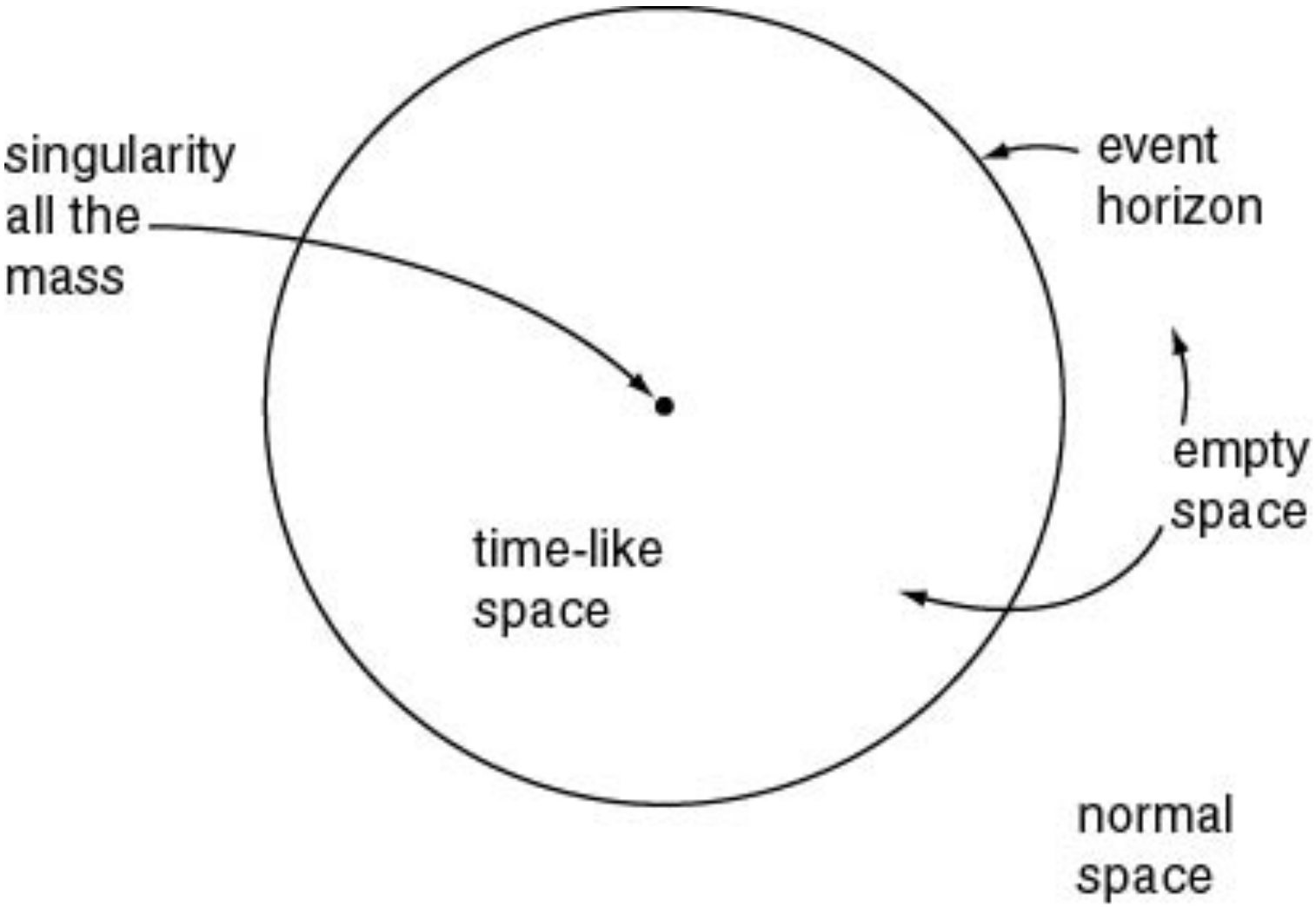
GPS depends not only on an array of satellites in orbit, but must be programmed to understand Einstein's theory of warped space and time to function properly.



Goal:

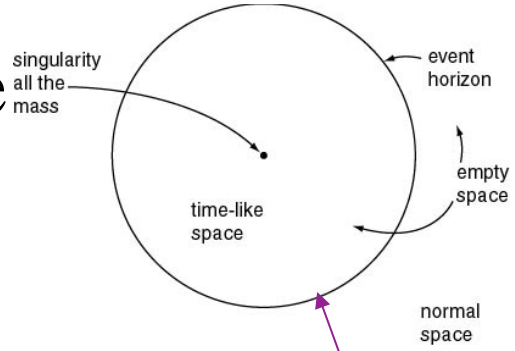
To understand the full space-time associated with rotating black holes.

Figure 9.1



Basic properties of a (non-rotating) black hole

Non-rotating Schwarzschild Black Hole



Mass, but no spin, no electrical charge

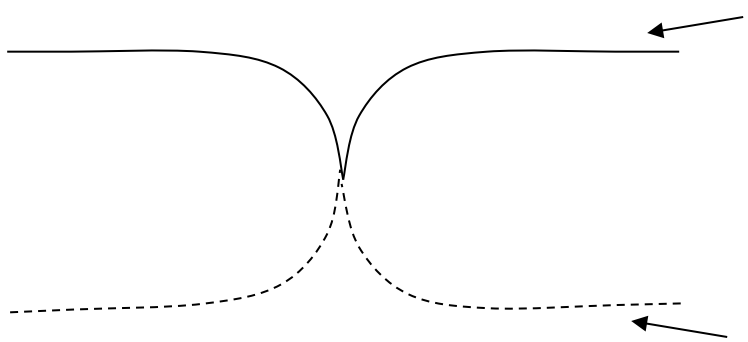
Assume all mass is in the singularity, no mass anywhere else (assumption necessary to solve equations)

Event horizon is also surface of infinite redshift

Find two Universes, each of infinite space, connected at one instant by the singularity.

Cannot pass from one to the other if travel at less than the speed of light.

Slice of embedding diagram



Universe #1

Universe #2

Somewhere else in hyperspace

Goal:

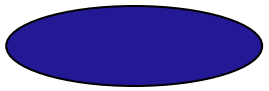
To understand the full space-time associated with rotating black holes.

Rotating Kerr Black Hole

Mass and spin, but no electrical charge

Assume all mass is in the singularity, no mass anywhere else
(assumption necessary to solve equations)

Find ***singularity is a ring*** (not a point)

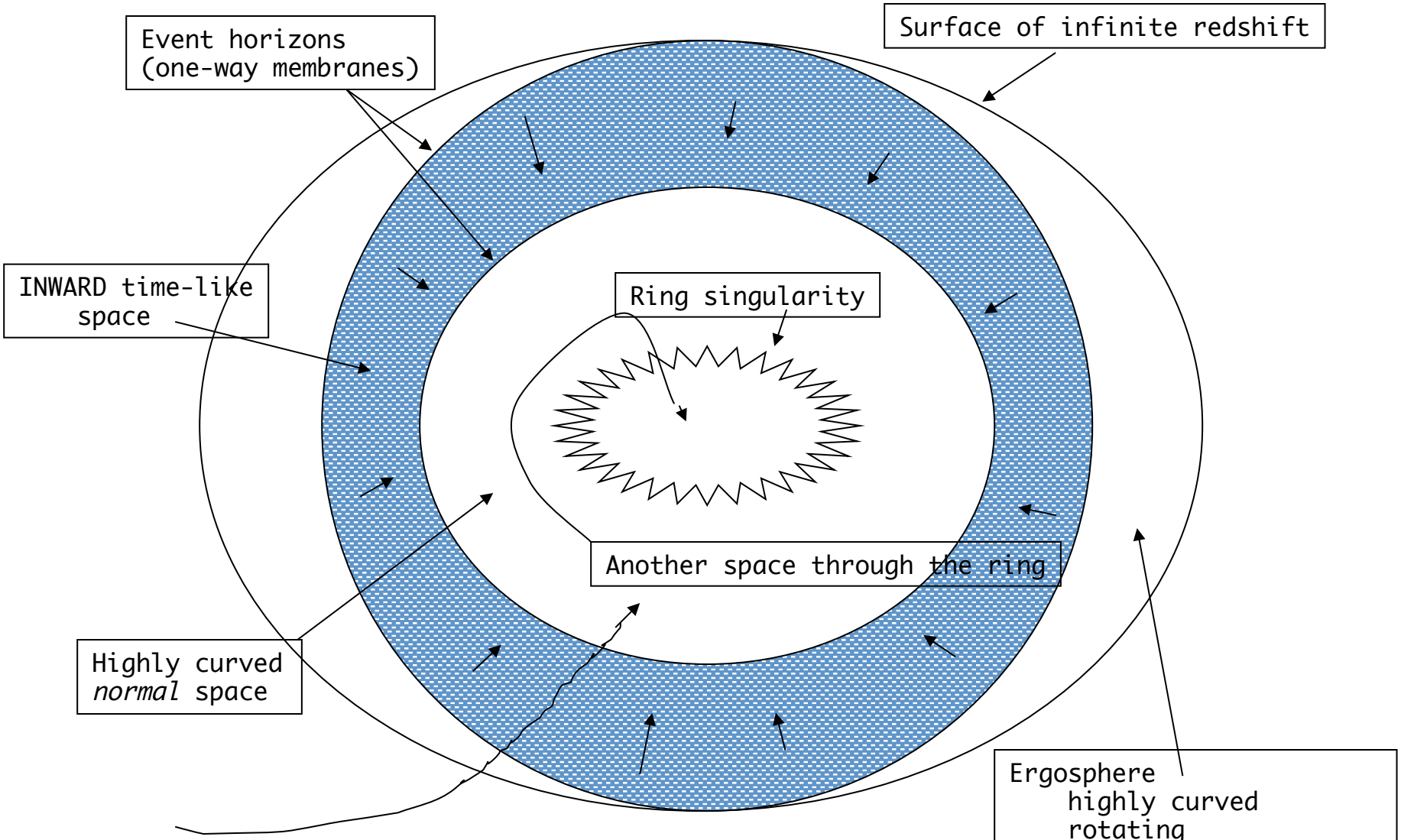


0 thickness, ∞ density, still infinite tidal forces

Infinite Universes!

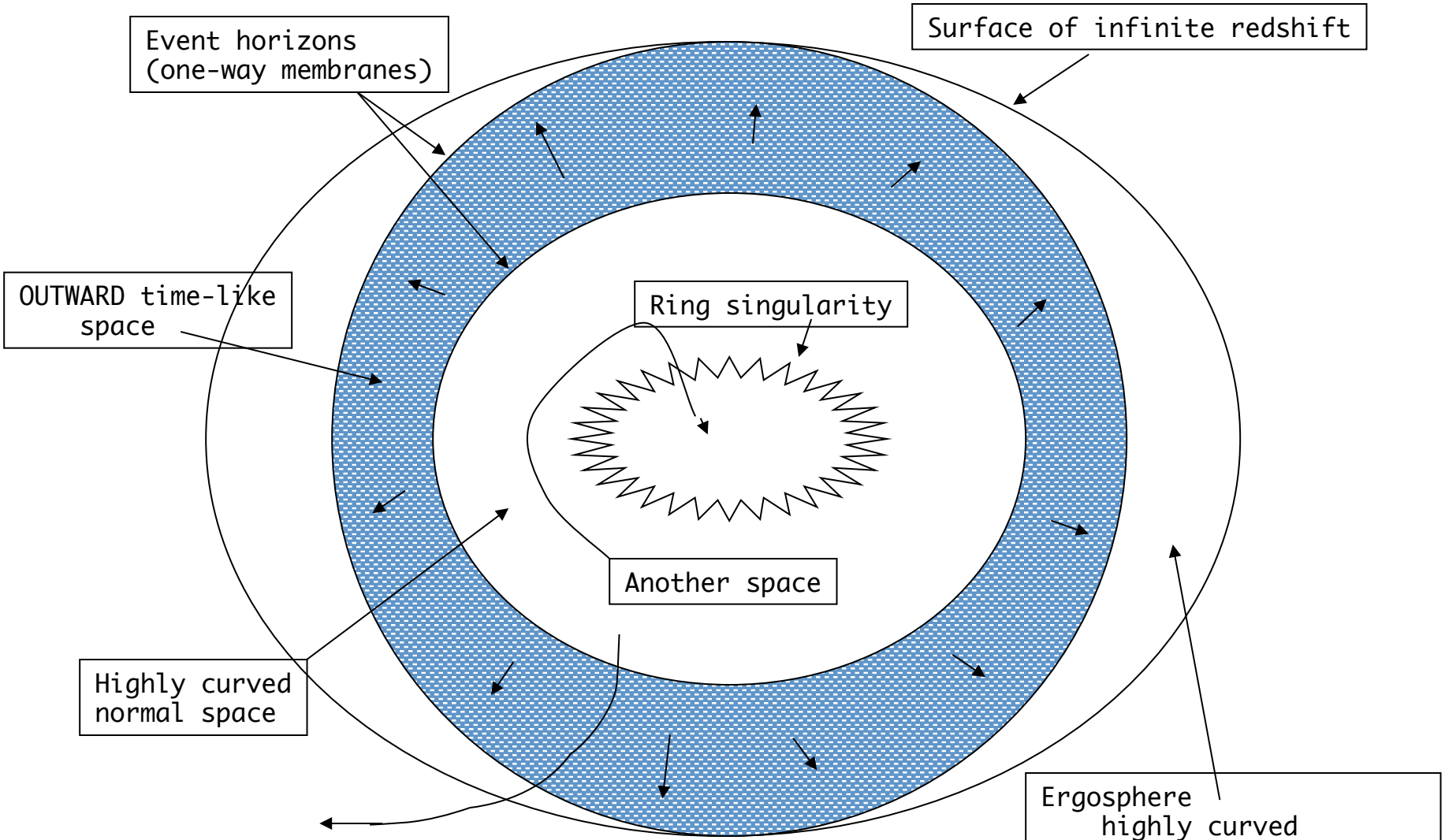
(implicitly spread through hyperspace)

Cross-sectional view of rotating Kerr black hole



Fly in, never to return

In future



Access to Universe different
than original one