

Wednesday, November 2, 2011

Reading: Chapter 9, Sections 9.5.1, 9.5.2, 9.6.1, 9.6.2. 9.7, 9.8;
Chapter 10, Sections 10.1-10.6, 10.9

Astronomy in the news? China launched the Shenzhou 8 spacecraft late Monday. It is expected to dock at the country's Tiangong 1 space module to form a miniature space station.

New Brian Greene series, The Fabric of the Cosmos, First installment "**WHAT IS SPACE?**" tonight, November 2, PBS (KLRU) 8 PM (re-runs <http://www.klr.org/schedule/viewProgram.php?id=246736>). Subsequent installments, next three Wednesdays, Nov 9, 16, 23.

Pic of the day: Wizard nebula



Goal:

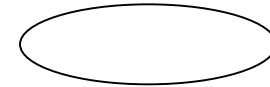
To understand the full space-time associated with rotating black holes.

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)

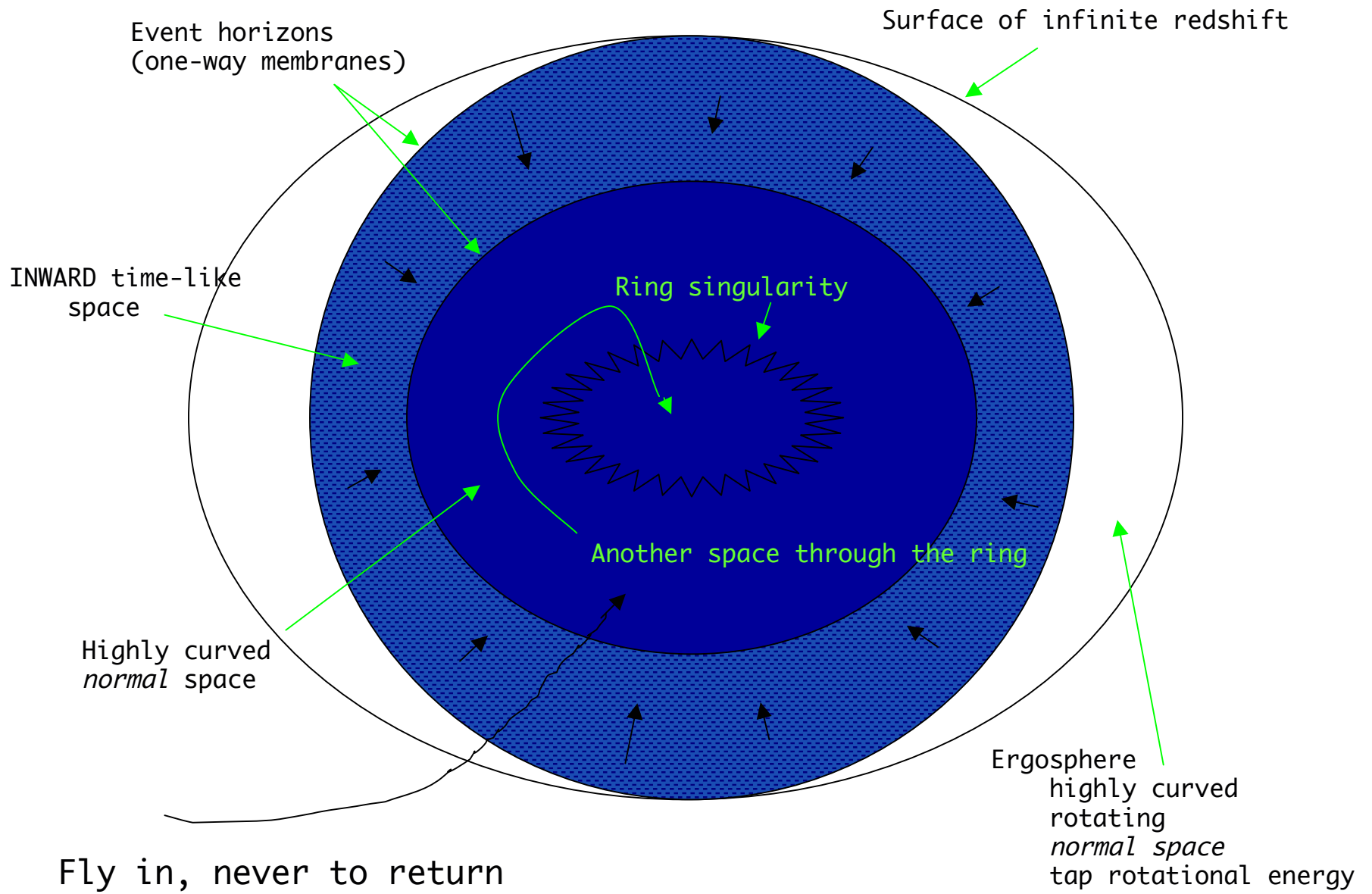


0 thickness, ∞ density, still uncertainty problem

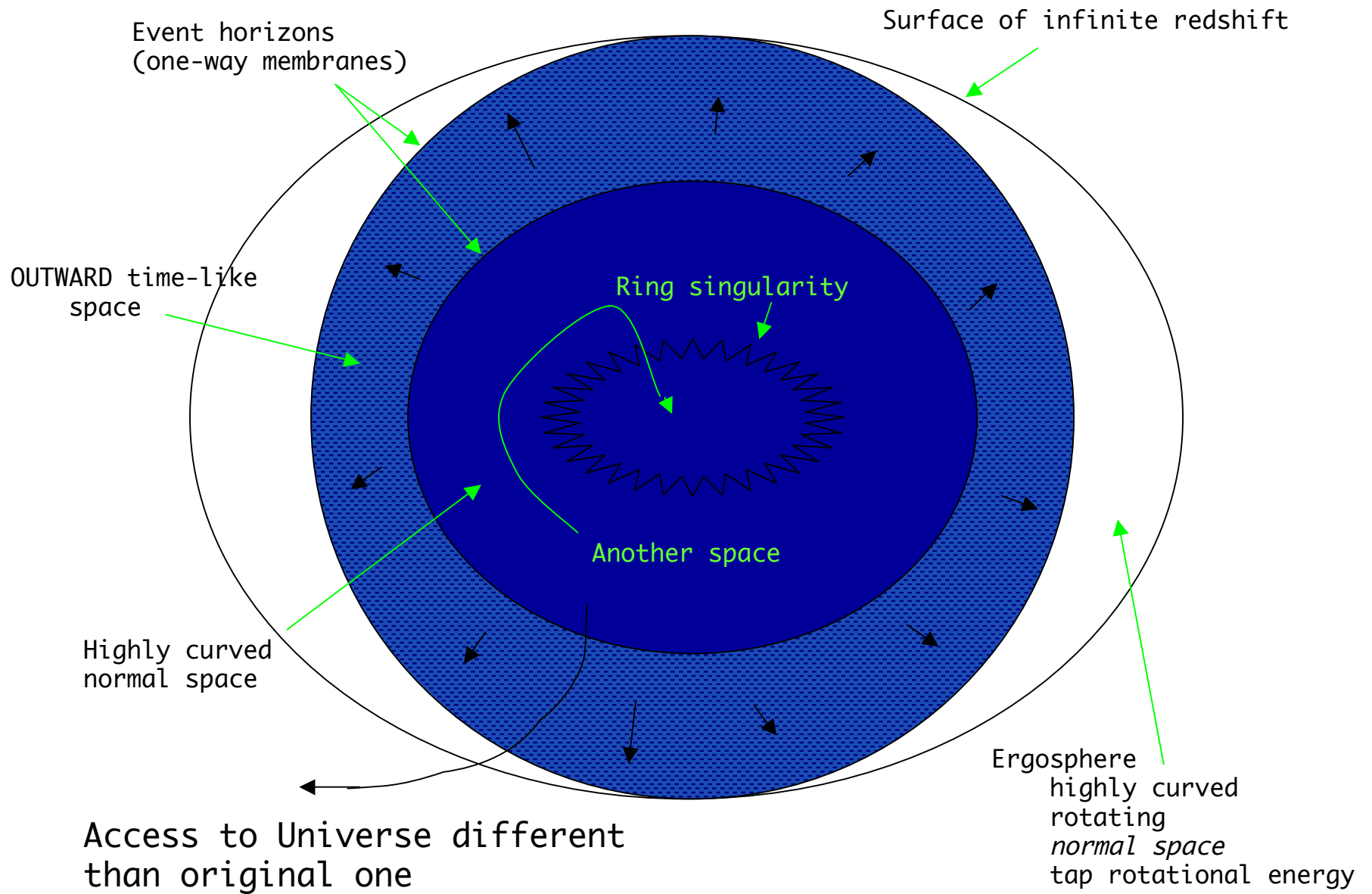
Infinite Universes!

(implicitly spread through hyperspace)

Cross-sectional view of rotating Kerr black hole



In future



Are Different Universes Real?

In Real Universe:

Light falls into the black hole





Photons are Doppler blue shifted, accelerated to higher energy, compacted into a thin shell: *Bluesheet*

=>the energy/mass of the blue sheet warps the space changes the mathematical, hence the physical solution

So, probably not in this case, but stay tuned...

One Minute Exam

In the mathematical solution for a rotating black hole:

-  The surface of infinite redshift is identical to the event horizon.
-  You can escape the black hole back to the universe from which you entered.
-  There are exactly two universes.
-  The space entered through the ring singularity is different than the space surrounding the singularity.

Chapter 10 - Finding Black Holes for Real

We know that massive stars evolve to form iron cores that absorb energy and collapse. A compact object must be left behind.

Some explode and leave rotating, magnetic pulsars

Some explode and leave highly magnetic magnetars

Some explode but leave black holes or completely collapse to leave black holes

We don't know which massive stars do which! Tendency to think that more massive stars are more prone to making black holes, but the rotation of the star, the presence of a binary companion, and other factors may influence the outcome.

We do know that black holes exist, so some stars make them.

Goal:

To understand how we search for real black holes and why binary systems with mass transfer and accretion disks are so important.

Black Holes for Real

There may be 1 - 100 million black holes in the Galaxy made by collapsing stars over the history of the Galaxy.

That means that the nearest black hole may be only a few tens of light years away. How do we find them?

Black holes made from stars are really black! (Negligible Hawking radiation).

Those alone in space are not impossible to find, but very tough.

Event horizon of 10 solar mass black hole has a radius of 30 km ~ 20 miles, somewhat bigger than size of Austin, easily fit between Georgetown and San Marcos

Very black

None yet identified.

Black Holes for Real

Look for binary systems, where mass accretion occurs.

Will not see the black hole, do not yet have the technology to “see” a black spot.

Can detect the *halo of X-rays* from orbiting matter, the accretion disk, near the event horizon that will reveal the presence and nature of the black hole.

Look in accreting binary systems!