April 2, 2010

Reading: 9.5.2, 9.6.1, 9.6.2, 9.6.3, 9.7, **9.8**.

Wheeler on travel next week, Wednesday and Friday.

Exam 4, April 16.

Astronomy in the News?

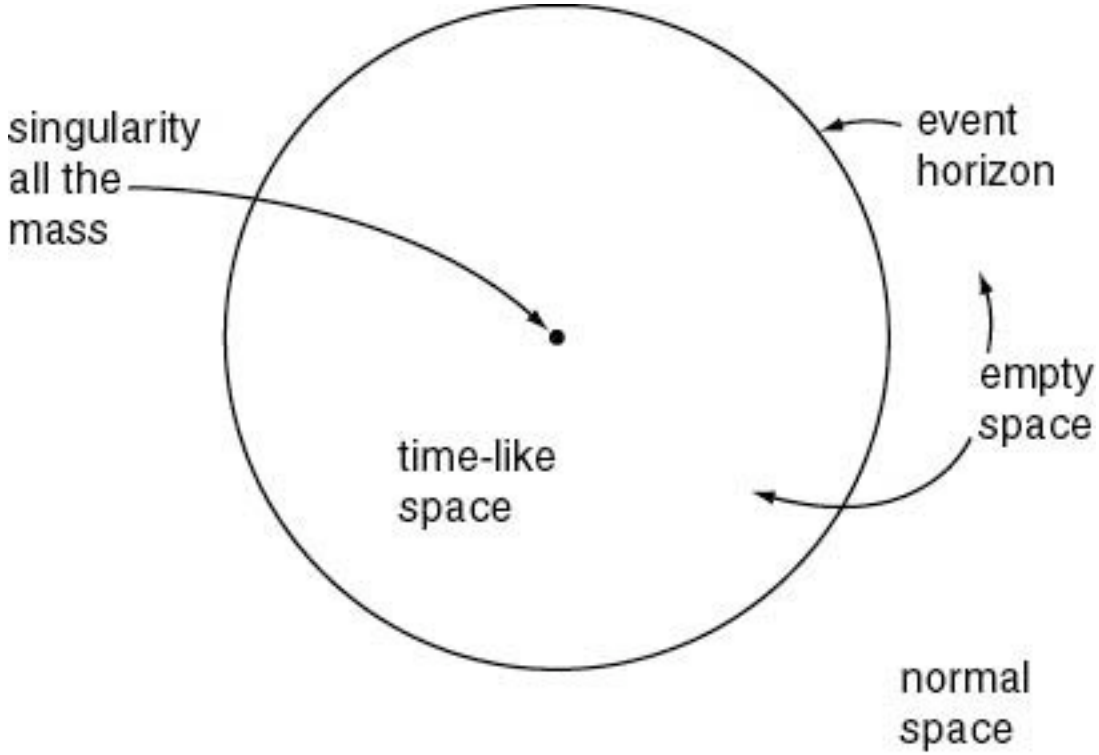
Pic of the Day - Moon, Saturn and a Moondog (reflection from ice crystals) in Austria

Goal:

To understand the nature of time-like space inside a black hole.

§ 8 Time-like Space

Figure 9.1

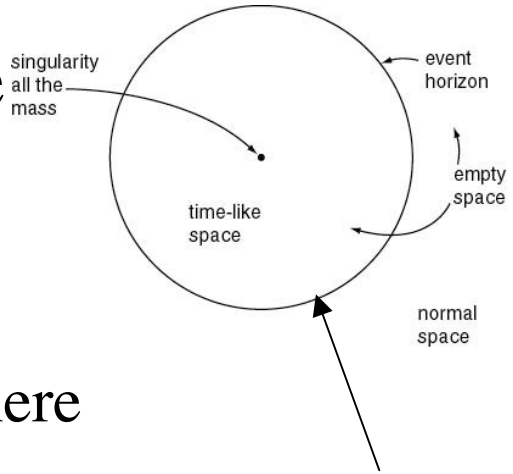


"Time-like" space forces motion in one direction. Space moves faster than the speed of light compared to a distant observer; the real reason black holes are black.

Goal:

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

Non-rotating Schwarzschild Black Hole



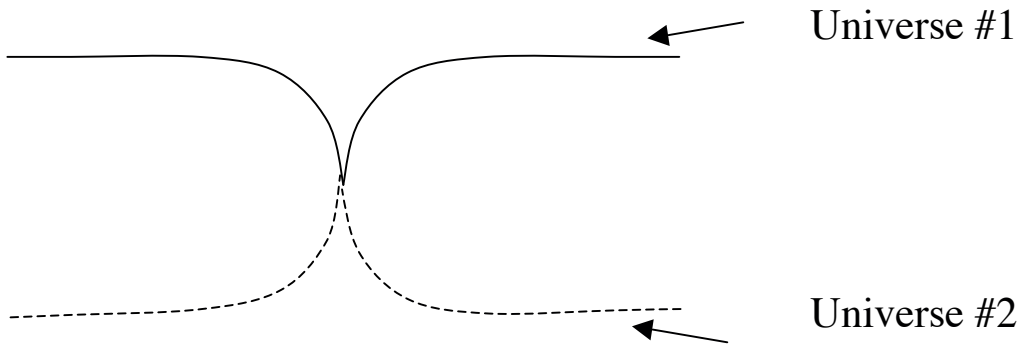
Mass, but no spin, no electrical charge

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



Goal:

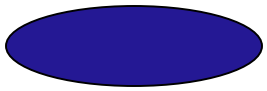
To understand the full space-time associated with rotating black holes.

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)

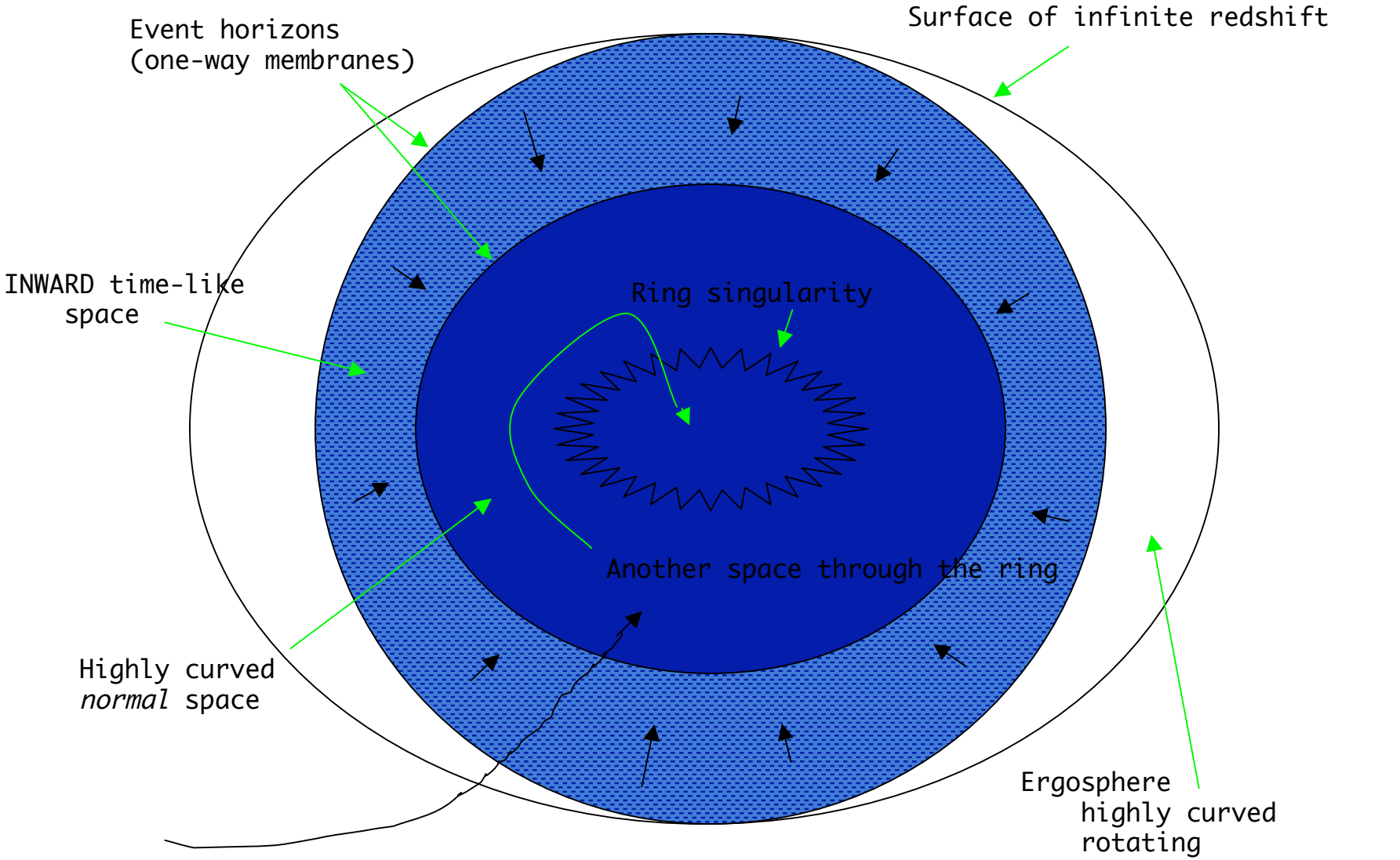
Find ***singularity is a ring*** (not a point)



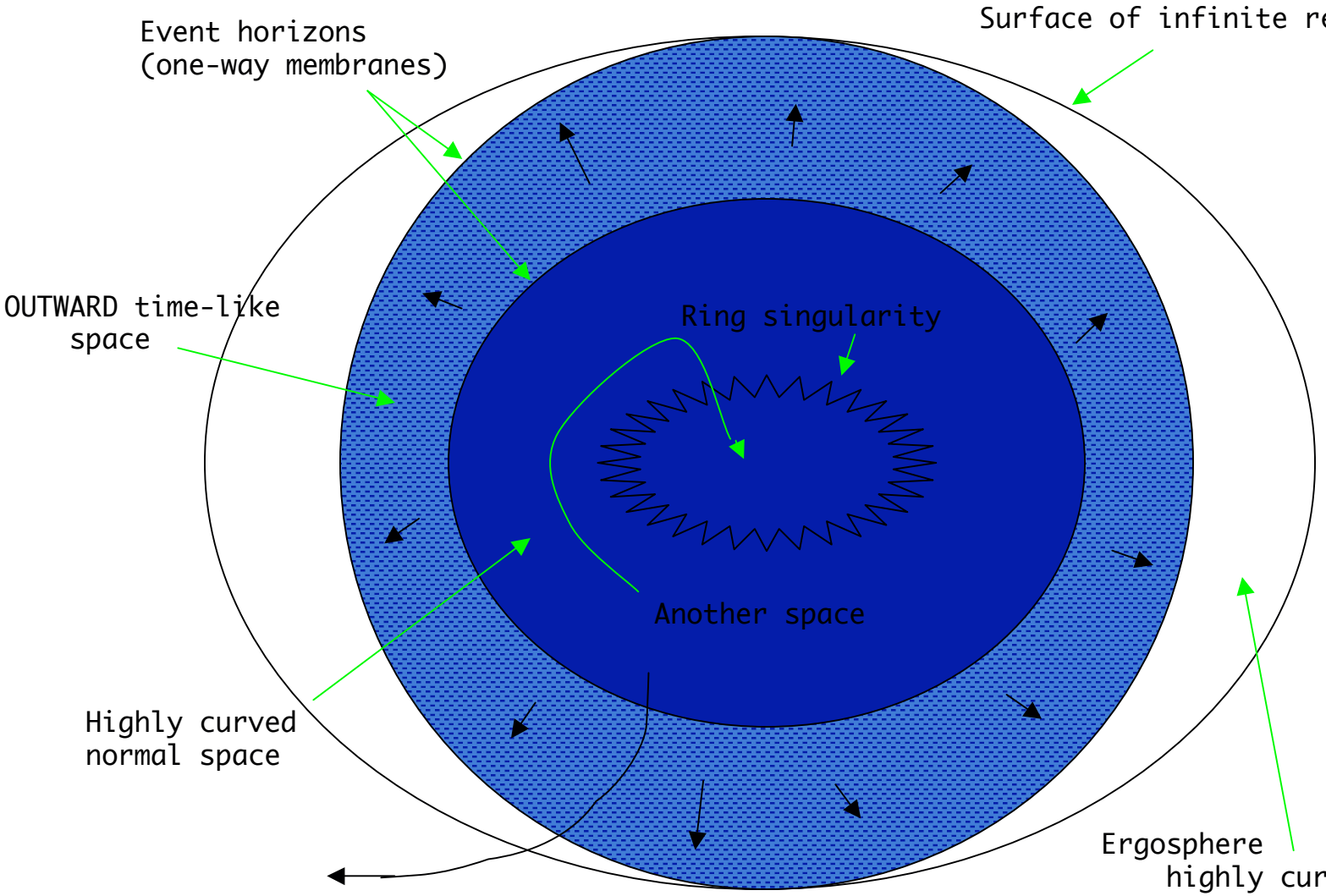
0 thickness, ∞ density, still uncertainty problem

Infinite Universes!

Cross-sectional view of rotating Kerr black hole



In future



Access to Universe different
than original one

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 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.