Wednesday, April 15, 2015
4<sup>th</sup> Exam, Skywatch, Friday, April 17
Review sheet posted
Review Session Thursday, 5 – 6 PM, RLM 6.104
Reading for 4<sup>th</sup> 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 (Note Revision)

Astronomy in the news?

Space X launched supply rocket to the International Space Station, landed the booster on the barge, but "too hard to survive." Saving the booster would lower the cost of launch.



Fifth exam and sky watch, FRIDAY, May 8.

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

## Goal:

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



Basic properties of a (non-rotating) black hole

## 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,  $\infty$  density, still infinite tidal forces

Infinite Universes!

(implicitly spread through hyperspace)



## Cross-sectional view of rotating Kerr black hole



## In future



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. Are different universes in Schwarzschild and Kerr solutions to non-rotating and rotating black holes real?

In Real Universe:

Light (at least!) 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...