

03/05/2008

Exams back, key will be posted.

Sky Watch posted Friday.

*No class Friday*

Astronomy in the News - Pulsar that also behaves like a magnetar.

Binary helium star will explode, may be “pointing” at us.

<http://www.physics.usyd.edu.au/~gekko/pinwheel.html>

Pic of the day -  
International Space Station



# New Topic: Black Holes

## Chapter 9

What do you know about them -- When did you learn?

# Black Holes

Mitchell, Laplace, late 18th Century: with Newton's Gravity  
could have escape velocity greater than the speed of light =>  
light could not get out, completely dark, *corps obscurs*.

Now know Newton was wrong.

Excellent approximation for weak gravity - “true” in that case

Conceptual problems  $F = \frac{G M_1 M_2}{r^2}$

infinite force for zero separation (in physics infinity  
=> problem )

instantaneous reaction => infinite speed of gravity

Experiment - wrong deflection of light.

Need Einstein and more!

# *Great conceptual differences between Newton and Einstein on the Nature of Gravity*

Newton - Force between two objects

Einstein - Mass curves space, objects move *with no force* in curved space

Need to explore curved space - use geometry in multiple dimensions

## SPACE - *The Final Frontier*

***Dimensions*** - defined by the number of mutually perpendicular directions

0 D - point

1 D - line

2 D - area

3 D - volume (secret hand sign)

4 D - ?

Hyperspace - space with more dimensions than the one under consideration