

# Physics 248

## Lecture 1

Gary Shiu

1/22/06

# Physics 248

## A Modern Introduction to Physics



### Professors

<p><a href="#">Gary Shiu</a> shiu@physics.wisc.edu</p>	<p>5279 Chamberlin Hall 265-3285</p>	<p>Office Hours W Th 2:00-3:00 pm</p>
<p><a href="#">Teresa Montaruli</a> tmontaruli@icecube.wisc.edu</p>	<p>4112 Chamberlin Hall 890-0901</p>	<p>Office Hours TBA</p>

If you need to contact us outside office hours or class time, if at all possible, please use email.

Lectures will be led by Gary (in the first part of the semester) and Teresa (in the second). The discussions will be led by Gary and Teresa in the periods in which they will be lecturing, and by Jim. Jim will be in charge of the laboratories.

### Teaching Assistant

<p><a href="#">Jim Braun</a> jim.braun@icecube.wisc.edu</p>	<p>4106 Chamberlin Hall 890-0919</p>	<p>Office Hours WF 11:00am-12:00 noon</p>
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# Grading Policies -Physics 248

<http://icecube.wisc.edu/~tmontaruli/Phys248/Policy.html>

**Grading:** Your grade will be based on a weighted average of your coursework as follows:



- 10% online homework ([Mastering Physics](#))
- 15% laboratories (All labs must be completed to pass the exam. If one is not completed your grade is reduced by 30%. If more than 1 is not completed you fail the Course.)



- 10% Discussions
- 15% midterm exam 1 (Feb. 14)
- 15% midterm exam 2 (Mar. 14)
- 15% midterm exam 3 (Apr. 18)
- 20% final exam (May 14)

Here are the letter grades to correlate with your exam score:

Letter grade
A
AB
B
BC
C
D
F

We will curve each exam and based on the average we will decide how to have numerical grades correspond to letter grades.

Lab grading policy will be determined by your Jim.

## Physics 248 Syllabus:

T&M=Tipler & Mosca, "Physics for Scientists and Engineers"

T&L=Tipler and Llewellyn, "Modern Physics"

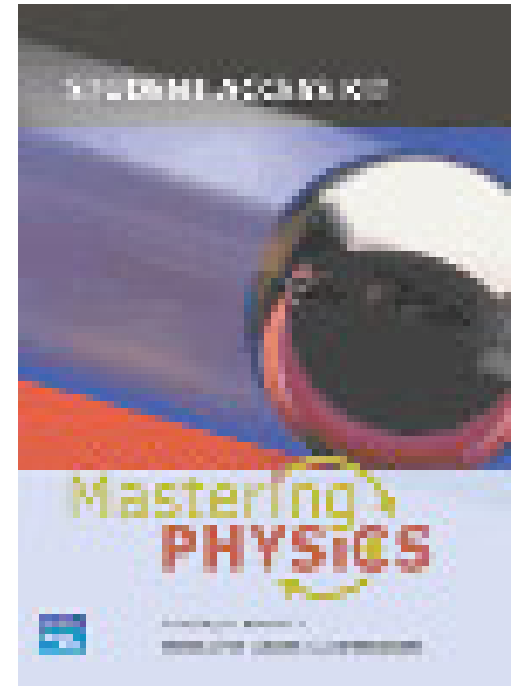
<u>Topic</u>	<u>Reading</u>	<u>Leader</u>	<u>Lectures</u>
Gravity	T&M 11	Gary	1-2
General Relativity	T&L 2	Gary	3-5
Waves	T&M 14-16	Gary	6-9
Diffraction and Interference	T&M 33	Gary	10-11
<b>Exam 1 Wednesday, February 14</b>			
DeBroglie Waves, Uncertainty Principle	T&L 5	Gary	12-14
Schrodinger Waves	T&L 6	Gary	15-21
<b>Exam 2 Wednesday, March 14</b>			
Electrostatics	T&M 21-24	Teresa	22-27
Bohr Model	T&L 4	Teresa	28-30
DC Circuits	T&M 25	Teresa	31-32
Magnetic Fields and Induction	T&M 26-28	Teresa	33-37
<b>Exam 3 Wednesday, April 18</b>			
Light	HRW 34-37	Teresa	38-40
Cosmology	T&L 14 (web)	Teresa	41-44

# Website of the course:

[http://www.icecube.wisc.edu/~shiu/PHY248\\_S07/  
Physics248.html](http://www.icecube.wisc.edu/~shiu/PHY248_S07/Physics248.html)

# Mastering Physics

- Online homework system
- Free (for this semester)!
- Access code (Teresa's email)
- To get yourself familiar: HW0



Homework: due Friday 11:59pm

10% of your grade

# Discussion Sessions

- First 25 minutes: questions, homework, other work examples, etc.
- Second 25 minutes: work 1 problem together in groups of 3-4, turn in your individual solutions to Jim at the end of class.
- Jim will grade your solutions.

Also 10% of your grade

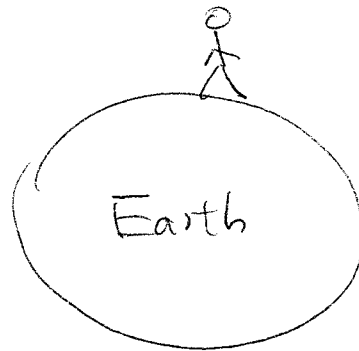


# Ch 11: Gravity

- Newton's law of gravitation.
- Test of inverse square law (and extra dimensions).
- Equivalence principle.
- Kepler's law.
- Gravitational potential.
- Escape velocity.
- Gravitational field.

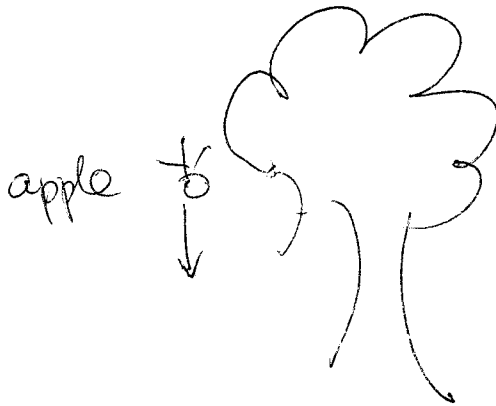
Gravity is the weakest force in nature,  
yet we notice it in everyday life.

Why? The masses involved are very large

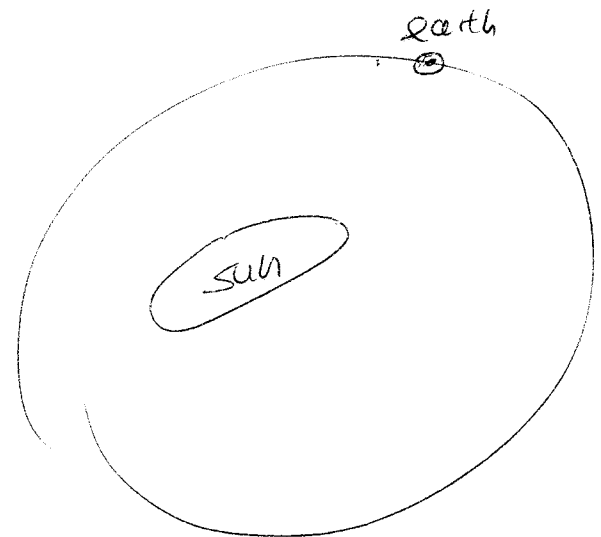


$M_E$  is large

Newton's discovery:



terrestrial



celestial

same equation !

# Newton's law of gravity (postulate)

↳ experimental science!

$$F = G \frac{m_1 m_2}{r_{12}^2} \quad \text{attractive}$$

explain observed phenomena

More precisely,

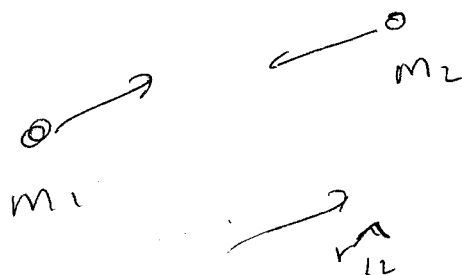
$$\vec{F}_{1,2} = - G \frac{m_1 m_2}{r_{12}^2} \hat{r}_{12}$$

force exerted  
by particle 1  
on particle 2

$\vec{r}_{12}$  = vector  
pointing  
from 1  
to 2

$$\hat{r}_{12} = \frac{\vec{r}_{12}}{r_{12}}$$

= unit  
vector

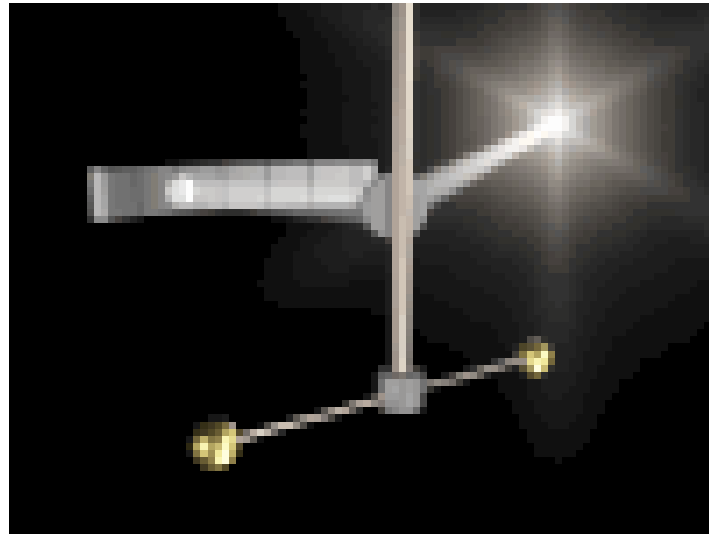


Indeed -ve  
sign is needed  
to give attractive  
force

$$G = 6.67 \times 10^{-11} \text{ N m}^2 / \text{kg}^2$$

Newton published his theory of gravitation 1686  
but it was only a century later that  
 $G$  is experimentally determined by Cavendish  
[Newton estimated  $M_E$  to get an estimate of  $G$ ]

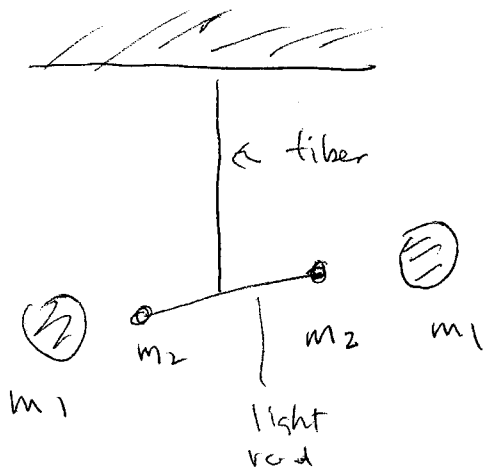
# Test of Newton's law



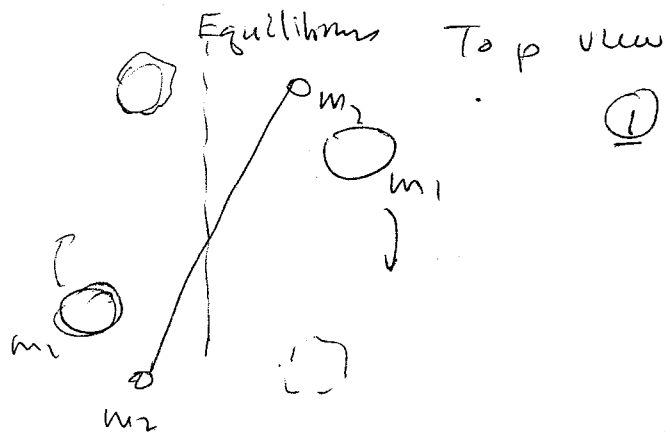
# An extremely difficult task to measure $G$ !

because gravity is so weak, almost any other source of force will overdominate gravity.

Cavendish's idea



careful measurements  
determine the torque  
required to turn the  
fiber through an angle



① because of gravitational  
torque, a torque  
which turn the  
fiber thru a  
small angle  $\theta$

② More the larger  
spheres to the  
other side,  
will turn  $2\theta$   
in response to  
the reversal of  
torque

③ Torque constants known

$$\rightarrow \frac{G m_1 m_2}{r_{12}^2}$$

$\rightarrow$  determine  $G$