

# Introduction To Quantum Physics

## PHY256

- Lecturer: Pierre Savard
  - email: [savard@physics.utoronto.ca](mailto:savard@physics.utoronto.ca)
    - please put "PHY256" in email title
  - Office: 803 in Burton Tower
    - office hours: Friday 3-5 (or by appointment)

# Introduction To Quantum Physics

## PHY256

- Your TAs:
  - Rob Adamson (office: 056)
  - Peter Sloan (office: 045)
- Schedule:
  - Lectures:
    - Monday, Wed., Friday 11:00-12:00 MP 103
  - Tutorials:
    - Wednesday (3-4) SS2111
    - Friday (1-2) MP134

# Introduction To Quantum Physics

## PHY256

- **Course website:**

[www.physics.utoronto.ca/undergraduate/PHY\\_256F/phy256-frontpage.htm](http://www.physics.utoronto.ca/undergraduate/PHY_256F/phy256-frontpage.htm) (should be back up within a day)

- **Course textbook:**

- **Quantum Mechanics** 2nd edition by Bransden & Joachain

- **other textbooks:**

- Shankar's **Principles of Quantum Mechanics**
- French and Taylor's **An Introduction to Quantum Physics.**
- Feynman's **Lectures on Physics** vol. III

# Introduction To Quantum Physics

## PHY256

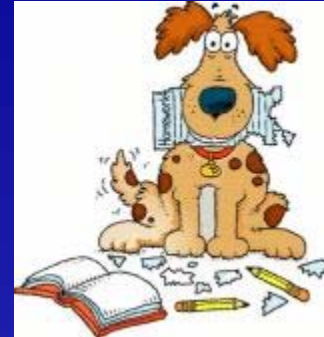
- Evaluation:

Fraction of Grade

- |                |                      |
|----------------|----------------------|
| - Problem Sets | 25%                  |
| - Mid Term     | 25% (Oct. 25th, TBC) |
| - Final Exam   | 50%                  |

# Introduction To Quantum Physics

- Comments on Problem Sets:

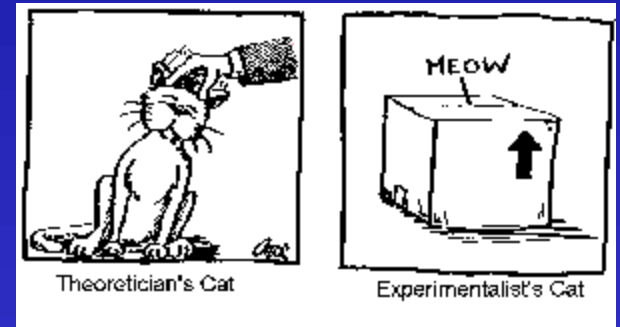


- Your dog can eat your homework only once. One late assignment over the course of the semester will be accepted without penalty. Prior to posting of solutions, late work will be accepted, but with a 20% penalty.
- 5 problem sets during semester. Do them by yourself!
- In general, the problem sets will be due about a 1.5 weeks after they are assigned
- Must be handed in before the start of lecture. Solutions will be posted on web about 1 week after due date and no late work will be accepted beyond that point

# Introduction To Quantum Physics

## PHY256

- Course will cover (roughly follows textbook):
  - Origins of Quantum Theory
  - Wave Function and the Uncertainty Principle
  - Schrodinger's Equation (and his cat)
  - One-Dimensional Problems
  - Operator Methods and Matrix Rep.
  - Angular Momentum
  - If we have time: Intro to the Hydrogen Atom
- Will add some supplements e.g. EPR Paradox, Aspect's experiments, interpretations of QM



# Introduction To Quantum Physics

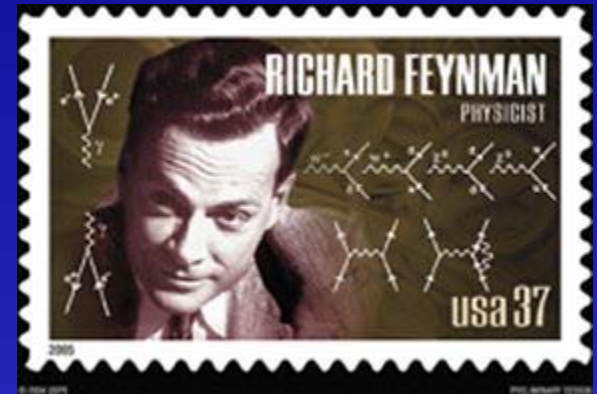
## PHY256

Today, I'll give an a short overview

Note: next week, tutorials will cover math background necessary for upcoming lectures

# A Quote from R. Feynman:

- “I think it is safe to say that nobody understands quantum mechanics”
- Yet, using his theory of quantum electrodynamics, one can verify its accuracy to within one part in a trillion (anomalous magnetic moment of the electron)
- So, it works... but we do not really understand why or how it works





- **Not an intuitive subject...**

- Not related to everyday reality
- Many physicists (like Einstein) have struggled with its interpretation
- A lesson on how rich physical reality is and the importance of experiments

- **Another quote from RP:**

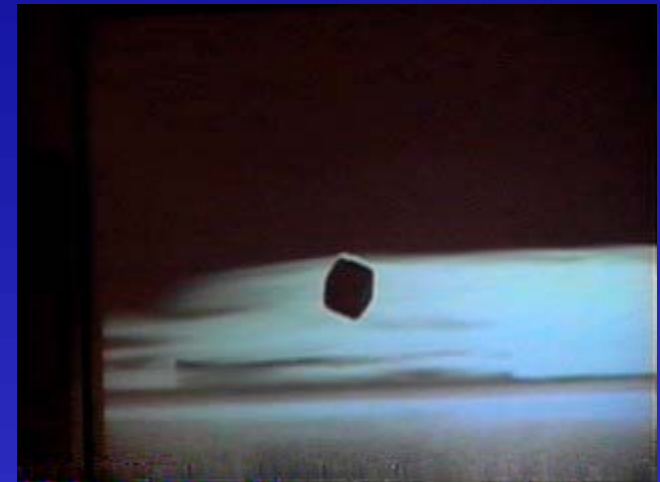
- "Our imagination is stretched to the utmost, not, as in fiction, to imagine things which are not really there, but just to comprehend those things which 'are' there."

# Why Study Classical Mechanics?



# Why Study Quantum Mechanics?

- Describes Microscopic world, led to a technological revolution:
  - microchips, computers
  - lasers
  - understand chemical bonds
  - superconductivity
  - nanotechnology
- Necessary to describe universe at very large scales
- To solve the biggest problem in physics...
- A scientific revolution - a cultural imperative



# Why Study Quantum Mechanics?

Now part of pop culture.  
In the animated movie "The Incredibles", the villain "Syndrome" uses "zero-point energy" as his source of power



# What is the meaning of "Quantum"???

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Temp-to-Hire in Office  
Support Environments

ENTER 



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# What is Quantum Physics ?

- Quantum, Quanta
  - a quantity... of what?
    - $E = h\nu$  (thanks to Planck and Einstein)
    - Planck's constant:  $h = 6.6 \times 10^{-34}$  joule-sec
    - $h$  sets the scale where quantum physics "kicks in"
  - waves  $\rightarrow$  particles,
    - De Broglie: particles  $\rightarrow$  waves
  - Heisenberg Uncertainty Relations
    - $\Delta x \Delta p, \Delta E \Delta t \gtrsim h$

# Some Advice:

- Attend Class
  - My notes will be available on the web but you will miss important information if you miss class
- Attend the tutorials
  - Early tutorials will be important to make sure you have the math background
- Consult your prof and your TAs
- Brush up on the required math. We will help you find resources you need to improve your skills
- This course is not easy! you'll need to take it seriously if you want to do well
- Do the problem sets and do them by yourself
- Please, please, follow my advice (I really want you to succeed)