PHYS 1901 – Physics 1A (Advanced)
Mechanics module

Prof Stephen Bartlett
School of Physics

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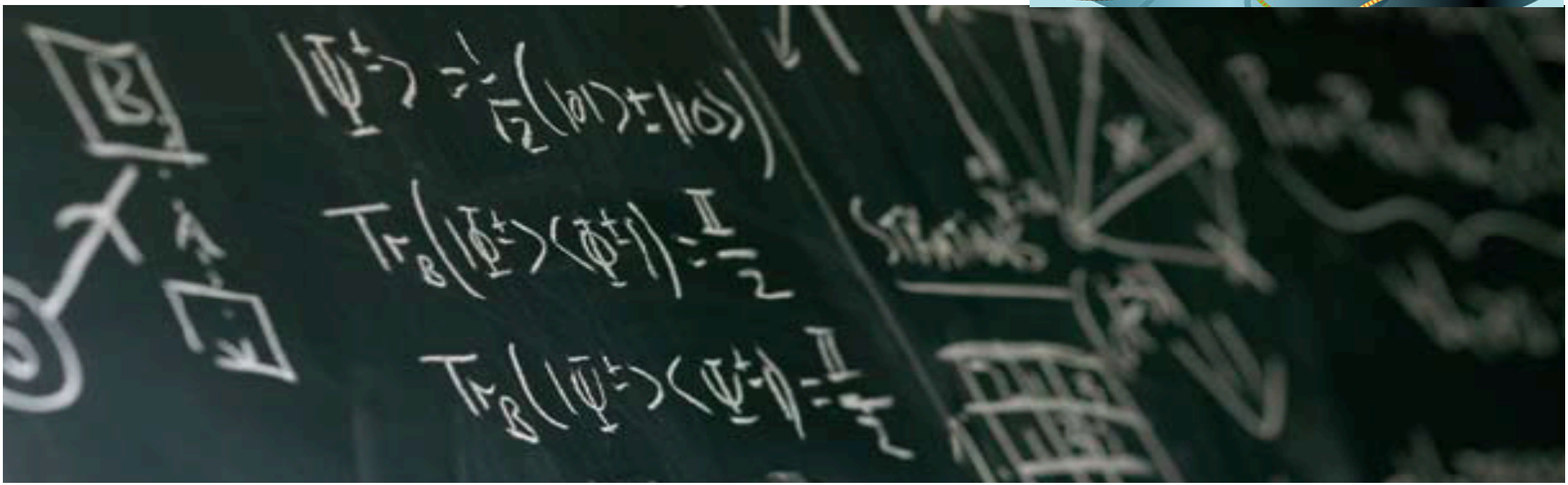
World renowned research

- –Optics & Photonics
- –Quantum Science
- –Astronomy, Astrophysics and Space Physics
- –Brain & Medical Physics
- –Particle Physics
- –*and much more…*

Take advantage of this expertise & think about research projects (TSP, Special Projects and Honours).

Quantum Information Theory

- What are the possibilities and limitations that physical laws place on information processing?
- What new systems and materials can we engineer to process information at the quantum level?



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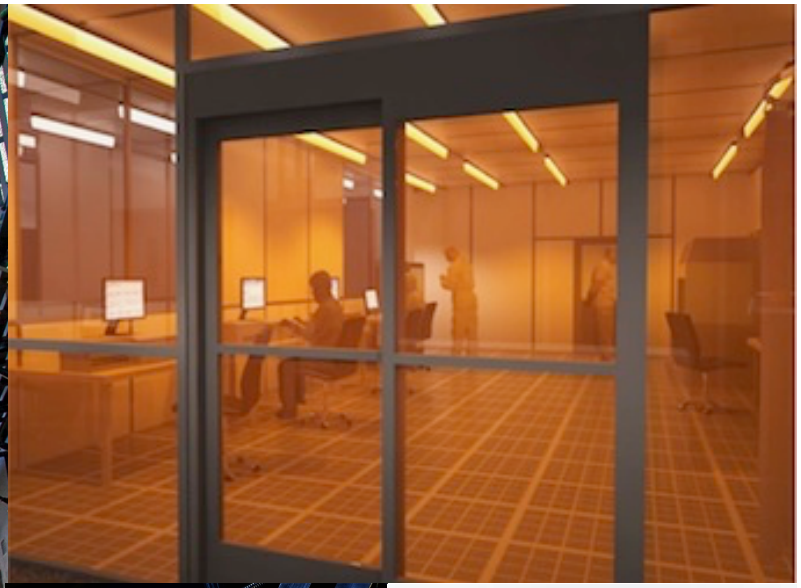
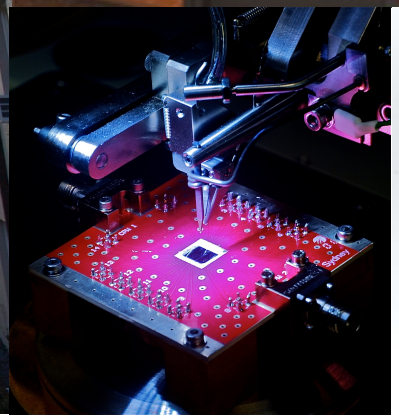
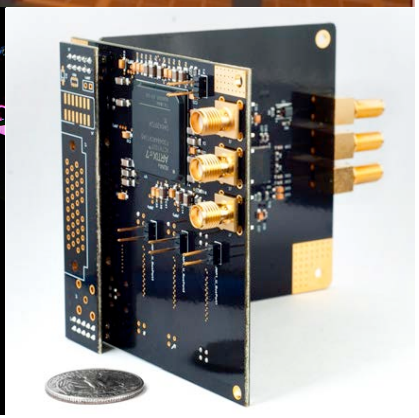
The Sydney Nanoscience Hub (SNH)







PHYS1901 – Physics 1A (Advanced)

Three module course consisting of

- Mechanics (15 lectures)
- Thermal Physics (10 lectures)
- Waves & Chaos (13 lectures)

In the Advanced stream, it is assumed you have prior physics knowledge.

Stream changes made by the census date.

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Mechanics Module

15 one-hour lectures – follow the text closely

Lecturer: Prof Stephen Bartlett

Chapters 1,2,3: Review

Chapter 4: Newton's Laws of Motion

Chapter 5: Applying Newton's Laws

Chapter 6: Work and Kinetic Energy

Chapter 7: Potential Energy and Energy Conservation

Chapter 8: Momentum, Impulse and Collisions

Chapter 9: Rotation of Rigid Bodies

Chapter 10: Dynamics of Rotational Motion

Chapter 13: Gravitation

Learning

What you learn depends on the effort you put in

- The lectures are a **guide** to the course material
- Textbook: *University Physics* by Young & Freedman (14th edition)
- Webpages: eLearning & Junior Physics
  elearning.sydney.edu.au (Blackboard)
- 6 hrs/week independent study

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Workshop Tutorials

- Interactive Workshop Tutorials
  - Work in small groups (4 students)
  - Worksheets & hands-on demonstrations
  - A chance to talk and clarify ideas

- Participation is recorded & counts towards final grade
- Starts Week 2 in SHN tutorial room 4001

Duty tutoring

- Staff member available for help
  - Monday, Tuesday, Wednesday 1:00 to 2:00 pm
- Great opportunity to sort out questions

- Starts Week 3 in SNH 4001

Laboratory sessions

- Lab sessions are 3 hours, work in groups of 3
- Online pre-work (before start of lab session)
- Read lab manual notes in advance
  – you will learn more & do experiments well
- Lab manuals available on eLearning

- Starts Week 2, Level 4 Carslaw building

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Assignments

- Done in *Mastering Physics* – access via Blackboard
- Register with SID and email address
- Each assignment comprises eight questions
- Interactive method, hints & help supplied
- Individual submissions only

Assessment – Standards based

Assignments	Required*
Workshop tutorials	Required*
Laboratory work	Required*
Mid-semester test	20%
End of semester exam	80%

**Non-completion will result in a reduced grade. See Unit of Study outline for more details*

If you need help?

- Consult the web resources on eLearning
- Physics Student Services (Room 210)
- Talk to me or a Duty Tutor

- Lectures are recorded onto eLearning website
- Serious personal problems or illness: submit a *Special Consideration Form* ASAP

Chapter

1-3

Kinematics (review)

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Kinematics (review, chapters 1-3)

Kinematics is the *description* of motion

(Dynamics deals with the *causes* of motion… that's next.)

Let's start with motion in one dimension

x_o is the initial position of an object

v_o is the initial velocity of an object

a is the (constant) acceleration of an object

What are its properties after a time *t* ?

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Velocity and acceleration

Velocity is the change of distance over time

$$v = \frac{dx}{dt}$$

Acceleration is the change of velocity over time

$$a = \frac{dv}{dt} = \frac{d^2x}{dt^2}$$

(Differential equations!)

Kinematic equations

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

You do not need to **memorize** such equations as they will be given in an exam. You should be able to derive them from the definitions of velocity and acceleration!

Problem: falling boulder

You see a boulder fall from a high cliff.

It takes 1.30s to fall the final 1/3 of the way to the ground.

Ignore air resistance. What is the height of the cliff?

0 $\quad t=0 \quad x_0=0 \quad v_0=0 \quad a=g$

$\frac{2}{3}d$ $\quad x_{2/3}=\frac{2}{3}d \qquad v_{2/3}^2 = v_0^2 + 2a(x_{2/3}-x_0) = 2g(\frac{2}{3}d)$

($v_0^2 \to 0$, $a \to g$, $x_{2/3} \to \frac{2}{3}d$)

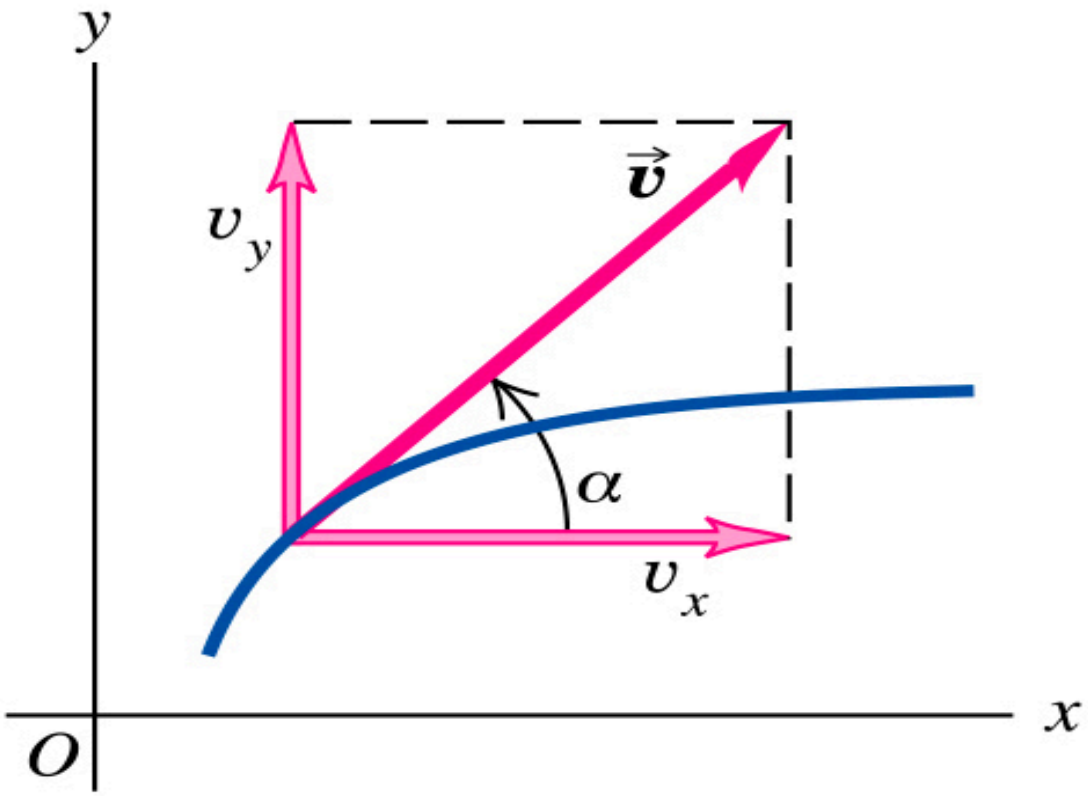
d $\quad x_d = d = x_{2/3} + v_{2/3}t_{1/3} + \frac{1}{2}at_{1/3}^2$

$$d = \frac{2}{3}d + \sqrt{\frac{4gd}{3}}\,t_{1/3} + \frac{1}{2}gt_{1/3}^2 \Rightarrow \text{solve of } d$$

More than one dimension: vectors

The kinematic equations can be applied in each direction separately.

You decide the coordinate system



Vectors have a length & direction. To use them we need to decompose the vector into its components.

$$v_x = |v| cos\ \alpha$$

$$v_y = |v| sin\ \alpha$$

(this is important!)

Monkey and Hunter