# PH1530: Quantum Mechanics

## *Learning Outcomes:*

After this course you are expected to:

- Know what a wave-function is.
- Be able to normalize a wave-function and understand why this is necessary.
- Use the wave-function to calculate the probability of finding an object at a given point.
- Know the assumptions used in the Bohr model of the hydrogen atom and be able to calculate from first principles the radii, velocity and energy of electrons in allowed orbits.
- Know what is meant by the term reduced mass.
- Know what is meant by the term principal quantum number.
- Know the position-momentum and energy-time Heisenberg Uncertainty principles and be able to apply them.
- Know the 1-d time-independent Schrödinger equation and what each of the terms mean classically.
- Know what is meant by the term boundary condition and how they are applied.
- Be able to solve the 1-d TISE for: A free particle; a particle in an infinite square well; a step potential.
- Be able to write down the general solution to the TISE for: A finite well; a potential step; an arbitrary combination of the above potentials.
- Be able to show that a wave-function is a solution to the TISE.
- Know what is meant by the term tunnelling.
- Know what is meant by the term collapse of the wave-function.
- Define the 5 quantum numbers which define the solutions to the Schrödinger equation for hydrogen and how to determine their allowed values for a given state.
- Know about the concept of spin.
- Know the Pauli exclusion principle and how it is used to determine the structure of an atom.

## *Reading:*

References to latest (11th edition) of Young & Freedman, *University Physics* (2004)

- Sections 38.5, 38.9
- Sections 39.2, 39.3, 39.5
- Sections 40.1, 40.2, 40.3
- Sections 41.1, 41.3, 41.4.

Previous edition of Young & Freedman, *University Physics with Modern Physics.*

- Section 40-6
- Chapter 41 except section 41-5
- Chapter 42 except sections 42-6 and 42-7
- Sections 43-2, 43-4, 43-5.