**U3a Physics: Atomic and Nuclear Physics**

**Session 1**

**Overview: What we hope to cover in the following 10 sessions**

**Structure of the atom**

* Particles: proton, neutron, electron.... other particles, quarks etc ... The Standard Model
* The nucleus, alpha particle scattering (Rutherford scattering)
* Simple model of the atom
* Atomic number, mass number, the Periodic Table
* Isotopes

**Wave Theory**

* Definitions of wavelength, frequency etc, speed of a wave
* Waves as carriers of energy
* Graphical representation of waves
* Transverse (eg light) and Longitudinal (eg sound) waves
* Properties of waves eg reflection, refraction, diffraction...

**Theories about Light**

* Corpuscular theory, light as a wave, photons
* The Photoelectric Effect
* Energy levels for atomic electrons, spectra

**Wave-Particle Duality**

* Wave-Particle Duality, electron diffraction

**Nuclear Reactions**

* Fission, power generation
* Fusion, possible future power generation
* Radioactivity: alpha, beta, gamma emissions, a random process
* One element decays to form a different element
* Half Life

**Quantum Mechanics**

* An introduction

**Plum Pudding model of the atom**

The idea that matter is made of very small particles called atoms was first suggested by the Greeks about 2000 years ago.

It wasn’t until the middle of the 19th century that any ideas about the structure of the atom were proposed. An English scientist, J J Thompson, suggested the idea that the atom is a neutral particle made of a positive charge, containing “lumps” of negative charge.

In 1897 Thompson was investigating the particles in *cathode rays* (produced when an electrically charged plate is heated). It was apparent that a new, very small, negatively charged particle had been discovered. He called it a *corpuscle*, but it was later given the name *electron*.

Since atoms are neutral and a negatively charged part of the atom had been discovered, it followed that there must be both positive and negative charges in the atom.

This led to the idea of the Plum Pudding model of the atom in which the atom resembles a plum pudding, with the atom consisting of positive 'dough' with negative electrons stuck in it.

By the early 20th century many physicists were investigating the newly discovered phenomenon of *radioactivity* and found emissions which they called *alpha particles* (known to be smaller than the atom). Alpha particles are now known to be positively charged. These particles would be used in 1905 by Ernest Rutherford to test the plum pudding model