

## **Episode 537: Preparation for the deep scattering and quarks topics**

Episodes 538 and 539 of this topic give clear evidence for the size of the nucleus, and for the fact that nucleons are not fundamental particles but contain different parts. This leads onto Gell-Mann & Zweig's quark model.

**Episode 538: Electron scattering**

**Episode 539: Deep inelastic scattering**

**Episode 540: Quarks and the standard model**

### **Main aims**

Students will:

1. Know that Rutherford's experiment, using alpha particles, cannot probe the nucleus because the alpha particles will interact with the nucleus by the strong nuclear force.
2. Know that electrons, being leptons, do not 'feel' the strong nuclear force, and so can probe the nucleus.
3. Use electron wavelength and scattering data to calculate the size of the nucleus.
4. Understand that the complex scattering from a nucleus reveals that nucleons are not simple points, but are themselves composed of smaller particles.
5. Describe how hadrons are made from two or three quarks.
6. Deduce the properties of a hadron from the properties of its constituent quarks.
7. Draw Feynman diagrams involving quarks and gluons.

### **Prior knowledge**

Rutherford's experiment, diffraction, and the quantum nature of electrons ('wave-particle duality').

If you have not covered diffraction already, you will have to modify the suggested approach to take account of this.