

Problem Sheet 8 – Physik V – WS05/06

due December 14-15, 2006

Problem 8.1 Kinematics in elastic scattering (50p)

Consider an electron of energy E_e which scatters elastically off a particle A with the mass M . This particle is at rest in the laboratory system.

a) Calculate the energy of the electron when scattered by an angle θ in the laboratory. Assume that the energies of the incoming and scattered electron are high enough such that the electron mass can be neglected.

b) An electron with energy 800 MeV scatters elastically off a ^{40}Ca nucleus. What maximum fraction of its energy can be taken by the nucleus as recoil energy?

c) An electron with energy 800 MeV scatters elastically off a proton. What maximum fraction of its energy can be taken by the proton as recoil energy?

Problem 8.2 Form factors (50p)

Demonstrate that the form factor of a spherical nucleus with an homogeneous charge distribution is $F(q^2) = 3\alpha^{-3}(\sin \alpha - \alpha \cos \alpha)$ with $\alpha = qR$.

If the Mott cross-section is known, predict the experimental angular cross-section for an electron-proton elastic scattering assuming the proton at rest. Is the proton at rest assumption justified?