Compton scattering from the proton at NLO in the chiral expansion

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We present calculations of differential cross sections for Compton scattering from the proton, using amplitudes calculated to fourth order in heavy baryon chiral perturbation theory. At this order, the experimental spin-independent polarisabilities α and β are not predicted but the spin-dependent polarisabilities γ_i are. We compare the predictions of the theory with available data up to 200 MeV [1]. We find that convergence is good, in that the third and fourth order predictions are quite similar; in general the fourth-order is an improvement. (Third order predictions were given by Babusci *et al.* in ref. [2].) The agreement for angles up to 90° is very good over the whole energy range, but at more backward angles the agreement decreases above about 100 MeV, and fails completely above the photoproduction threshold. Although in the absence of an explicit Δ agreement must break down at some point, it is not obvious why that point should be so much lower for backward angles. We explore the sensitivity to the input parameters, and find that it is impossible to reproduce the steep rise above 150 MeV, and even at lower energies agreement at backward angles requires $\alpha = 8$ and $\beta = 6 \times 10^{-4}$ fm^3 (to be compared with the PDG value of 12.1 and 2.1 respectively). The results are fairly insensitive to the values of the spin polarisabilities, and to the second order LECs c_i (taken from fits to pion-scattering data [3]).

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[3] N. Fettes and U.-G. Meißner, Nucl. Phys. **A 676** 311 (2000).