Progress in Higher Order Delbrück Scattering Calculations

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Delbrück Scattering, the scattering of gamma rays by virtual electron-positron pairs in the vacuum, has been studied from the early 20th century to investigate nonlinear effects in quantum electrodynamics (QED). We have shown that precise nearly isolated measurement of Delbrück scattering using high flux linearly polarized gamma ray sources is possible [1]. Since the scattering amplitude increases rapidly as Z^4 where Z is the atomic charge [2], high Z materials such as lead, and uranium are advantageous. However, higher order corrections to the scattering amplitude at high Z also become large. We will report on progress in calculating them using automatic software developed by the high energy physics community to compute integrals from the Feynman diagrams [3,4] and determine the precision to which the Delbrück scattering amplitude can be measured using high flux high linearly polarized gamma-ray sources such as from ultrahigh intensity laser interactions [5] or the Gamma factory [6–8].

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