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Advanced topics in the physics of Compton back-scattering

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Compton back-scattering has been demonstrated to provide compact, highly tunable, versatile and not expensive sources of X-gamma rays. New possibilities of improving the performances of the Compton sources are discussed. One of the methods for increasing the spectral density is based on the chirp of the laser. In this way, the oscillations and the broadening of the spectrum occurring in non linear regime can be eliminated, obtaining highly monochromatic signals. The occurrence of collective effects, taking place when the laser has high energy and long pulses permits to increase both the spectral density and the total number of photons. The control of polarization, the encoding of orbital momentum on the radiation and the possibility of producing two color radiation are also presented. Furthermore, the collisions between the gamma photons produced by two Compton scatterings provide an efficient way to test the QED photon-photon physics.

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