Photon angular distributions in laser modified bremsstrahlung

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We extend our previous study of electron Coulomb bremsstrahlung in the presence of a laser field [1] from the case of the spectrum $d\sigma/d\omega_X$ to the case of the photon angular distribution $d^2\sigma/d\omega_X\, d\Omega_X$.

Going to electron energies up to 50 keV, much higher than in the previous calculation, we include **retardation** in the description of the spontaneously emitted photon.

In our semiperturbative approach [1], the presence of the laser field modifies the shape function of the spontaneous emission of a single photon of frequency ω_X, defined as [2] the ratio $S = (d^2\sigma/d\omega_X d\Omega_X)/(d\sigma/d\omega_X)$, and leads to processes in which laser photons are emitted and absorbed simultaneously with the X photon emission.

Simple analytic results for the transitions in which the spontaneous emission is accompanied by the absorption or emission of a fixed number of laser photons are established in first-order Born approximation; they reduce to Karapetyan and Fedorov result [3] in the dipole approximation limit. Results beyond Born-approximation are obtained using the δ-approximation introduced by Korol [4], which exploits the behaviour of the matrix element of the momentum operator between two-continuum states of the same type ("in" or "out").

Numerical results will be presented for the frequency of the CO_2 laser field ($\omega_L = 0.117\ eV$) and intensities up to $10^{-6}\, a.u.$

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