Complete description of polarization effects in the nonlinear Compton scattering

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The emission of a photon by an electron in the field of **a strong laser wave** is studied.

Polarization effects in this process are important for a number of physical problems.

We discuss a probability of this process for circularly or linearly polarized laser photons and for **arbitrary polarization of all other particles**.

The **effective** differential cross section for the nonlinear Compton scattering can be presented in the following form

$$\frac{d\sigma(\zeta_i, \xi'_i, \zeta'_j)}{dy d\varphi} =$$

$$= \frac{r_e^2}{4x}\left[F_0 + \sum_{j=1}^{3}\left(F_j \xi'_j + G_j \zeta'_j\right) + \sum_{i,j=1}^{3} H_{ij}\,\zeta'_i\,\xi'_j\right],$$

$$y = \frac{\omega'}{E}, \quad x = \frac{4E\omega}{m^2}.$$

Here function F_0 describes **the total cross section**, summed over spin states of the final particles.

Items $F_j\,\xi'_j$ and $G_j\,\zeta'_j$ describe the **polarization of the final photons and the final electrons**, respectively.

The last items $H_{ij}\,\zeta'_i\,\xi'_j$ stand for **the correlations** of the final particles' polarizations.

All these functions depend on the initial electron polarization ζ_i and the intensity of the laser field.

For the circularly (linearly) polarized laser photons **we found all 16 functions** and compared them with the 5 (4) functions known in the literature.

Besides, we discuss an application of the obtained formulas to the problem of $e \to \gamma$ conversion at $\gamma\gamma$ and γe colliders.