Laser generated X and gamma ray sources and thier scalings

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Interaction of a relativistically intense powerfull laser pulses with long-scale plasmas can give rise to effective acceleration of background electrons. In laser wakefield acceleration regime in rarefied plasmas (with electrons concentration much less than critical one) electron bunches with charges from tens to hundreds pC (depending on the nonlinearity of interaction) can be accelerated to GeV or multi-GeV energies. In more dense near critical density plasmas direct laser acceleration regime is possible, with generation of high current (charges from tens nC to several mkC), high energy (from several MeV to several hundreds of MeV) electron bunches. Betatron radiation of these electrons can serve as an important tool both for practical applications and also for diagnostic of the process in laser plasma. And if these electrons impinge on a metalic foil converter, powerful sources of bremsstrahlung gamma photons are generated. In order to preliminary (before the loanch of respective simulations) estimate parameters of these laser generated sources of X and γ– ray photons, we elleborate theoretical models, which helps one to obtaine scalings of energetic , spacial-angular and spectral characteristics of electrons [1, 2] and thier betatron [3] and bremsstrahlung [4] radiation . These models can be helpfull for optimisation of the parameters of laser-generated accelerated electron bunches and sources of short-wavelength radiation.

[1] Veysman M, Popov V, Umarov I and Andreev N 2025 *Bulletin of the Lebedev Physics Institute* in press

[2] Veysman M, Popov V, Umarov I and Andreev N 2026 *Matter and radiation at extrems* to be submitted

[3] Veysman M E 2024 *Physics of Plasmas* **31** 103112

[4] Veysman M, Umarov I and Andreev N 2026 *Plasma Physics and Controlled Fusion* submitted