ON THE ROLE OF NONLINEARITY IN COMPTON EFFECT IN NARROWBAND GAMMA-RAY SOURCES

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This paper considers the nonlinear aspects of the Compton effect in the development of narrowband gamma radiation sources based on the interaction of electron beams with laser pulses. The study focuses on parameters relevant to a project being implemented at the National Center for Physics and Mathematics (NCPM) [1]. Estimates of photon yield and relative spectral width are presented, along with the influence of laser and electron beam parameters on these characteristics. Particular attention is paid to the weakly nonlinear regime of the Compton effect, where radiation pressure on electrons is significant but not dominant, and quantum effects are negligible. Both analytical calculations and numerical simulations are used to describe the gamma radiation generation processes and optimize system parameters. Methods for significantly increasing photon yield due to interaction nonlinearity are proposed [2], and their experimental feasibility within the project framework is discussed. The possibility of studying the strongly nonlinear regime within this project is also considered. The obtained results will be applied to the development of highly efficient narrowband gamma sources.

References

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