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Coherent radiation of photons by particle wave packets

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The radiation of photons by electrons is investigated in the framework of quantum electrodynamics up to the second order in the coupling constant e. The N-particle, coherent, and thermal initial states are considered and the forms of the electron wave packets are taken into account. The explicit expressions for the intensity of radiation and the inclusive probability to record a photon are obtained. It is found that there are three processes in this order of perturbation theory where the electron wave packet radiates coherently and can be regarded as a charged fluid [1,2,3] even on integrating over the final states of the electron, i.e., in considering the inclusive probabilities and intensity of radiation. These processes are stimulated radiation by an electron, coherent radiation from a beam of particles, and reradiation of a photon in the Compton process [4]. We obtain the explicit expressions for the intensity of radiation and the inclusive probability to record a photon for these processes. As particular cases, we consider: stimulated transition radiation produced by an electron wave packet traversing a mirror [3] and backlighted by a laser wave, reradiation of photons in a coherent state by an electron wave packet. In the latter case, we deduce that the wave packet of a single electron can be endowed with the susceptibility tensor and this tensor has the same form as for an electron plasma in the small recoil limit.

References

1. I.P. Ivanov, D.V. Karlovets, Detecting transition radiation from a magnetic moment. Phys. Rev. Lett. 110, 264801 (2013)
2. I.P. Ivanov, D.V. Karlovets, Polarization radiation of vortex electrons with large orbital angular momentum. Phys. Rev. A 88, 043840 (2013)
3. Y. Pan, A. Gover, Spontaneous and stimulated emissions of a preformed quantum free-electron wave function. Phys. Rev. A 99, 052107 (2019)
4. P.O. Kazinski, G.Yu. Lazarenko, Transition radiation from a Dirac-particle wave packet traversing a mirror. Phys. Rev. A 103, 012216 (2021)
5. Y. Pan, A. Gover, Beyond Fermi's golden rule in free-electron quantum electrodynamics: acceleration/radiation correspondence. New J. Phys. 23, 063070 (2021)

Primary author(s) : Mr. SOLOVYEV, Timofey (National Research Tomsk State University)

Co-author(s) : Prof. KAZINSKI, Peter (National Research Tomsk State University)

Presenter(s) : Mr. SOLOVYEV, Timofey (National Research Tomsk State University)

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