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Kinetics of relativistic electrons passing through quasi-periodic fields

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We report a novel method for evaluating the energy spectrum of electrons emitting hard x-rays and gamma-rays in undulators and Compton sources. The method takes into account the quantum nature of recoils undergone by the electrons emitting high energy photons. The method is susceptible to evaluate a spectrum of electrons for the whole range of the emission rates per electron-pass through the driving force, from much less than one emitted photon in average (Compton sources and short undulators) to many photons emitted (long undulators, relatively low-energy electrons). As is shown, in the former limiting case the spectrum of electrons reflects the spectrum of emitted radiation whereas it is close to the Gaussian shape in the latter case. Limitation of coherency for the sources of high-energy electromagnetic radiation caused by recoils from emitted photons is discussed.

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