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PS1-01: Cooperative Parametric (Quasi-Cherenkov) Radiation Produced by Electron Bunches in Natural or Photonic Crystals

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We study the features of cooperative parametric (quasi-Cherenkov) radiation arising when an electron bunch passes through a crystal (natural or artificial) under the conditions of dynamical diffraction of electromagnetic waves in the presence of shot noise.

It is shown that the intensity of cooperative quasi-Cherenkov radiation emitted at small angles to the particle velocity direction reaches saturation at a sufficiently smaller number of particles than that emitted at large angles (in two- and three-wave diffraction cases, parametric radiation consists of two and three strong pulses, respectively). The presence of shot noise causes strong fluctuations in the intensity of cooperative parametric radiation at saturation.

A detailed analysis is given for cooperative parametric X-ray radiation in LiH crystals and quasi-Cherenkov THz radiation in photonic crystals.

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