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Investigation of super-radiant Smith-Purcell radiation from double grating and DC beam

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Generation of intense THz radiation beams is important for a growing demand in research based on THz spectroscopy and imaging. Physical processes associated with the beam propagation near a grating or a system of gratings give rise to beam energy modulation as well as radiation emission based on the mechanism of Smith-Purcell radiation, with the capability to tune both processes. Devices that contain compact, periodic structure, operate in a continuous wave mode and allow to produce moderate levels of average output power have been the subjects of extensive research from the perspectives of analytical studies, electromagnetic simulations, and experiments. The purpose of this report is to investigate both of these processes using Particle In Cell simulations. We discuss characteristics of the SPR emitted from such double grating system, including spectral response and dependence of the radiation power on the beam current. We also investigate conditions that have to be fulfilled for beam modulation and efficient radiation emission to occur.

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