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Smith-Purcell radiation from a cylindrical grating

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We investigate the radiation from a charged particle rotating around a diffraction grating on a cylindrical surface. The grating consists metallic strips parallel to the cylinder axis. The expressions are derived for the electric and magnetic fields and for the angular density of the spectral-angular distribution of the radiation intensity. The angular density of the radiation intensity is decomposed into the pure synchrotron, Smith-Purcell and interference contributions. Depending on the parameters of the diffraction grating, the interference can enhance or suppress the radiation on a given harmonic. The behavior of the radiation intensity on large harmonics can be essentially different from that for a charge rotating in the vacuum or around a solid cylinder. Unlike to these limiting cases, for the geometry of diffraction grating the radiation intensity on higher harmonics does not vanish for small angles with respect to the cylinder axis. For given characteristics of the charge, by the choice of the parameters of the grating, one can have highly directional radiation directed near the normal to the plane of the charge rotation. With decreasing energy, the relative contribution of the synchrotron radiation decreases and the Smith-Purcell part is dominant.

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