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Smith-Purcell Radiation from Active Gratings

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We propose the idea to drive Smith-Purcell effect by changing properties of the elements a diffraction grating consists of. The control of elements composing a diffraction grating is the idea that has already been realised in the active phase gratings, which are, e.g., integral part of modern avionics. In terms of fundamental research such gratings today are very actively investigated in the physics of metamaterials, and particularly in metasurfaces, in which they provide the attractive opportunity to control the characteristics of refracted and reflected light.
In this report we show how to control the characteristics of Smith-Purcell radiation ruling by the properties of the grating's elements and show how it can be realised by the example of the 2D dotted grating consisting of arranged small subwavelength elements. The grating considered is a metasurface comprising dot-like particles each of which is a bunch (bush) of nanotubes, imbedded into a substrate. The operation is supposed to be executed by the external electric potential, which will allow changing the electron density at the ends of nanotubes. General properties of Smith-Purcell effect are calculated and discussed.

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