# Smith-Purcell radiation from drift electrons in graphene

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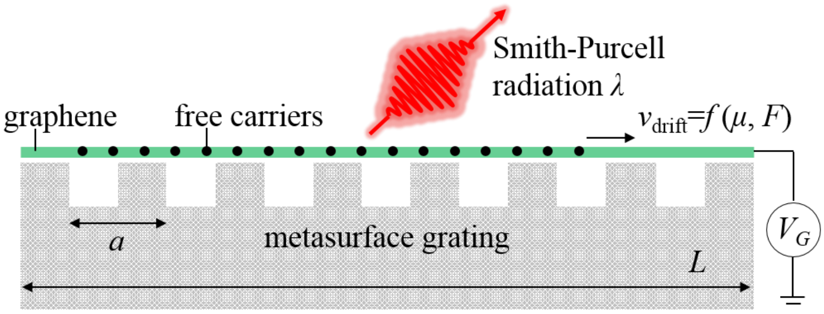
Cherenkov radiation is an electromagnetic radiation emitted when a charged particle (such as an electron) passes through a dielectric medium at a speed greater than the phase velocity of light in that medium [1]. As one of the forms of Cherenkov radiation, Smith-Purcell radiation is the electromagnetic radiation emitted when energetic electrons move closely parallel to a periodic grating, where the phase velocity of the light has been altered by the periodic grating [2]. Recently, both Cherenkov and Smith-Purcell radiations have been experimentally demonstrated using low-energy electrons of 0.25-1.4 keV [3] and 1.5-6 keV [4], respectively. This low speed of free electrons in space (0.01c) is almost reachable by the "quasi-free" highly mobile electrons in graphene [5].

In this work, we demonstrate the feasibility of Smith-Purcell radiation from highly mobile field-effect electrons in graphene. The effects of electron velocity and number of graphene layers are studied. It shows that the radiation frequency can be tuned by applying a voltage. Additionally, we also design the grating underneath, to further engineer the direction and profile of the radiated beam. This proposal opens up the field of constructing compact solid-state Smith-Purcell sources of light.

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