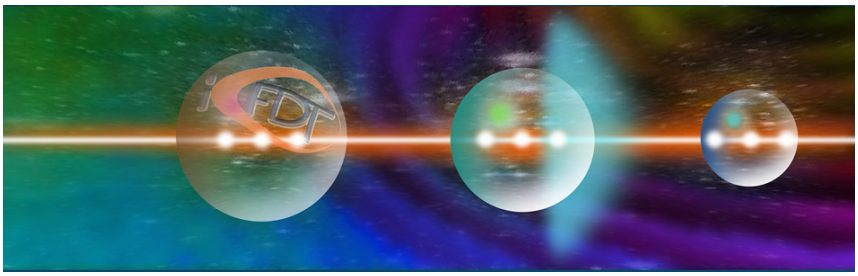

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THz driven surface plasmon undulator

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In a free-electron laser a beam of relativistic electrons is moving in vacuum trough a magnetic undulator producing electromagnetic radiation with high brightness and narrow bandwidth. In order to build a table-top source one has to reduce the undulator periodicity. One approach for realizing such mini-undulator is by laser micromachining permanent magnets or by electroplating a magnetic material onto silicon. Another approach is to use the periodic electromagnetic field of surface plasmon polaritons and our approach is derived from this proposal.
Here, we propose a THz driven undulator which is composed of two graphene coated dielectric gratings separated by a vacuum gap. The periodic plasmonic fields force the electron bunch on an oscillatory motion which in turn causes the bunch to radiate. First, we characterize the graphene plasmons excited by the incident THz pulse. The resulting electromagnetic field distribution is subsequently used to calculate the trajectory of a single electron or of a bunch of electrons. The trajectories are further used to calculate the radiation emitted by the electrons. The emitted radiation is analyzed for different accelerator and undulator parameters.

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