Plasmon - photon coupling in high electron mobility heterostructures at THz frequencies

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ABSTRACT

Terahertz (THz) radiation can be used to probe low-energy excitations in semiconductor structures and devices. In the present paper we will address a few phenomena related to THz excitation of a two-dimensional plasma in high-electron-mobility heterostructures. Starting in 1977 with the first demonstration of plasmons in a plasma situated at a Si/SiO_2 interface, the physics of two-dimensional plasmons has been still vividly developing. In spite of well - established dispersion relations of plasmons in gated and ungated structures, new experimental observations require still new theoretical concepts.

A crucial factor in analyzing plasmons' excitation spectra is a proper choice of plasmon's wavevector. We will show how the wavevectors are quantized in different systems and devices, and how the geometry and construction of a sample influences dispersion relations.

A number of plasmon - THz photon coupling mechanisms will be described and illustrated with appropriate experiments. These include plasma excitations in field-effect transistors, strong light-matter coupling in cavities and ratchet effect in noncentrosymmetric structures.