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Title

THz electrical instability of a hybrid system composed of quantum dot and quantum well with drifting electrons

Source

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Abstract

We studied the hybrid system composed of a polarizable nanoparticle and a quantum well. For coupled oscillations of dipole excitations of the nanoparticle and two-dimensional electron gas, we determined frequencies and damping of the Landau-type. We found that under the drift of two-dimensional electrons, electrostatic coupling between the nanoparticle and the quantum well gives rise to a novel type of electrical instability in the terahertz frequency range. Under this electrical instability, amplitudes of the dipole and plasma oscillations increase in time due to the energy transfer from the drifting electrons. The instability arises when the electron drift velocity exceeds a critical value. Long relaxation times of the dipole excitations of the nanoparticle are favorable for development of the instability. We presented estimates, which demonstrate that the instability can be realized in quantum dot-quantum well hybrid systems fabricated by contemporary semiconductor technologies. This instability can provide a new mechanism for generation of THz radiation. (27 References).