606. 标题: Plasmons in a free-standing nanorod with a two-dimensional parabolic quantum well caused by surface states

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摘要: The collective charge density excitations in a free-standing nanorod with a two-dimensional parabolic quantum well are investigated within the framework of Bohm-Pine's random-phase approximation in the two-subband model. The new simplified analytical expressions of the Coulomb interaction matrix elements and dielectric functions are derived and numerically discussed. In addition, the electron density and temperature dependences of dispersion features are also investigated. We find that in the two-dimensional parabolic quantum well, the intrasubband upper branch is coupled with the intersubband mode, which is quite different from other quasi-one-dimensional systems like a cylindrical quantum wire with an infinite rectangular potential. In addition, we also find that higher temperature results in the intersubband mode (with an energy of 12 meV (similar to 3 THz)) becoming totally damped, which agrees well with the experimental results of Raman scattering in the literature. These interesting properties may provide useful references to the design of free-standing nanorod based devices.

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