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Grating-Enhanced Response for current-driven coupled quantum wells[1] ANTONIOS BALASSIS, Fordham University, GODFREY GUMBS, Hunter College/CUNY — We have investigated the conditions necessary to achieve stronger plasmon instability leading to emission in the terahertz (THz) regime for semiconductor quantum wells (QWs). The surface response function is calculated for a bilayer two-dimensional electron gas (2DEG) system in the presence of a metal grating placed on the surface and which modulates the electron density. The 2DEG layers are coupled to surface plasmons arising from excitations of free carriers in the bulk region between the layers. A current is passed through one of the layers and is characterized by a drift velocity v_D. With the use of the surface response function, the plasmon dispersion equation is obtained as a function of frequency ω, the in-plane wave vector $\mathbf{q}_{\parallel} = (q_x, q_y)$ and reciprocal lattice vector nG where $n = 0, \pm 1, \pm 2, \cdots$ and $G = 2\pi/d$ with d denoting the period of the grating. The dispersion equation, which yields the resonant frequencies, is solved in the complex ω-plane for real wave vector $\mathbf{q}_{\parallel}$. It is ascertained that the imaginary part of ω is enhanced with decreasing d, and with increasing the doping density of the free carriers in the bulk medium for fixed grating period.

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