Exchange and correlation effects on the plasmon dispersions and the Coulomb drag in low-density electron bi-layers

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We investigate the effect of exchange and correlation (xc) on the plasmon spectrum and on the Coulomb drag between spatially separated low-density two-dimensional electron layers. We adopt a new approach, which employs dynamic xc kernels in the calculation of the bi-layer plasmon spectra and of the plasmon-mediated drag, and static many-body local field factors in the calculation of the particle-hole contribution to the drag. The spectrum of bi-layer plasmons and the drag resistivity are calculated in a broad range of temperatures taking into account both intra- and inter-layer correlation effects. We observe that both plasmon modes are strongly affected by the xc effects. After the inclusion of the complex dynamic xc kernels, a decrease of the electron density induces shifts of the plasmon branches in opposite directions. And this is in stark contrast to the tendency obtained within the random phase approximation that both optical and acoustical plasmons move away from the boundary of the particle-hole continuum with a decrease of the electron density. We find that the introduction of xc corrections results in a significant enhancement of the transresistivity and qualitative changes in its temperature dependence. In particular, the large high-temperature plasmon peak that is present in the random phase approximation is found to disappear when the xc corrections are included. Our numerical results at low temperatures are in good agreement with the results of recent experiments by M. Kellogg *et al.*, Solid State Commun. **123**, 515 (2002).

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