Pair Densities in a Two-dimensional Electron Gas (Jellium) at Strong Coupling from Scattering Theory with Kukkonen-Overhauser Effective Interactions

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We present a calculation of the spin-averaged and spin-resolved pair distribution functions for a homogeneous gas of electrons moving in a plane with e^2/r interactions at coupling strength $r_s = 10$. The calculation is based on the solution of a two-electron scattering problem for both parallel-spin- and antiparallel-spin-pairs interacting *via* effective spin-dependent many-body potentials. The scattering potentials are modeled within the approach proposed by Kukkonen and Overhauser to treat exchange and correlations under close constraints imposed by sum rules. We find very good agreement with quantum MonteCarlo data for the spin-averaged pair density. We also find that short-range pairing between parallel-spin electrons is beginning to emerge in the paramagnetic fluid at this coupling strength, as a precursor of a transition to a fully spin-polarized fluid state occurring at stronger coupling.

Key words: Electron Gas; Electron-electron Interactions; Exchange; Correlation; Dielectric and Magnetic Response.