Two-Electron Systems in Generalized Exponential Cosine Screened Coulomb Potentials

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We look at the ground state of two-electron systems placed in a dense quantum plasma environment where the three interactions between two particles of charges $z_i$ and $z_j$ placed at a distance $r_{ij}$ can be described by exponential-cosine-screened Coulomb potential (ECSCP) $V(r_{ij}) = z_i z_j \exp(-\lambda r_{ij}) \cos(\delta r_{ij})/r_{ij}$ where $\lambda$ and $\delta$ are two positive real screening parameters related to the plasma frequency. The first calculations of the ground and first excited states of $H^-$, $\text{He}$ and $\text{Li}^+$ where all three interactions between pairs of particles were represented by the same ECSCP, and with $\lambda = \delta$, were recently reported [2,3]. In the present work we show results for two-electron systems for which the interactions are described by generalized ECSCP with unequal parameters. Our calculations are performed with a rather versatile Configuration Interaction approach (see [3] and references therein), with correlated basis functions which explicitly depend on the three interparticle distances and which respect exactly all three cusp conditions.