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QMC Study of Quantum Dots with Strong Interactions AMIT GHOSAL, Duke University, CYRUS UMRIGAR, Cornell University, DENIS ULLMO, Duke University, HAROLD BARANGER, Duke University — We study the interplay of Coulomb repulsion and shell effects for electrons confined in a circular parabolic quantum dot. We use variational and diffusion Monte Carlo methods to calculate the ground state, excitation energies, and addition energy. We focus on the dependence of these quantities on both the total electron number, N up to 20, and the electron gas parameter (which measures interaction strength), r_s up to about 10. For strong interaction our results show violations of Hund's second rule, which is expected. Strong interaction drives an electron gas toward Wigner crystallization; it is thought that nanoscale confinement may affect significantly this process, leading perhaps to "incipient" crystallization. With regard to the latter, we present results for the pair correlation function and discuss implications.
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