FEW-ELECTRON ANISOTROPIC QUANTUM DOTS IN LOW MAGNETIC FIELDS: EXACT-DIAGONALIZATION RESULTS FOR EXCITATIONS, SPIN CONFIGURATIONS, AND ENTANGLEMENT

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Following earlier studies [1-2] for $N = 2 - 3$ electrons, exact-diagonalization calculations for $N = 3 - 6$ electrons in anisotropic two-dimensional quantum dots, covering a broad range of confinement anisotropies and strength of inter-electron repulsion, will be presented for zero and low magnetic fields. The excitation spectra are analyzed as a function of the magnetic field and of quantum-dot anisotropy. Analysis of the many-body wave functions through spin-resolved two-point correlation functions confirms that the electrons tend to localize forming Wigner molecules (WMs) [3]. For strong anisotropy, the WMs acquire a linear geometry, and the wave functions with a spin projection $S_z = (N - 2)/2$ are similar to the strongly entangled N-qubit W states. For general values of S_z, the linear WM wave functions exhibit analogies with the class of entangled states known as N-qubit Dicke states. For intermediate anisotropy, the WMs exhibit a more complex structure. The degree of entanglement can be quantified through the use of the von Neumann entropy. Results for some cases of lateral double-quantum-dot molecules will also be discussed.

[**1**] T. Ihn, C. Ellenberger, K. Ensslin, C. Yannouleas, U. Landman, D.C. Driscoll, and A.C. Gossard, Int. J. Mod. Phys. B **21**, 1316 (2007); C. Ellenberger, T. Ihn, C. Yannouleas, U. Landman, K. Ensslin, D.C. Driscoll, and A.C. Gossard, Phys. Rev. Lett. **96**, 126806 (2006).
[**2**] Yuesong Li, C. Yannouleas, and U. Landman, Phys. Rev. B **76**, 245310 (2007).
[**3**] For a review of earlier literature in this area, see C. Yannouleas and U. Landman, Rep. Prog. Phys. **70**, 2067 (2007).