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Exotic few-particle ground states in charged self-assembled InAs/GaAs quantum dots[1] LIXIN HE, GABRIEL BESTER, ALEX ZUNGER, National Renewable Energy Laboratory, Golden, Colorado 80401 — Three-dimensionally confined quantum dots can be loaded with a few carriers. However, unlike real atoms, in self-assembled InAs/GaAs quantum dots, the Coulomb repulsion between holes $J_{hh} \sim 15$ -25 meV is comparable to the single-particle energy spacing between levels $\Delta\epsilon \sim 10$ - 20 meV. This opens the possibility of observing stable, exotic spin configurations that defy the rules of atomic physics (Hund's rule and the Aufbau principle). We have applied a combination of atomistic pseudopotential description for the single-particle level structure, with a many-body configuration interaction (CI) description of many-particle effects to predict both electron and hole charged states in InGaAs/GaAs self-assembled quantum-dots. We find that while electron charging follow both the Aufbau principle and Hund's rule, hole charging gives rise to stable but unusual spin configurations. Our theory[1] offer a self-consistent interpretation to recent experimental observations[2], where the simple 2D effective mass parabolic models fail. [1] L. He, G. Bester and A. Zunger, Phys. Rev. Lett. (in press), cond-mat/0505330. [2] Reuter *et al*, Phys. Rev. Lett. **94**, 026808 (2005)

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