Exotic few-particle ground states in charged self-assembled InAs/GaAs quantum dots\textsuperscript{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\textsuperscript{1} offer a self-consistent interpretation to recent experimental observations\textsuperscript{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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