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Shell Filling and Magnetic Anisotropy In A Few Hole Silicon Metal-Oxide-Semiconductor Quantum Dot ALEX HAMILTON, R. LI., S.D. LILES, C.H. YANG, F.E. HUDSON, University of New South Wales, M.E. VELDHORST, TU Delft, A.S. DZURAK, University of New South Wales — There is growing interest in hole spin states in group IV materials for quantum information applications. The near-absence of nuclear spins in group IV crystals promises long spin coherence times, while the strong spin-orbit interaction of the hole states provides fast electrical spin manipulation methods. However, the level-mixing and magnetic field dependence of the p-orbital hole states is non-trivial in nanostructures, and is not as well understood as for electron systems. In this work, we study the hole states in a gate-defined silicon metal-oxide-semiconductor quantum dot. Using an adjacent charge sensor, we monitor quantum dot orbital level spacing down to the very last hole, and find the standard two-dimensional (2D) circular dot shell filling structure. We can change the shell filling sequence by applying an out-of-plane magnetic field. However, when the field is applied in-plane, the shell filling is not changed. This magnetic field anisotropy suggests that the confined hole states are Ising-like.

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