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Spectroscopy of a few-electron single-crystal silicon quantum dot¹ MARK FRIESEN, University of Wisconsin-Madison, MARTIN FUECHSLE, S. MAHAPATRA, F. A. ZWANENBURG, University of New South Wales, M. A. ERIKSSON, University of Wisconsin-Madison, MICHELLE Y. SIMMONS, University of New South Wales — We report measurements and theoretical simulations of a few-electron quantum dot formed by atomically patterned doping in a P:Si δ -layer. The device is embedded entirely within epitaxial Si, including source-drain tunnel leads and capacitive side-gates. Coulomb blockade and excited state resonances are observed, and we discuss these excited states in the context of calculated multi-electron levels on the dot and van Hove singularities in the leads. The atomically abrupt confinement potential causes a large valley splitting of states within the Γ band, as appropriate for spin quantum computing. The sharp lateral confinement in the dot, with radius < 2 nm, leads to novel effects associated with valley splitting in the Δ band.

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