

Abstract Submitted  
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**Effects of valley degeneracy and valley mixing in SiGe quantum dot structures**<sup>1</sup> A.A. KISELEV, R.S. ROSS, M.F. GYURE, HRL Laboratories LLC, 3011 Malibu Canyon Road, Malibu CA 90265 — We have analyzed the effects of valley degeneracy and valley mixing on single- and few-electron states in (001) electrostatically defined SiGe quantum dots (QDs), focusing on those most sensitive to macro- and microscopic characteristics of Si/SiGe interface. Theoretical analysis suggests that interface steps, variations in interface quality, and especially intentional interface engineering can dramatically modify valley-induced effects; this notion is further supported by our numerical simulations, where we explicitly allow for an arbitrary and spatially inhomogeneous stacking of heterolayers in the active area of the device. A correspondence with recent experimental data on SiGe QDs is critically examined. We have also considered intervalley relaxation in (001) SiGe QDs and identified an “admixture” mechanism, based on valley-orbit mixing, as a possible leading candidate. We evaluated its characteristic times for a number of relevant scenarios. The admixture mechanism is strongly suppressed in a truly planar geometry, whereas it can provide a fast relaxation channel for structures with macroscopically inhomogeneous interfaces.

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