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Spin-orbit interactions in two-dimensional holes in quasi-triangular wells: variational calculations ELIZABETH MARCELLINA, ALEX HAMILTON, The University of New South Wales, ROLAND WINKLER, Northern Illinois University, DIMITRIE CULCER, The University of New South Wales, UNSW COLLABORATION, NIU COLLABORATION — Spin-orbit (SO) interactions in semiconductors are key to the realization of semiconductor spintronic devices and quantum information processing. Low-dimensional holes are strongly SO-coupled systems, as such, they offer the promise of all-electrical spin control which can lead to more efficient electronic devices. However the spin properties of holes are highly complex, and heavily influencd by the nature of the confining potential. So far, calculations on two-dimensional holes in semiconductor heterojunctions have mostly been numerical and material-specific. In this work, we develop variational-based methods, which are easy to use and applicable to various materials, to quantify SO interactions in two-dimensional holes confined in self-consistent quasi-triangular wells. In particular, we calculate the SO hole spin-splittings and effective masses in common semiconductor materials such as GaAs, Ge, InSb, InAs, and Si. Our results show that the strength of SO interactions is very sensitive to the material type and that in zincblende materials with a bulk inversion asymmetry (BIA), the dominant contribution to the SO interaction is still the structure inversion asymmetry (SIA) term corresponding to the confinement potential.

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