Abstract Submitted
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Absence of intrinsic spin splitting in 1D quantum wires of tetrahedral semiconductors[1] JUN-WEI LUO, LIJUN ZHANG, National Renewable Energy Laboratory, Golden, Colorado 80401, USA, ALEX ZUNGER, University of Colorado, Boulder, Colorado 80309, USA — The energy bands of 3D, 2D, and 1D structures are generally split at certain wavevector values into spin-components, a spin splitting that occurs even without external magnetic field and reflects the effect of spin-orbit interaction on certain symmetries. We show via atomistic theory that 1D quantum-wires made of conventional zincblende semiconductors have unexpected zero SS for all electron and hole bands if the wire is oriented along (001) (belonging to D2d symmetry), and for some of bands if the wire is oriented along (111) (belonging to C3v symmetry). We find that the predicted absence of Dresselhaus SS in both (001)-oriented and (111)-oriented 1D wires is immune to perturbations lowering their original D_{2d} and C_{3v} structural symmetries, such as alloying of the matrix around the wire or application of an external electric field. Indeed, such perturbations induce only Rashba SS. We find that the scaling of the SS with wavevector is dominated by a linear term plus a minor cubic term.

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Jun-Wei Luo
National Renewable Energy Laboratory

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