Abstract Submitted
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Novel giant Rashba spin splitting of holes in semiconductor nanowires for Majorana Fermions[1] JUN-WEI LUO, LIJUN ZHANG, National Renewable Energy Laboratory, ALEX ZUNGER, CU Boulder, USA — Majorana Fermions (MFs) are particles identical to their own antiparticles that have been first theoretical predicted and then experimentally observed in hybrid superconductor-semiconductor nanowire devices. The appearance of MFs requires (spin-orbit-induced) giant nanowire spin splitting (SS) to exceed the topological superconductor gap, a condition realized by tuning the magnetic field. Because the SS due to the conventional Dresselhaus or Rashba mechanisms is inversely proportional to the wire diameter, these mechanisms contribute but vanishing SS ($\ll$ 1 meV Å) for wide ($\sim$ 100 nm) wires that are appropriate to device uses–a significant disadvantage of nanowire for this application. Our atomistic pseudopotential calculation predicted a novel large Rashba SS in GaAs/AlAs wires under electric field [1], which increases as the wire diameter to the potential benefit of nanowire MF device. This emerged automatically when the ordinary Schrödinger equation is solved in the presence of spin-orbit interaction. We will report such giant Rashba SS coefficient of the order of $\sim$ 200 meVÅ in a number of semiconductor wire materials $\sim$ 100 nm wide.

[1] J.W. Luo, L. Zhang, and A. Zunger, Phys. Rev. B 84, 121303(R) (2011) see Ref.25.

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