Abstract Submitted
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**Spin-orbit coupling in semiconductor nanowires: Physical limits for Majorana states**[1] TIAGO DE CAMPOS, GUILHERME SIPAHI, PAULO EDUARDO DE FARIA JUNIOR, Universidade de São Paulo, State University of New York at Buffalo, CARLOS BASTOS, Universidade de São Paulo, IGOR ZUTIC, State University of New York at Buffalo, MARTIN GMITRA, JAROSLAV FABIAN, Universität Regensburg — Proximity induced superconductivity in semiconductor nanowires with spin-orbit coupling (SOC) provides a promising realization of Majorana fermions [1,2]. While SOC is typically included within only the first conduction band, such simplified models lack a more detailed understanding of Majorana fermions and their implementation. We perform systematic and comprehensive numerical investigations of SOC in zinc-blende and wurtzite semiconductor cylindrical nanowires. We employ the k.p method, with input parameters fitted to first-principles calculations, to determine realistic values of the Rashba and Dresselhaus spin-orbit fields in nanowires of varying diameters. Specifically, we use a state of the art 14 band k.p formalism together with the envelope function approach [1] to obtain the electronic band structure for various compounds, and analyze the effect of the quantum confinement on the effective masses and spin-orbit splitting of the subbands. We also make specific suggestions towards the optimal orientation and geometry, evaluating the prospects of the nanowires as platforms to observe Majorana states. [1] J. Alicea, Rep. Prog. Phys. 75, 076501 (2012). [2] A. Yu. Kitaev, Phys-Usp. 44, 131 (2001). [3] P. E. Faria Junior and G. M. Sipahi, J. Appl. Phys. 10, 103716 (2012).

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