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Spin-orbit coupling in InSb semiconductor nanowires: physical limits for majorana states[1] GUILHERME SIPAHI, TIAGO DE CAMPOS, Universidade de So Paulo, SUNY at Buffalo, PAULO E. FARIA JUNIOR, Universidade de So Paulo, Universitt Regensburg, MARTIN GMITRA, Universitt Regensburg, IGOR ZUTIC, SUNY at Buffalo, JAROSLAV FABIAN, Universitt Regensburg — The search for Majorana fermions is a hot subject nowadays [1]. One of the possibilities for their realization is the use of semiconductor nanowires and p-type superconductors coupled together. Following this path, the first step is the determination of realistic band structures of these wires including spin-orbit effects. To consider the spin-orbit effects, its common to use models that take into account only the first conduction band. Although these reduced models have been successfully used to determine some physical properties, a more realistic description of the spin-orbit coupling between the bands is required to further investigate possible ways to realize the Majorana fermions. In this study we use a state of the art 14 band k.p formalism together with the envelope function approach [2] to determine the band structure of InAs semiconductor nanowires and analyze how the quantum confinement change the coupling between the bands. As a result we have extracted the effective masses and the spin-orbit splitting for a large range of nanowire radial sizes and for several conduction bands that can be used in effective models. [1] J. Alicea, Rep. Prog. Phys. 75, 076501 (2012). [2] P. E. Faria Junior and G. M. Sipahi, J. Appl. Phys. 10, 10, 103716 (2012).

[1]FAPESP (No. 2011/19333-4, No. 2012/05618-0 and No. 2013/23393-8), CNPq (No. 246549/2012-2 and No. 149904/2013-4), CAPES(PVE 88881.068174/2014-01) and DFG SFB 689

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