Spin-orbit coupling effects in ZB InSb and WZ InAs nanowires using multiband $k \cdot p$ method$^1$ TIAGO CAMPOS, Universidade de São Paulo, PAULO EDUARDO FARIA JUNIOR, MARTIN GMITRA, Regensburg University, GUILHERME MATOS SIPAHI, Universidade de São Paulo, JAROSLAV FABIAN, Regensburg University — We perform comprehensive numerical calculations of spin-orbit effects in semiconductor nanowires. In particular, we focus on zinc-blende InSb and wurtzite InAs semiconductors, and employ realistic $k \cdot p$ models fitted to first-principles band structures \cite{1}, to obtain spin-orbit spin splittings of the electronic subbands for square, circular, and hexagonal nanowires. In addition to the bulk-inversion asymmetry spin-orbit fields (Dresselhaus in zinc-blende and Rashba in wurtzite phases), we also apply a transverse electric field to induce Rashba spin splittings caused by structure inversion asymmetry. We fit the numerical band structures to symmetry-based effective Hamiltonians and obtain important materials parameters for the lowest subbands, including the spin-orbit spin splitting magnitudes and spin textures. Our work is important in the current research related to Majorana states in semiconductor nanowires. \cite{1} FARIA JUNIOR, P. E. et al. Realistic multiband $k \cdot p$ approach from ab initio and spin-orbit coupling effects of InAs and InP in wurtzite phase. Physical Review B 93, 235204 (2016)

$^1$CAPES PVE (Grant No. 88881.068174/2014-01), CNPq (Grants No. 149904/2013-4, No. 88887.110814/2015-00, and No. 304289/2015-9), DFG SFB 689, and FAPESP (Grant No. 2012/05618-0)

Tiago Campos
Universidade de São Paulo