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Effect of spin-orbit interaction on the ballistic transport properties of nanowires SHEEHAN AHMED, RYAN BRENNAN, Fordham University, GODFREY GUMBS, Hunter College, CUNY, ANTONIOS BALASSIS, Fordham University, DANHONG HUANG, Air Force Research Laboratory, Kirtland Air Force Base — We calculated the effects of spin-orbit interaction (SOI) on the energy bands, ballistic conductance (G) and the electron-diffusion thermoelectric power ($S_{\rm d}$) of a nanowire by varying the temperature, electron density and width of the wire. We used the effective mass approximation in a model for the quasi-1D electron system that includes a Rashba potential lateral confinement of the 2DEG and a quasi-square potential well confinement transverse to the 2DEG. Both terms (α and β) give rise to SOI coupling which affects significantly the band structure obtained from numerical solutions of a pair of coupled equations. Comparing our model with the already published work where harmonic confinement was employed to describe the transverse confinement, we found that the energy bands are different and, in addition to crossing effect of the transverse energy bands, there is also anticrossing for specific values of the wavevector k_y along the wire. The β-term of the Hamiltonian causes a displacement and a deformation of the transverse energy band structure which is more pronounced for large values of the wave vector.

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