# Improved effective equation for the Rashba spin-orbit coupling in semiconductor nanowires

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Semiconductor Rashba nanowires are quasi-one dimensional materials that have large spin-orbit (SO) coupling arising from a broken crystal potential symmetry due to an external electric field. There exist parametrized multiband models that can describe accurately this effect [1]. However, simplified single band models are highly desirable to study geometries of recent experimental interest, since they may allow to incorporate the effect of low dimensionality and the nanowire electrostatic environment [2] at a reduced computational cost. Commonly used conduction band approximations, valid for bulk materials, greatly underestimate the SO coupling in Zinc-blende crystal structures and overestimate it for Wurzite ones when applied to finite cross-section wires, where confinement effects turn out to play an important role. We demonstrate [3] that an effective equation for the linear Rashba SO coupling of the semiconductor conduction band (CB) can reproduce the behaviour of more sophisticated eight-band k·p model calculations. This is achieved by adjusting a single effective parameter that depends on the nanowire crystal structure and its chemical composition. We further compare our results with the Rashba coupling extracted from magnetoconductance measurements in several experiments on InAs and InSb nanowires (see Fig. 1 below), finding excellent agreement. This approach may be relevant in systems where Rashba coupling is known to play a major role, such as in spintronic devices or Majorana nanowires.

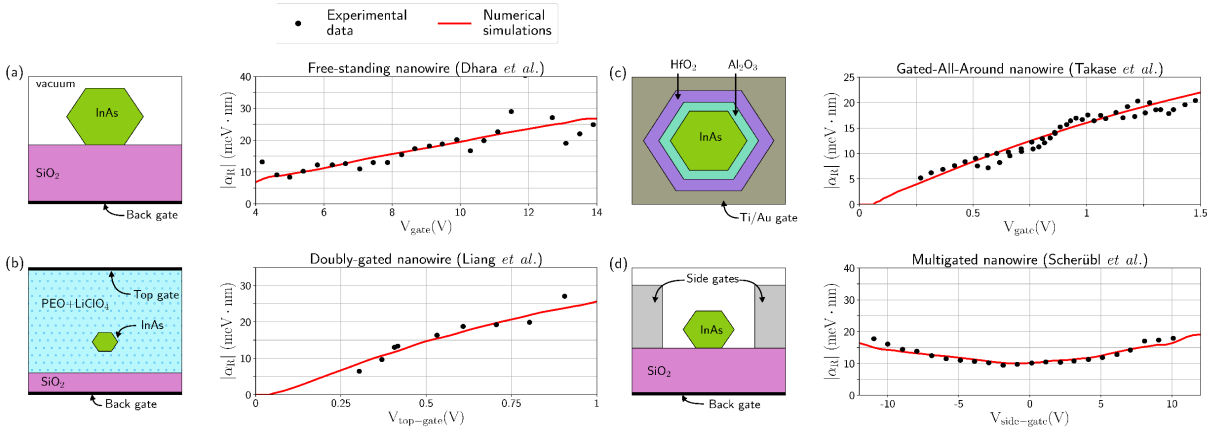


Figure 1. Electrostatic environment modelling of some experimental setups (left), and corresponding effective Rashba couplings (right) obtained with magnetoconductance measurements (dots) and with numerical simulations using the conduction band approximation (red lines).

## References

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