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Magnetoconductance signatures of subband structure in semiconductor nanowires GREGORY HOLLOWAY, CHRIS HAAPAMAKI, University of Waterloo, RAY LAPIERRE, McMaster University, JONATHAN BAUGH, University of Waterloo — Understanding the subband structure due to radial confinement in semiconductor nanowires can benefit technologies ranging from optical sensors to quantum information processing. An axial magnetic field couples to the orbital angular momentum, giving rise to non-trivial features in electronic transport as a function of magnetic field. Previous reports focused on conduction electrons confined to a thin shell near the nanowire surface, which lead to flux-periodic energies and conductance oscillations. Here, we calculate the eigenstates for more general radial potentials with moderate to low surface band bending such that electrons are distributed more uniformly across the nanowire cross-section. It is found that the energy spectrum becomes aperiodic in both gate voltage and magnetic field as the radial potential becomes flatter. The behavior of an energy level is dictated by its angular momentum, and this allows, in principle, each state to be identified based on its dependence on magnetic field and the chemical potential. We experimentally investigate a short-channel InAs nanowire FET in search of conductance features that reveal this subband structure. A quantitative measure for assigning conductance features to specific transverse states is introduced and applied to this device.

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