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Differential Conductance in Semiconductor-Superconductor Hybrid Structures JOHN STENGER, TUDOR STANESCU, West Virginia University — We construct a theory for calculating the differential conductance in semiconductor-superconductor hybrid structures that accounts for both the current carried by quasiparticles in the bulk superconductor and the contributions due to proximity effects induced in the semiconductor. Starting with a Blonder-Tinkham-Klapwijk (BTK) type approach, we show that the superconductor degrees of freedom can be conveniently integrated out and replaced by an interface 'Green function' determined by the properties of the superconductor and the original outgoing-wave boundary conditions corresponding to quasiparticle propagation. We find that the features present in the differential conductance are associated with both semiconductor and bulk superconductor spectral features, with a relative strength that depends on the parameters of the structure. We systematically investigate the dependence of the differential conductance on the parameters of the system, including coupling strength, semiconductor band occupancy, and barrier transparency, and correlate our findings with recent experimental measurements on proximity-coupled semiconductor wires.

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