Transmission Phase through Finite-sized Normal-metallic and Superconducting Electron Systems

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I will first discuss the transmission phase for electronic transport through Coulomb-blockaded quantum dots. A major difference in behavior occurs between quantum chaotic ballistic and disordered diffusive systems, due to differences in the range of wave-function correlations. In a second move I will discuss the case of a superconducting island. In the topologically trivial phase, only even numbers of electrons can be transferred through the superconductor, and the Friedel sum rule is automatically satisfied. In the presence of a Majorana bound state on the other hand, electrons can be transmitted individually, and I will show that the breaking of time-reversal symmetry induced by the Majorana bound state restores the Friedel sum rule also in that case, with interesting consequences for persistent currents in hybrid normal-superconducting rings.