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Observation of Majorana-like Behavior at the Quantum Critical Point in a Resonant Level Coupled to a Dissipative Environment[1]

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We investigate tunneling through a resonant level embedded in a dissipative environment, which suppresses tunneling rates at low temperatures. Specifically, the resonant level is formed in a carbon nanotube quantum dot, and the dissipative environment is realized by fabricating resistive leads. For the symmetric coupling of the resonant level to the two leads, we find that the resonant peak reaches the unitary conductance e^2/h despite the presence of dissipative modes. Simultaneously, the width of the resonance tends to zero as a non-trivial power of temperature. We draw a connection between our system and a resonant tunneling in a Luttinger liquid and interpret the observed unitary resonance of vanishing width in terms of a quantum critical point (QCP). We further investigate an exotic state of electronic matter obtained by fine-tuning the system exactly to the QCP and report on several transport scaling laws both near and far from equilibrium. Particularly striking is a quasi-linear non-Fermi liquid scattering rate found at the QCP, interpreted in terms of a model with Majorana modes at the resonant level. Although unlikely to be practical for fault-tolerant quantum computing, our device constitutes a viable alternative to topological superconductors as a platform for studying strong correlation effects within Majorana physics.

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