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Measurement of the statistical properties of the persistent current in normal metal rings MANUEL CASTELLANOS BELTRAN, WILL SHANKS, DUSTIN NGO, Yale University, ANIA BLESZYNSKI-JAYICH, UCSB, JACK HARRIS, Yale University — A striking manifestation of quantum mechanics at the mesoscopic scale is the existence of an equilibrium persistent current in normal metal rings threaded by a magnetic flux. A theory of non-interacting diffusive electrons predicts that the amplitude of these currents is a stochastic function of the disorder profile of the specific ring. Thus the persistent current is different from sample to sample, with a Gaussian distribution. Due to the difficulty of measuring these currents, experiments to determine the form of the persistent current distribution had not yet been performed. However, our group recently developed a technique for measuring persistent currents in normal metal rings with high SNR, low measurement back-action, excellent background rejection, and over a large range of magnetic fields. We have measured a total of roughly 100 independent realizations of persistent current amplitudes in single rings. Within the statistical limits of our data, we corroborate that the first five cumulants are consistent with a Gaussian distribution. As a further test of the higher-order statistical properties of the persistent current, we also show that the quadrature amplitudes of the current's Aharonov-Bohm oscillations are uncorrelated.

Manuel Castellanos Beltran
Yale University

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