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Noise in Mesoscopic, Quantum, and Nano-Systems¹

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Studies of fluctuations and noise have been pursued for over a century. These allow investigation of basic physical concepts, dynamics of small systems, internal electronic structure of mesoscopic and nano systems, and quantum limits on detection. We review recent studies at Yale that illustrate these topics. We discuss quantum and classical noise in mesoscopic systems, noise in normal and superconducting tunnel junctions, higher moments of noise, and electrothermal fluctuations in superconducting nanosystems. We conclude by outlining a detector that utilizes many of these concepts, and should allow efficient detection and energy measurement of single microwave and higher-energy photons, at high count rates.

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