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Non-equilibrium Fermi-edge Singularity in Mesoscopic Devices JIN ZHANG, NICHOLAS D'AMBRUMENIL, BORIS MUZYKANTSKII, University of Warwick, DAVID COBDEN, University of Washington — The non-equilibrium Fermi-edge singularity (NFES) was observed as a non-linearity in the random telegraph signal [1] in mesoscopic devices at low temperatures. Based on a modified NFES theory, we found that when a low-frequency ac signal is applied, the Fumi shift and the electron dephasing contribute in an opposite way to the violation of the detailed balance, which is measured in the logarithmic ratio of tunneling rates. In the case of large electron phase shift and weak dephasing, the usually-ignored Fumi shift plays an important role, and manifests itself as an "S"- shape curve in the logarithmic ratio of rates. For stronger dephasing, near the transition threshold, the tunneling spectra are dominated by the increased effective temperature because of the bias voltage, while for energies larger than that of the probing signal, the thermal excitation restores the system to pseudo-equilibrium. The overall shape of the logarithmic ratio of rates shows a "Z"-shape.

[1] D. H. Cobden, and B. A. Muzykantskii, Phys. Rev. Lett. 75, 4274 (1995)

Jin Zhang
University of Warwick

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