Chirality and fluctuation relations in mesoscopic tranpsort

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The linear conductance of a two terminal conductor is even under magnetic field reversal and through the Nyquist-Johnson relation connected to the equilibrium current noise. Already the quadratic in voltage term of the current-voltage relation (the second order conductance) is typically asymmetrical in magnetic field. Such chirality is obtained in theory and has been observed in experiments. Does this chirality have a signature in the noise of the sample? Is there a Nyquist-Johnson type relation between rectification coefficients and current fluctuations? We show that this indeed the case and discuss a higher-order fluctuation relation. We discuss different theories and suggest possible experiments [1-3] to test such non-equilibrium relations in mesoscopic and nearly macroscopic conductors.

[1] H. Forster and M. Buttiker, PRL 101, 136805 (2008). See also arXiv: 0903.1431
[2] R. Sanchez, R. Lopez, D. Sanchez, and M. Buttiker, PRL 104, 076801 (2010).
[3] K. E. Nagaev, O. S. Ayvazyan, N. Yu. Sergeeva, and M. Buttiker, arXiv: 1004.5310