Abstract Submitted for the MAR06 Meeting of The American Physical Society

Counting Statistics of Density Fluctuations in a Quantum Gas WOLFGANG BELZIG, University of Konstanz, Theoretical Solid State Physics, Department of Physics, D-78457 Konstanz, Germany, CHRISTIAN SCHROLL, CHRISTOPH BRUDER, Dept. of Physics and Astronomy, University of Basel, Klingelbergstr. 82, CH-4056 Basel, Switzerland — We investigate the statistics of density fluctuations in a coherent ensemble of interacting fermionic atoms around the BEC-BCS crossover. Adapting the concept of full counting statistics, well-known from quantum optics and mesoscopic electron transport, we study second-order as well as higher-order correlators of density fluctuations. This method is applied to the crossover from a molecular BEC state to a fermionic BCS state and yields a transition from Poissonian statistics to binomial statistics. The large Poissonian fluctuations confirm the picture of independent molecules on the BEC side of the transition. Strongly suppressed fluctuations on the BCS side reflect the correlation among Cooper pairs and the inertness of a Fermi sea. In the transition region the third cumulant is a measure of the particle hole symmetry of the distribution function. The statistics can thus be used as an experimental tool to gain information on the many-body ground states.

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Date submitted: 04 Dec 2005

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