Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Observation of grand-canonical number statistics in a photon Bose-Einstein JULIAN SCHMITT, TOBIAS DAMM, DAVID DUNG, FRANK VEWINGER, JAN KLAERS, MARTIN WEITZ, University of Bonn — Large (super-Poissonian) statistical fluctuations are a well known for the thermal behavior of bosons, as revealed in Hanbury Brown-Twiss experiments. For a Bose-Einstein condensed sample such large fluctuations usually conflict with particle number conservation, and when e.g. a cold atom cloud condenses to a BEC the fluctuations dampen and the sources acquires second-order coherence. In 2010, we have observed Bose-Einstein condensation of photons in a dye-filled optical microcavity, where photons thermalize with dye molecules by repeated absorption-emission processes. Here we report measurements of photon correlations and the statistical fluctuations of a photon Bose-Einstein condensate realized in the dye microcavity system. The dye molecules act both as a heat bath and a particle reservoir to realize grand-canonical conditions for the photon gas. We observe a regime with condensate number fluctuations of order of the total particle number, which demonstrates Bose-Einstein condensation under grand-canonical statistical conditions. In this regime, condensation and extremely large statistical fluctuations coexist.

Martin Weitz
University of Bonn

Date submitted: 30 Jan 2014 Electronic form version 1.4