Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Probing microscopic correlations from quantum depletion of a Bose-Einstein condensate ROCKSON CHANG, QUENTIN BOUTON, HUGO CAYLA, FLORENCE NOGRETTE, CHRISTOPH WESTBROOK, ALAIN ASPECT, DAVID CLEMENT, Laboratoire Charles Fabry, Institut dOptique Graduate School — Interactions between particles can have a significant impact on the nature of the ground state of a quantum system. In the case of bosons at zero temperature, interactions lead to the population of higher energy states (momentum $|p| > 0$) while depleting the condensate mode ($p = 0$) [1]. The resulting many-body state exhibits strong correlations, such as pairing between particles of opposite momenta ($+p$ and $-p$), and characteristic $1/p$ tails in the momentum distribution [2]. Here I will present our recent progress towards observation of these signatures of quantum depletion in an ultracold lattice gas. Our experiments are performed with a gas of metastable Helium-4 atoms [3] for which three-dimensional electronic detection of individual particles is possible, providing direct access to the momentum-space correlations $g^{(2)}(p, p')$ [4]. Moreover, the high-resolution of our detection method allows for a careful investigation of the distribution $n(p)$ of the excited states, allowing us to distinguish between thermal and quantum contributions to the condensate depletion. [1] N. N. Bogoliubov, J. Phys. (Moscow) 11, 23 (1947) [2] L. Mathey et al, PRA 79, 013609 (2009) [3] Q. Bouton et al. PRA 91, 061402(R) (2015) [4] T. Jeltes et al., Nature 445, 402-405 (2007)

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Date submitted: 26 Jan 2016 Electronic form version 1.4