Ofir Alon
Department of Physics
University of Haifa at Oranim
Tivon 36006 Israel

# Variance as a sensitive probe of correlations in Bose-Einstein condensates

ABSTRACT:

The variance of a many-particle operator, such as the position or momentum operators, is a very sensitive probe of many-body correlations. In contrast to the expectation value of such operators which depends on the condensation fraction of the Bose-Einstein condensate, their variance depends on the absolute number of depleted particles. Consequentially, the many-body correlations incorporated within the variance can be observed even in the limit of an infinite number of particles (keeping the interaction parameter, i.e., the product of the number of particles times the scattering length, constant) when the system becomes 100% condensed. In the talk we show both analytically and numerically the effect of many-body correlations on the variance and uncertainty product for an out-of-equilibrium Bose-Einstein condensate. We discuss the need to go beyond a mean-field description of the condensate in order to correctly describe these quantities even when only a single particle is depleted and the system is by definition 100% condensed. Finally, recent extensions for mixtures of Bose-Einstein condensates are briefly discussed as well.