Intensity and phase correlations in a hot atomic vapor superfluid of light

Tangui Aladjidi[1], Quentin Glorieux[1]

[1] Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL Research University, Collège de France, Paris 75005, France.

Hot atomic vapors represent an excellent platform to study quantum fluids of light thanks to their simplicity, tunability and excellent imaging capabilities [1]. Here we study the phase and intensity correlations of the light exiting a hot vapor cell, resulting from the quantum effects arising due to photon-photon interactions. We show that these correlations contain all of the relevant information about our experiment, and apply this to the study of quantum quenches. For this we implement a simple yet accurate phase sensor using a SLM and a camera. This non interferometric setup allows to shift experimental complexity to a computational one, thus allowing for cheap in place phase measurement [2].

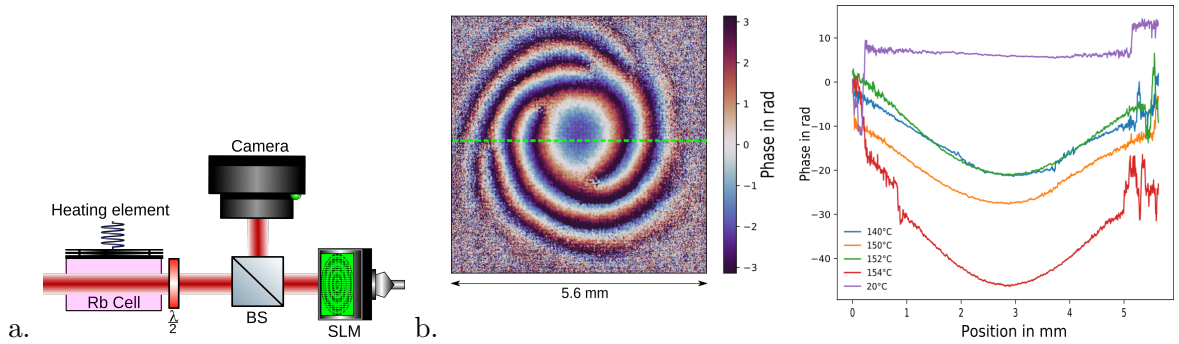

Figure 1. a. Setup for our phase sensor. **b.** Non linear dephasing undergone by a beam when traversing a Rubidium cell, for various interaction strengths.

[1] P.-É. Larré and I. Carusotto, Propagation of a quantum fluid of light in a cavityless nonlinear optical medium: General theory and response to quantum quenches, Physical Review A **92**, 043802 (2015).

[2] Wu, Y. et al. WISH: wavefront imaging sensor with high resolution. Light Sci Appl **8**, 44 (2019).