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Relative number squeezing by atomic four-wave mixing JEAN-CHRISTOPHE JASKULA, VALENTINA KRACHMALNICOFF, MARIE BONNEAU, GUTHRIE PARTRIDGE, DENIS BOIRON, ALAIN ASPECT, CHRISTOPH WESTBROOK, Institut d'Optique — A collision between two Bose-Einstein condensates (BEC) can formally be seen as an atomic four-wave mixing process, equivalent to parametric down conversion (PDC) in quantum optics. In this poster, we report the realization and observation of such a collision. By using a 3D position sensitive single atom detector, we are able to measure the time of flight momentum distribution of the atoms that are scattered from the BEC by s-wave interactions, and find that these atoms lie on a halo. Contrary to an ideal s-wave scattering distribution, however, we find that the scattered halo is not uniform and spherical, but instead has an angle dependent thickness and radius. In addition, by considering opposing regions of the halo, we observe relative number squeezing whereas relative atom number distributions between non-opposing regions show a poissonnian behaviour. Sub-poissonnian distributions have previously been measured in PDC experiments when non-classical states of light such as squeezed and entangled states were studied. This observation suggests that a collision between two BECs is a potentially good candidate as a source of entangled atoms.

Jean-Christophe Jaskula
Institut d'Optique

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