

DAMOP19-2019-000656

Abstract for an Invited Paper  
for the DAMOP19 Meeting of  
the American Physical Society

**Density oscillations induced by individual ultracold two-body collision<sup>1</sup>**

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Access to single particle momenta provides new means of studying the dynamics of few interacting particles. In a joint theoretical and experimental effort, we observe and analyze the effects of a finite number of ultracold two-body collisions on the relative and single-particle densities by quenching two ultracold atoms with initial narrow wave packet into a wide trap with inverted aspect ratio. The experimentally observed spatial oscillations of the relative density are reproduced by a parameter-free zero-range theory and interpreted in terms of cross-dimensional flux. We theoretically study the long time dynamics and find that the system does not approach its thermodynamic limit. The set-up can be viewed as an advanced particle-collider that allows one to watch the collision process itself.

<sup>1</sup>Contributions from V. Klinkhamer, J. H. Becher, A. Bergschneider, P. M. Preiss, S. Jochim, and D. Blume are highly acknowledged. This work is supported by NSF.