Contribution ID: **750** Type: **Poster**

How many particles do make a fluid? Searching for fluid dynamic behavior with expanding clouds of few and many cold atoms

Friday 8 April 2022 14:24 (4 minutes)

The observation of long-range azimuthal anisotropies in small collision systems triggers pressing questions concerning the applicability of fluid dynamics and whether ensembles of only a small number of particles may be effectively treated as fluids. We propose to use experiments on expanding clouds of cold atoms to answer the latter question. We consider strongly-interacting fermions confined in a two-dimensional trap with an elliptical deformation, and, upon release of the trap, we use the emergence of elliptic flow, v_2, as an indicator of collective behavior. Borrowing a well-known method from heavy-ion collisions, we quantify the collectivity of the system through the ratio v_2/ε_2, where ε_2 is the anisotropy of the trapping potential. By experimentally controlling both the value of ε_2 and the number of trapped atoms (down to a single particle), one can investigate what particle number is needed for the system to yield a v_2/ε_2 as large as in the fluid dynamic regime. Interestingly, in a quantum formulation, we find that a small number of particles can show elliptic flow even in the absence of interactions, and we discuss how this quantum effect disappears quickly with increasing particle number.

Based on: S. Floerchinger, G. Giacalone, L. H. Heyen, L. Tharwat, https://arxiv.org/pdf/2111.13591.pdf

Primary author: HEYEN, Lars Helge (Heidelberg University)

Co-authors: FLOERCHINGER, Stefan (Heidelberg University); GIACALONE, Giuliano (Universität Heidelberg); Ms THARWAT, Leena (Heidelberg University)

Presenter: HEYEN, Lars Helge (Heidelberg University)

Session Classification: Poster Session 3 T12_2

Track Classification: New theoretical developments