

Abstract Submitted
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Phase diagram of a thin film of ^3He confined within a $1.08\ \mu\text{m}$ deep cavity¹ NIKOLAY ZHELEV, ABHILASH SEBASTIAN, ERIC SMITH, JEEVAK PARPIA, Cornell University — We describe measurements of superfluid ^3He confined to a high-aspect ratio cavity within the head of a high quality factor torsion pendulum. Superfluid phase diagram for the confined thin film of fluid is predicted to be radically different compared to that of the bulk. In particular, at low pressures at the onset of the A-B transition, a “stripe phase” of alternating degenerate domains of B phase is predicted to occur [1]. By tracking the torsion pendulum frequency and quality factor, we identify a well-defined superfluid transition for the fluid within the pendulum head. At lower temperatures, sharp transitions from the A phase to the B phase on cooling and a gradual transition from the B phase to the A phase on warming are observed. The values for the ratio of the cavity depth and the coherence length ($D/\xi(T, P)$) at the transitions match well the values of the transitions seen in the NMR measurements of ^3He confined to a 700 nm deep cavity [2]. At present, we do not see any evidence in our measurements that the “stripe phase” is realized at the A-B phase boundary.

[1] A.B. Vorontsov and J.A. Sauls, Phys. Rev. Lett. 98, 045301 (2007).

[2] L.V. Levitin, et. al., Science 340, 841 (2013).

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