A Variable Path Length Cell for Transverse Acoustic Studies of Superfluid ^{3}He

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Transverse acoustic cavities have recently been used to great effect to probe the order parameter structure of superfluid ^{3}He. We have used cavities with thicknesses of tens of microns to explore the acoustic Faraday effect,[1] f-wave interactions,[2] and possible new order parameter collective modes[3] in ^{3}He. The attenuation of transverse sound can approach 1000 cm^{-1} for temperatures increasing toward T_c and at frequencies greater than 100 MHz. In order to explore surface bound states in superfluid ^{3}He-B and to search for transverse sound modes in the normal fluid predicted by Landau[4] in 1957, we require acoustic path lengths of much smaller dimension, on the micron scale, and we need to perform in-situ variations of the cavity spacing. For this purpose we have developed a variable path length acoustic cavity having continuous actuation. Here we describe the design considerations, the unique challenges of our approach, and the physical motivations for our experiments.

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