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Measurement of Isothermal Compressibility of ^3He near its Critical Point * FANG ZHONG, INSEOB HAHN, MARTIN BARMATZ, *Jet Propulsion Lab., Caltech* - The **isothermal** compressibility χ_T of a fluid is conventionally derived from the measurement of density ρ versus pressure P along an isotherm or from ρ measurements at two known vertical locations. For a fluid near its liquid-gas critical point χ_T diverges strongly. As a result, the application of the first method requires the development of a pressure sensor with resolution of $\delta P/P < 10^{-10}$ in order to measure χ_T at a reduced temperature $\epsilon < 10^{-6}$. The second method fails for $\epsilon < 10^{-4}$ due to the nonlinear density stratification induced by earth's gravity. A technique using electrostriction has been developed to measure χ_T of ^3He fluid near its critical point. The application of a DC electric field within a parallel plate capacitor induces a δP in the gap. The resultant $\delta\rho$ is then measured with the same capacitor. χ_T can then be obtained from the ratio of the $\delta\rho$ to δP . Tests of this technique at low temperatures as well as the results of initial χ_T measurements near the ^3He critical point will be presented. This χ_T measurement technique will be an integral part of a microgravity flight experiment that will also measure the divergence of the specific heat at constant volume in order to test the static scaling relations predicted by the Renormalization Group Theory.
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- Prefer Oral Session
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