A New Electrostriction Technique for Measuring the Isothermal Susceptibility and Chemical Potential Change Near the ^{3}He Liquid-Gas Critical Point

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A new electrostrictive technique has been developed to measure isothermal susceptibility, $\chi_T = (\partial\rho/\partial\mu)_T$, near the liquid-gas critical point of ^{3}He. This technique takes advantage of the fact that an electric field gradient can produce a pressure gradient within a dielectric fluid ($\delta P \propto E^2$). When an electric field is applied across a parallel plate capacitor, the density change, $\delta\rho$, can be measured as a function of the electric field. The susceptibility, χ_T, is proportional to the ratio of $\delta\rho/E^2$ in the limit of $E \rightarrow 0$. Electrostriction χ_T measurements were performed in the single phase over the reduced temperature range $1\times10^{-6} < T/T_c - 1 < 1\times10^{-3}$. Data obtained with this technique agree with the susceptibility measurements using a conventional *PVT* method. The data from the electrostriction measurements were also used to derive the chemical potential change, $\Delta\mu$, in the critical region. This new technique and recent experimental results for the susceptibility and chemical potential change will be presented.