Progress in the Development of a New Field-Theoretical Crossover Equation-of-State

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Abstract

A new field-theoretical crossover equation-of-state model is being developed. This model of a liquid-gas critical point provides a bridge between the asymptotic equation-of-state behavior close to the transition, obtained by the Guida and Zinn-Justin parametric model [J. Phys. A: Math. Gen. **31**, 8103 (1998)], and the expected mean field behavior farther away. The crossover is based on the beta function for the renormalized fourth-order coupling constant and incorporates the correct crossover exponents and critical amplitude ratios in both regimes. A crossover model is now being developed that is consistent with predictions along the critical isochore and coexistence curve of the minimal subtraction renormalization approach developed by Dohm and co-workers and recently applied to the $O(1)$ universality class [Phys. Rev. E, **67**, 021106 (2003)]. Experimental measurements of the heat capacity at constant volume, isothermal susceptibility, and coexistence curve near the ^{3}He critical point are being compared to the predictions of this model. The results of these comparisons will be presented.