

Thermodynamic Curvature of the Binary van der Waals Fluid

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The thermodynamic Ricci curvature scalar R has been applied in a number of contexts, mostly for systems characterized by 2D thermodynamic geometries. Calculations of R in thermodynamic geometries of dimension three or greater have been very few, especially in the fluid regime. In this talk I discuss recent calculations of R for binary mixtures, with the thermodynamics obtained from the binary van der Waals (vdW) model. Considered are cases with only repulsive interactions, as well as a binary vdW mixture with attractive interactions added. In both these examples, R was evaluated for full 3D thermodynamic geometries. The general finding is that basic physical patterns found for R in the pure fluid are reproduced to a large extent for the binary fluid. Particularly interesting are asymptotic results along critical isochores approaching lines of critical points, where we expect $-R/2 = \lambda/x^3$, with λ the correlation volume. The application of thermodynamic geometry in binary fluids opens up a new frontier in the exploration of the thermodynamic curvature, one which will require heavy use of thermodynamic equations of state.