Abstract Submitted
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Thermodynamic curvature measures interactions GEORGE RUPPEINER, New College of Florida — Thermodynamic fluctuation theory originated with Einstein who inverted the relation $S = k_B \ln \Omega$ to express the number of states in terms of entropy: $\Omega = \exp(S/k_B)$. The theory's Gaussian approximation is discussed in most statistical mechanics texts. I review work showing how to go beyond the Gaussian approximation by adding covariance, conservation, and consistency. This generalization leads to a fundamentally new object: the thermodynamic Riemannian curvature scalar R, a thermodynamic invariant. I argue that $|R|$ is a thermodynamic measure of the correlation length and suggest that the sign of R corresponds to whether the interparticle interactions are effectively attractive or repulsive. These ideas have been tested in a number of model systems. They are also significant in real fluids near the critical point, along the coexistence curve, and near the triple point. Also interesting are results for black hole thermodynamics, for which a foundation in terms of an underlying microscopic system is so far absent.

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