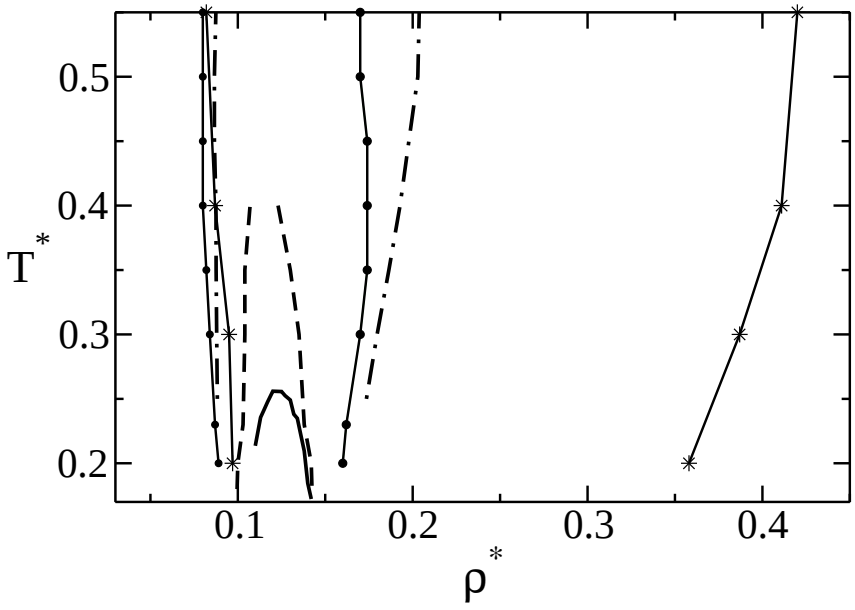

FIG. 10: Cascade of water-like anomalies in the density-temperature plane. The solid line limits the region of density anomaly, the dashed line illustrates the region of diffusion anomaly and the dot-dashed line shows the region of structural anomaly. The filled circles represent the density of minimum and maximum s_2 and the stars represent the region of minimum and maximum F_{im}.

We demonstrate that the diffusivity and the excess entropy of a core-softened fluid with isotropic pair interactions obey Rosenfeld-type excess entropy scaling of transport properties. The use of macroscopic reduction parameters for the diffusivity based on temperature and density is particularly appropriate for fluids with multiple length scales where defining an effective hard-sphere radius is inappropriate. We also show that the substituting the excess entropy by the pair correlation entropy leads to a weak isochore dependence of the Rosenfeld-scaling parameters, not seen in simple liquids but observed in other water-like liquids.[66]

The instantaneous normal mode spectra, including the Einstein frequency and the fraction of imaginary modes, is computed over a wide range of temperatures and densities. INM analysis is shown to provide unexpected insights into the dynamical consequences of the interplay between length scales characteristic of anomalous fluids that cannot be obtained from an equilibrium transport property such as the diffusivity.

Both the real and imaginary branches of the INM spectra exhibit bimodality that has so far not been observed. As a function of density along an isotherm, the bimodality in the real branch of the INM spectrum persists to very high densities well beyond the structurally