Local drive in interacting diffusive systems

David Mukamel

The Weizmann Institute of Science

The long-range nature of the nonequilibrium steady state resulting from a local drive (a pump or a battery) in an interacting diffusive fluid is discussed. It is shown that off criticality the pump generates long-range modulation in the density profile of the form of a dipolar electric potential, and a current profile in the form of a dipolar electric field. The density profile is drastically modified when the fluid is at its critical point: here, in addition to the long-rage influence of the current generated by the battery, the fluid is dominated by its intrinsic long-range critical correlations. It is demonstrated that the resulting density profile is of the same form as that of a fluid in equilibrium but under the influence of dipolar ordering field. As a result, the nonequilibrium steady state density profile at criticality can be expressed in terms of the equilibrium critical exponents of the fluid. In contrast, the current is shown to retain it off critical dipolar field form.