

Hydrodynamic instabilities in presence of Marangoni surfers

In hydrodynamics, the emergence of a flow stemming from a surface tension gradient is known as the Marangoni effect. The surface tension gradient can originate from either a temperature gradient (thermocapillary flow) or a concentration gradient (solutal Marangoni flow). This phenomenon is encountered in numerous situations, ranging from the stability of foams and emulsions to coating and printing processes, or even the locomotion of insects. Recently, an intriguing hydrodynamic instability has been observed at the water–air interface with a pattern consisting of an even number of azimuthal cells that are symmetrically growing about a pointlike heat or matter source, something like the petals of a flower blossoming all around its heart. Our aim is then to characterize Marangoni flows at the micro–scale, where inertial effects can be discarded. In particular, we wonder to what extent advection could be sufficient to give birth to such an interfacial instability. Answering this question is crucial to better understand hydrodynamic instabilities at small scales, offering the hope to control the motion of microswimmers trapped at the water–air interface.