Minicolloque n°13 **X Oral** ☐ **Poster**

Thermocapillary flows at the microscales: actuation of colloidal particles and instabilities at low Reynolds number

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When a liquid interface is exposed to a temperature gradient, the local variation of the surface tension induces a shear stress that drives the fluid in motion. The resulting thermocapillary (or Marangoni) flows are ubiquitous in everyday life as well as in industrial processes, and their structure and stability have been thoroughly documented.

Current challenges involving thermocapillary flows are focused on the microscopic scales. Indeed, the prevalence of interfacial phenomena as the size decreases allows for a fine control of free surface flows. A convenient way to remotely supply heat at microscales is provided by light absorption from a focused laser beam. Direct conversion of light into work has been evidence in the field of active matter: I will first discuss the actuation of micron-sized particles at the liquid-air interface, showing that thermocapillarity is a highly efficient mechanism for colloid self-propulsion [1]. Then I will describe recent experiments regarding azimuthal instabilities of thermocapillary flows that are observed at low Reynolds number [2]. In particular, I will show that the presence of a minute quantity of surface-active impurities may explain the complex structure of the flows [3,4].

[1] A. Girot *et al.*, Motion of optically heated spheres at the water-air interface, Langmuir **32**, 2687 (2016)
[2] G. Koleski *et al.*, Azimuthal instability of the radial thermocapillary flow around a hot bead trapped at the water-air interface, Phys Fluids **32**, 092108 (2020)
[3] T. Bickel, Effect of surface-active contaminants on radial thermocapillary flows, EPJE **42**, 131 (2019)
[4] G. Koleski *et al.*, Surfactant-driven instability of a divergent flow, submitted

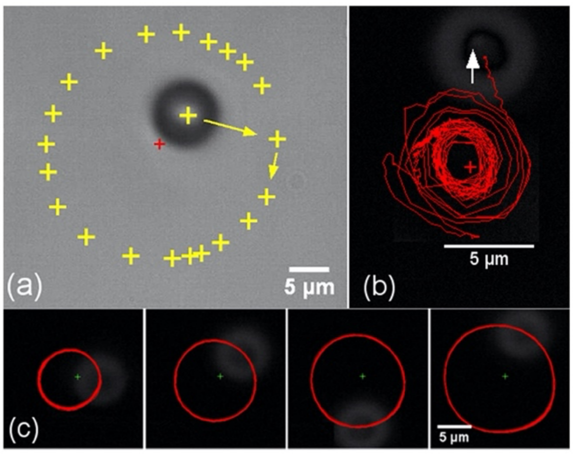

Figure 1: Quasi-circular orbits of a colloidal particle at the water-air interface around the axis of the laser beam. The radius increases with the laser power (3.2 to 19.6 mW, from left to right). The particle eventually escapes the optical trap at higher power [1].