Imaging the drying of a colloidal suspension

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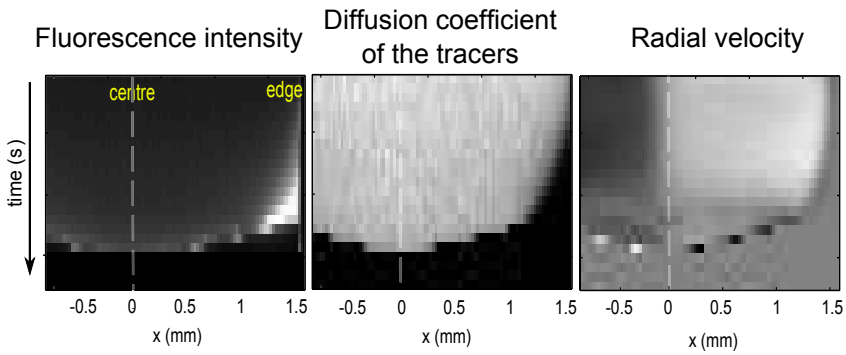
The drying of a droplet cointaining nanoparticles been the focus of numerous studies during the past ten years, following the introduction of the coffee-stain effect by Deeagan et al [1]. The formation of a solid deposit at the edge of the droplet involve several mechanisms including the pinning of the contact line, transport properties and hydrodynamics inside the droplet.

In order to get some insights into this problem and to validate some proposed theoretical models (see for example [2]), we present an experimental investigation of the drying kinetics *seen from inside* a sessile droplet laden with a colloidal sol of silica nanoparticles[3]. We have recently developed a method that take advantage of fast, two-color confocal microscopy. We quantitatively extract simultaneously as a function of time on the one hand the concentration field of the rhodamine-tagged nanosol and on the other hand the velocity field and the mobility field of large, fluorescein-tagged tracers. Figure shows an example of these results.



By changing the initial concentration at which the drop dries up, we propose a method that yields a self-consistent way to obtain the rheology of the sol. Based on these results, we analyse the drying kinetics in terms i) of flow patterns that include evaporating and Marangoni flows which compete to determine the final concentration profile and ii) of truncated dynamics that we quantitatively relate to the rheology of the sol.

References

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[2] R. Zheng, *Eur. Phys. J. E*, 2009, **29**, 205–218.

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