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Near-wall hydrodynamic interactions between a settling sphere and a wall.

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The near-wall dynamics of a sphere can be experimentally resolved using an interferometer device, in which a millimeter size sphere, settling in viscous oil, is used as a reflector. The accuracy on the displacement of the sphere is of the order of 0.1μm. Since its early implementation [Assou et al. , *J. Phys III* (1991) ; Lecoq et al., *Phys. Fluids* (1993)], this technique has been used to tackle various issues related to near-wall hydrodynamics. In this presentation, I will focus on two of its most recent developments.

Considering a sphere whose density is of same order as the fluid density, settling in this fluid with a Reynolds number of order unity, then the sphere enters the near-wall region with no-negligible inertia. In the range of impact Stokes number under study (of order unity), experiments reveal two distinct regimes for the dynamics of the sphere within this region. A linear regime still exists prior to contact, with velocity decreasing proportionally to wall-distance and vanishing at contact, ruling out the possibility of rebound. The vertical extent of this regime decreases with increasing Stokes number, and is e.g. only 10μm large at an impact Stokes number of order St=5 [Mongruel et al., *J. Fluid Mech.* (2010)].

For the case of a sphere settling towards a corrugated wall, at small Reynolds number, it has been shown that the drag force on the sphere in the near-wall region is smaller compared to the case of a "smooth" wall [Lecoq et al, *J. Fluid Mech.* (2004)]. Similar results are currently obtained by using well-defined micro-patterned surfaces elaborated by photolithography, with a texture height of the order of 50μm. These textured surfaces allow a systematic characterization of the drag reduction and of its vertical extent to be carried out, for various texture geometries (grooves, pillars …). Description of experimental results in terms of hydrodynamic models at micro-scale, i.e. taking into account the texture geometry, is under progress.