Brownian diffusion and active motion of partially wetted colloids.

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The interface between a liquid and a fluid affects dramatically both the interactions and the motion of colloidal particles. In this talk, the impact of partial wetting dynamics on the motion of passive and active colloids will be presented. First, experimental results on the Brownian dynamics of micrometric spherical silica colloids and polymeric ellipsoids trapped at a planar air-water interface will be described. Partial wetting defines a contact angle which sets the immersion depth of the colloid. Particle motion is confined in the interfacial plane. For spherical colloids, the contact angle is finely tuned in the range 30°-140° by surface treatments and measured in situ. Translational and rotational diffusion coefficients of colloids trapped at the water interface are obtained by particle tracking video-microscopy. Counter-intuitively, the friction felt by the colloid increases when the contact angle increases; i.e. when particles are less immersed in water and more in air, which has a negligible viscosity. To explain the slowing down of the translational motion for spheres and rotational diffusion for ellipsoids, an extra friction term originating from contact line fluctuations will be introduced.

The second part of the talk deals with the motion of isolated active Janus colloids at the surface of water. Spherical catalytic Janus colloids have been prepared coating half surface of silica particles by a thin platinum layer. Immersion depth of the Janus colloids as well as their orientation with respect to the water surface reveal the complex wetting properties of Janus particles. The active motion of Janus colloids at the interface in the presence of various concentration of hydrogen peroxide has been studied. The types of trajectories, directional and circular ones observed revealed the effective force and torque induced by the catalytic decomposition of H_2O_2. At the water surface, active colloids perform more persistent directional motions as compared to the motions performed in the bulk. This has been interpreted as due to the loss of degrees of freedom resulting from the confinement at interface and also to the partial wetting conditions that possibly bring new contributions to the rotational friction at interface.

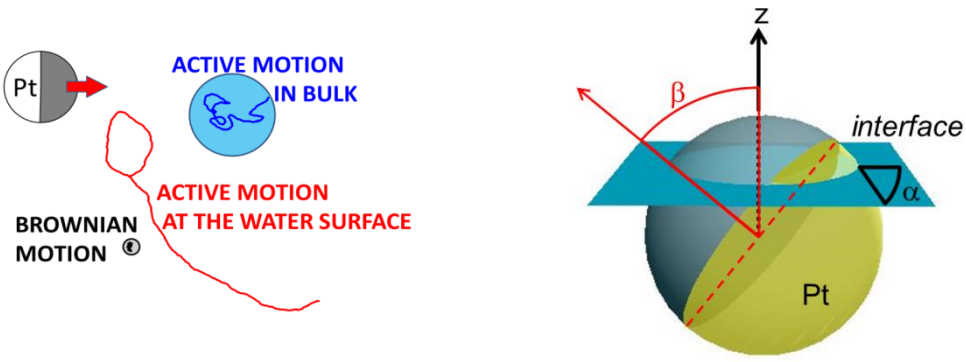

Figure : *Trajectories and sketch of an active Janus colloid attached on the water interface.*

G. Boniello et al. Nature Materials 2015, 14, 908–911

X. Wang et al Soft Matter 2015, 11, 7376-7384

X. Wang et al Faraday Discussions 2016, DOI: 10.1039/C6FD00025H