

Colloid meets Giant Vesicle: passive and active encounters

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When a colloid is close to a lipid giant vesicle, the interaction between the Brownian particle and the fluctuating soft membrane affects not only the particle motion but also the membrane properties. The membrane may change its shape to accommodate the particle and partial or complete engulfment may occur as a function of the energy of adhesion, membrane tension and bending. Furthermore, the encounter between the micrometric solid particle and the lipid giant vesicle generates complex active dynamics when the particle is driven out of equilibrium. Here, we report our efforts with self-propelled Janus colloids and with bare colloids under optical trapping to mimic complex dynamics such as particle endocytosis, the motion of a self-propelled particle confined to a spherical membrane, or the physics of particle engulfment by a membrane. In a wide range of experimental conditions, we have observed that a self-propelled Janus colloid is able to perform orbital motion around a giant vesicle remaining in a non-engulfment state [1]. Still, the active particle is able to impart a force of the order of 0.01 pN on the vesicle, which is however too small to trigger particle engulfment. By applying external forces in the 1-100 pN range, we were able to observe engulfment of bare and Janus colloids by a giant vesicle. Finally, we succeed to realize active dynamics such as particle penetration and vesicle transportation by a partially engulfed self-propelled colloid [2][3].

[1] V Sharma, E Azar, AP Schroder, CM Marques, A Stocco, Active colloids orbiting giant vesicles, *Soft Matter* **17**, 4275 (2021)

[2] V Sharma, CM Marques, A Stocco, Driven Engulfment of Janus Particles by Giant Vesicles in and out of thermal equilibrium, *Nanomaterials*, *under review* (2022)

[3] F. Fessler, V Sharma, P Muller, F Thalmann, CM Marques, A Stocco, Entry of Microparticles into Giant Lipid Vesicles by Optical Tweezers, *in preparation*.

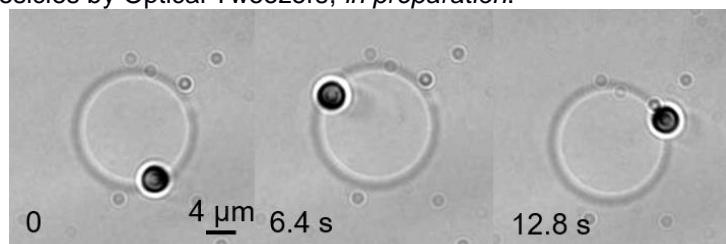


Figure 1: A self-propelled Janus SiO₂-Pt orbiting a giant lipid vesicle in a 2% H₂O₂ aqueous solution.