Magnetic biohybrid vesicles transported by an internal propulsion mechanism

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Some biological microorganisms can crawl or swim due to coordinated motions of their cytoskeleton or the flagella located inside their bodies, which push the cells forward through intracellular forces [1]. To date, there is no demonstration of a biomimetic self-propelled swimmer operating at a low Reynolds number due to internal movements within an enclosing membrane.

Here, we report lipid vesicles and other more complex self-assembled biohybrid structures able to propel due to the advection flows generated by the actuated rotation of the superparamagnetic particles they contain [2]. The proposed swimming and release strategies, based on near infrared laser pulse-triggered destabilization of the phospholipid membranes, open new possibilities for the on-command transport of minute quantities of drugs, fluids or nano-objects. The lipid membranes protect the confined substances from the outside environment during transportation, thus enabling to work in physiological conditions.

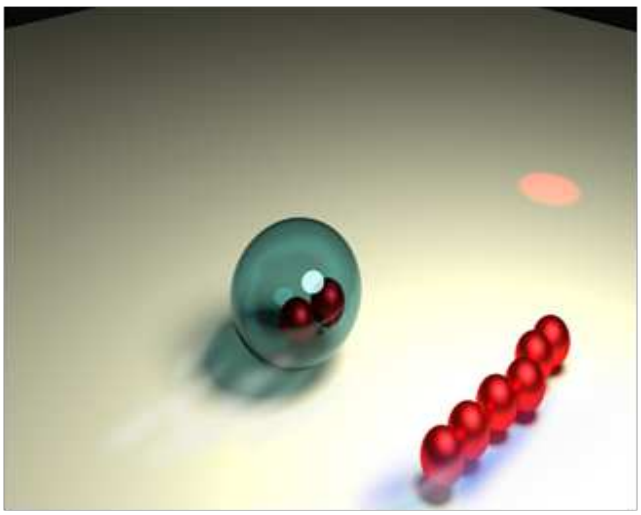

Fig. 1. The sketch shows the motion of one linear aggregate of free particles and two particles encapsulated within a giant vesicle in the presence of a circularly polarized rotating field.

[1] E. Lauga and T. R. Powers, The hydrodynamics of swimming microorganisms, Rep. Prog. Phys. **72**, 096601 (2009).

[2] F. Martinez-Pedrero, A. Ortiz-Ambriz, I. Pagonabarraga, and P. Tierno, Colloidal microworms propelling via a cooperative hydrodynamic conveyor belt, Phys. Rev. Lett. **115**, 138301 (2015).