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# Individually tunable micromachines driven by laser induced self propelled thermophoresis

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Trapping and guiding individual micro- or nano-objects in solution by optical means is one important task for nanotechnology. Living cells have developed strategies to transport objects with the help of molecular motors. Thus combining active motion with optical control may deliver new pathways for micro and nanomanipulation.

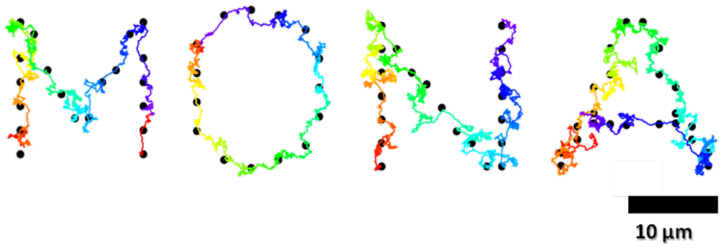


Figure 1: Sample trajectories of an individual self-propelled Janus particle along a given path.

Here we present a new concept based on self-thermophoretic action [1]. A particle which is capped by a thin metal layer is heated by an laser beam causing a temperature gradient along the particle surface. This temperature gradient leads to a directed thermophoretic propulsion of the particle. This directed motion, however, is randomized by rotational Brownian motion and just enhanced the diffusive motion on a large timescale. To overcome this randomizing a stochastic feedback mechanism can be developed, which employs the rotational Brownian motion to suppress their action. This method can be extended to the control of multiple individual particles on independent pathways (Fig. 1) or to simply localize them on individual positions (Fig. 2). This method provides numerous new perspectives for nano-manipulations in liquids.

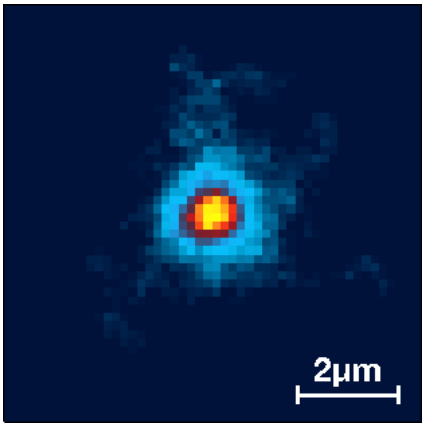


Figure 2: Localization of a 1 $\mu$m self-propelled Janus particle in the sample plane by a stochastic feedback mechanism.

## References

[1] B. Qian , D. Montiel, A. Bregulla, F. Cichos, H. Yang: *Harnessing thermal fluctuations for purposeful activities: The manipulation of single micro-swimmers by adaptive photon nudging*. Chemical Science, accepted (2012)