

**Title:** Emergent Hydrodynamic Bound States Between Magnetically Powered Active Micropropellers

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### **Abstract**

We study the hydrodynamic interactions (HIs) between colloidal micropropellers [1] confined above a plane and driven in a viscous fluid via application of a circularly polarized rotating magnetic field [2]. The applied field torques the particles, which translate close to the surface due to the HIs with the bounding plate. At high driving frequencies, the strong flow generated by the spinning particles makes HIs dominating over magnetic dipolar ones, and close propelling particles form bound states by temporarily adjusting their translational speed in order to optimize the transport of the couple. We develop a theoretical model which shows quantitative agreement with the direct experimental data. In dense suspension, these bound states can be extended to metastable 1D array of particles assembled by the sole HIs. Our results also demonstrate the importance of the boundary surface in the interaction and dynamics of confined propelling microswimmers.

### **References**

1. F. Martinez-Pedrero, A. Cebers, P. Tierno, *Soft Matter* (2016), 12, 3657.
2. F. Martinez-Pedrero, A. Ortiz-Ambriz, I. Pagonabarraga, P. Tierno *Phys. Rev. Lett.* (2015) 115, 138301