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Alignment of active particles with hydrodynamic interactions and formation of a self-assembled pump KATRIN WOLFF, MARC HENNES, HOLGER STARK, Institut fuer Theoretische Physik, TU Berlin — Hydrodynamically interacting active particles in an external harmonic potential are known to form a self-assembled pump at large enough Peclet numbers [1]. Here, we give a quantitative criterion for the formation of the pump for active Brownian particles depending on the rotational diffusion of particles, their swim speed and the strength of the harmonic trap. The emerging flow field caused by the swimmers corresponds to a regularized stokeslet and stabilises the pump. We find that the particle distribution settles into a non-equilibrium steady state with non-vanisihing flux. The particle orientations can be mapped onto an equilibrium system as they align along a common "pump axis" in analogy to dipoles in an electric field. We perform Brownian dynamics simulations with hydrodynamic interactions and compare the many-particle simulations with an analytically tractable mean field system.

[1] R. W. Nash et al., *Phys. Rev. Lett.* **104**, 258101 (2010)

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