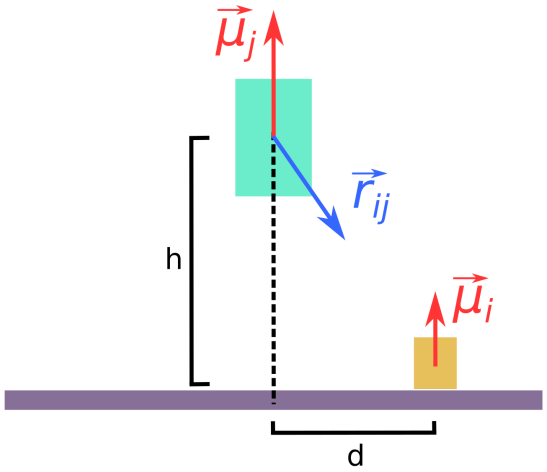
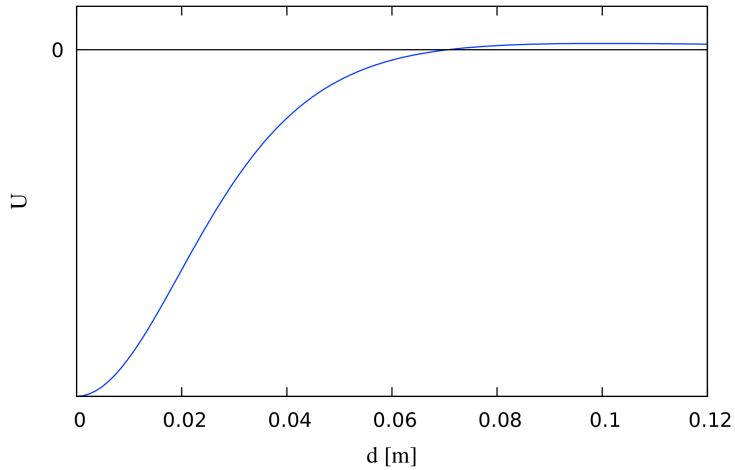
Synchronous Motion of Active Particles in a Trap

Simulations with an external dipole above self-propelled particles (SPP)



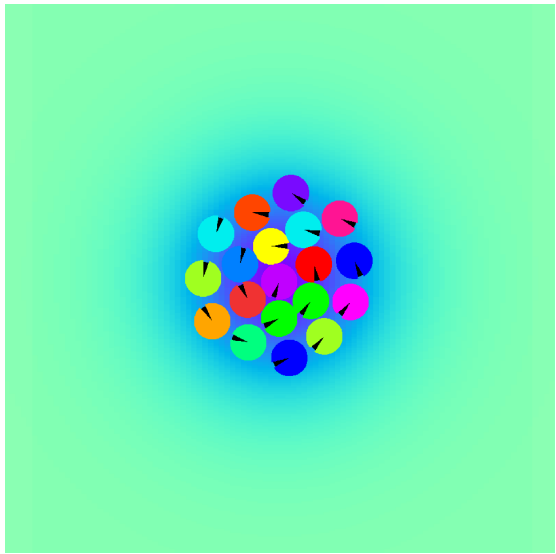


$$U_i(d) = \frac{\mu_0}{4\pi} M \frac{\left(d^2 - 2h^2\right)}{\left(d^2 + h^2\right)^{5/2}}$$

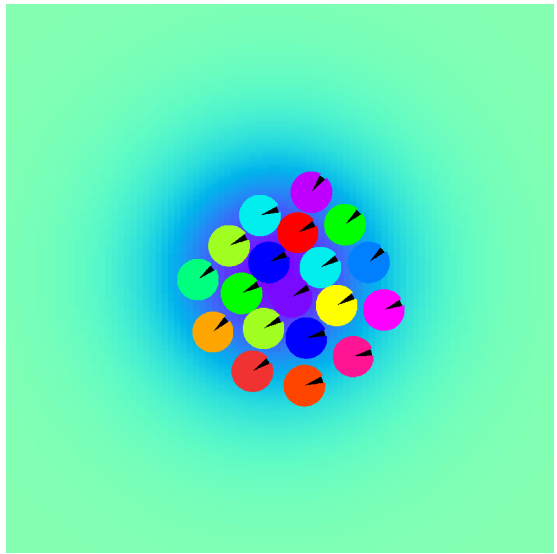
where the shape of the potential well varies with

- M, the product of μ_i and μ_j (depth of the trap)
- h, the height of the external dipole (depth and limit of the trap)

With several particles in a trap (19 here), we observe collective motion



Rotating motion



Synchronous motion

Some observations:

- Rotating motion is expected in a deep trap since a single trapped particle has an orbit motion
- Synchronous motion appears if repulsion between particles is sufficient