Large Deviations of Interacting Self-Propelled Particles

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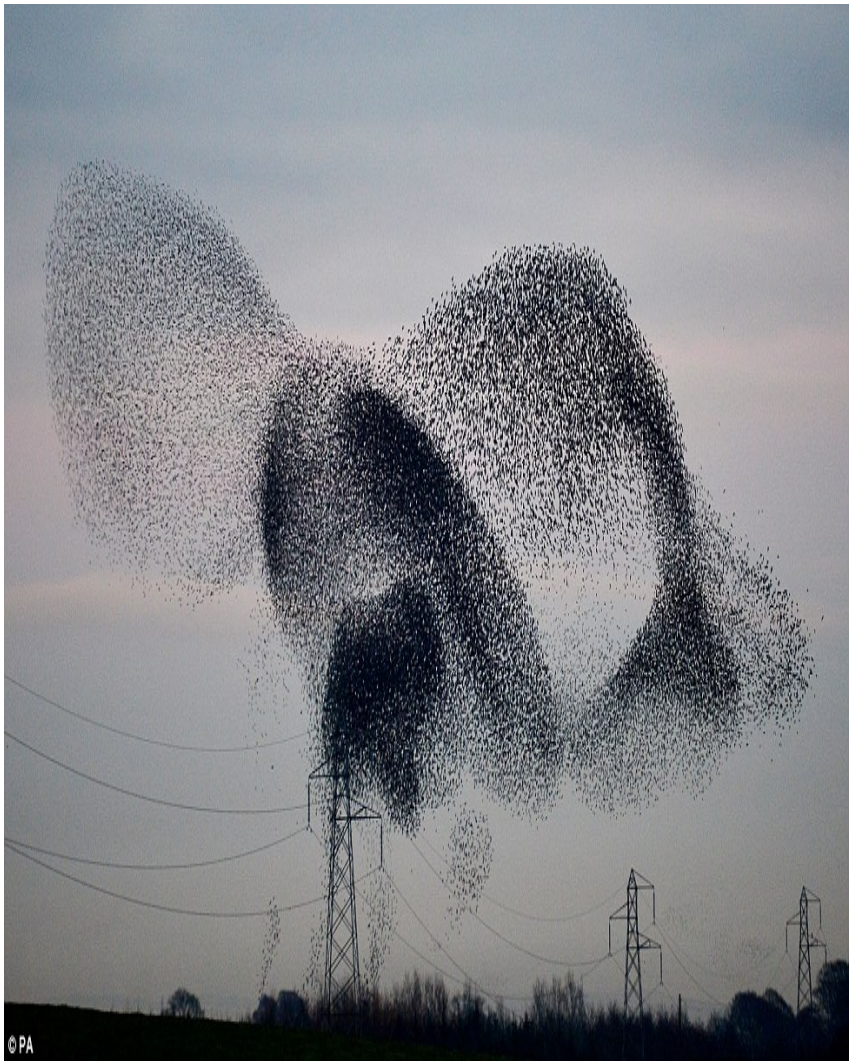
Active Matter and ABPs



Active Brownian Particles

$$m\dot{v} = -\gamma v + \xi(t) + F(x, v) + \\ + F^{ACT}(\theta_{int}),$$

Energy input at the individuals level!

$$\begin{cases} m\dot{\mathbf{v}} = -\gamma \mathbf{v} + \xi(t) + \mathbf{p} v_0, \\ \dot{\mathbf{p}} = \mathbf{p} \times \eta(t). \end{cases}$$

Stochastic Thermodynamics of ABPs

$$m\dot{v} = -\gamma v + \xi(t) - \frac{\partial U}{\partial x} + F^{EXT}(t) + F^{ACT}$$

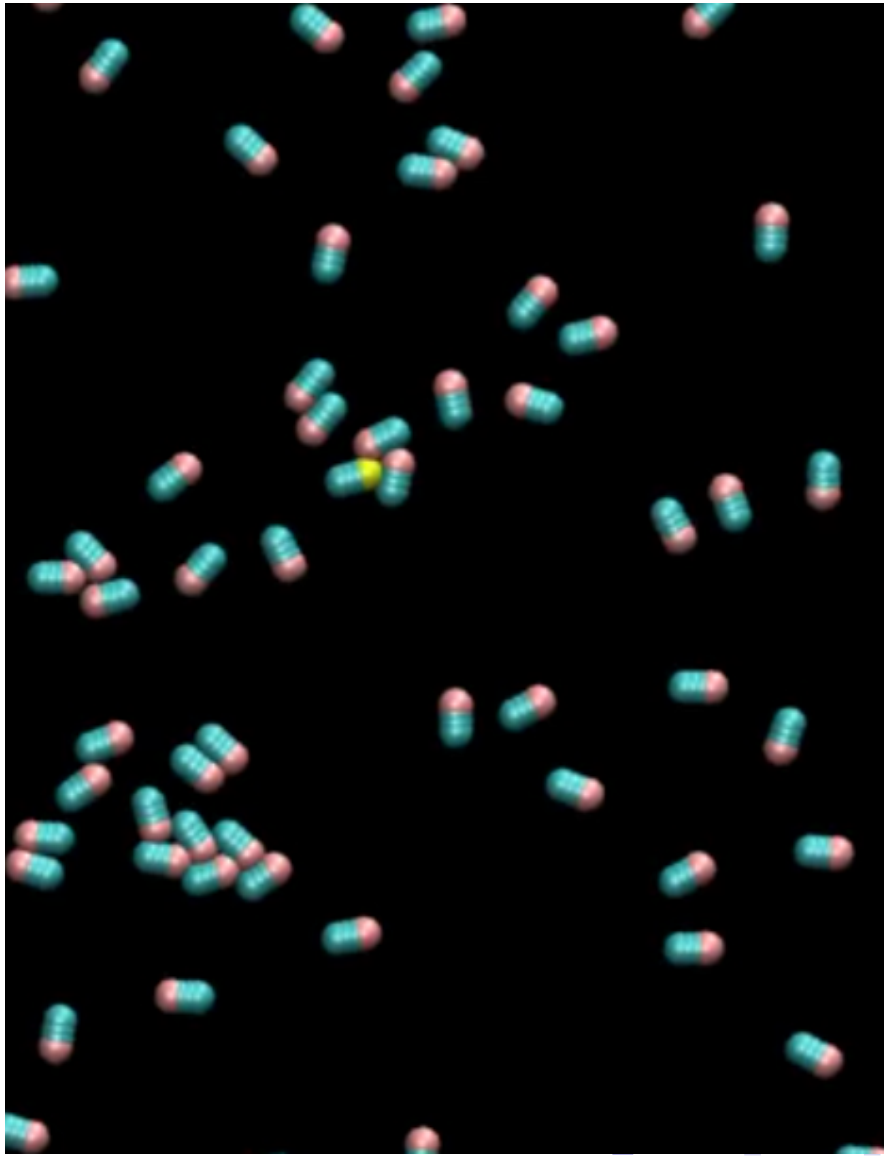
$$\overbrace{\int_0^\tau dt\, v \cdot \left\{ m\dot{v} + \frac{\partial U}{\partial x} \right\}}^{\Delta E_\tau} = \overbrace{\int_0^\tau dt\, v \cdot \left\{ -\gamma v + \xi(t) + F^{EXT}(t) + F^{ACT} \right\}}^{\Delta Q_\tau + \Delta W_\tau^{EXT} + \Delta W_\tau^{ACT}}$$

2nd law

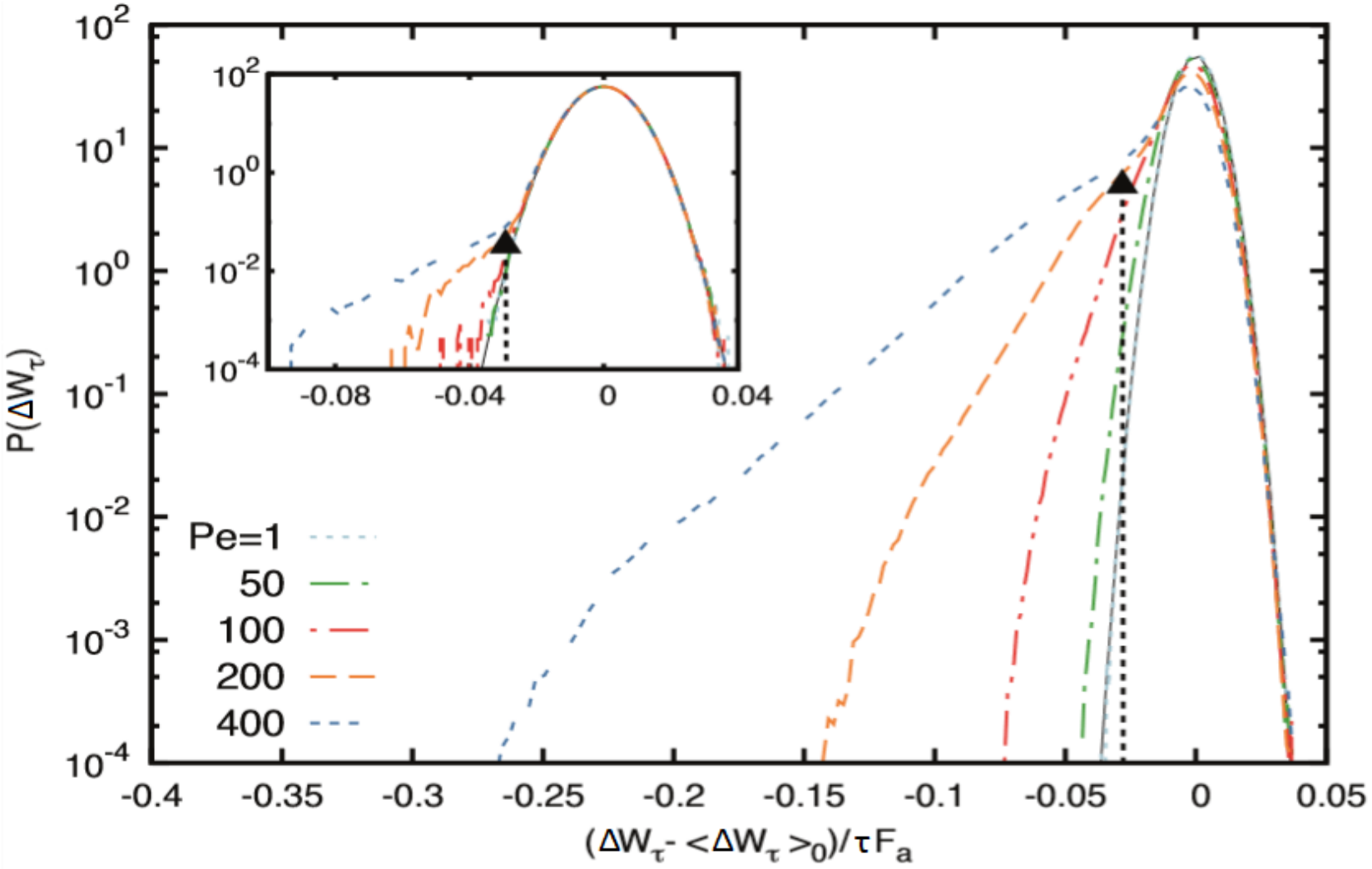
$$\Delta E_\tau = \Delta Q_\tau + \Delta W_\tau^{EXT} + \Delta W_\tau^{ACT}$$

The model

- Self-propelled particles with diffusing orientation;
- No external force;
- Pairwise interaction;
- Various shapes;
- $P(\Delta W_\tau^{ACT})$?



Active work probability



Active work Large Deviations