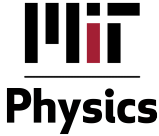
8.08/8.308: Stochastic dynamics in and out of equilibrium

Julien Tailleur (office 6C-419)



All info on **http://www.mit.edu/∼jgt/Content-Web/Teaching/8088308.html**

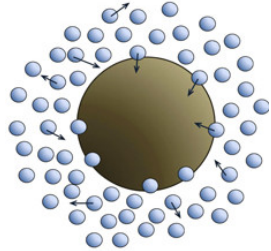
Goals

- Introduce non-equilibrium statistical physics and its applications to Active Matter & Biophysics.
- Give you the analytical & numerical tools to model and study a broad class of non-equilibrium systems
- Introduce important historical examples and current hot topics

Organization of lectures

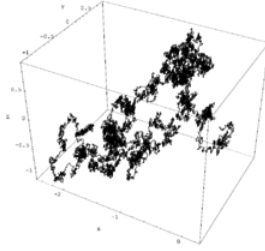
Part I: Relaxations towards equilibrium

- Dynamics of a colloid in a bath
  Trajectory: construction of Langevin equation



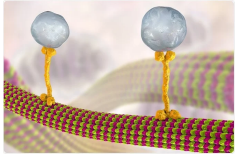
- Stochastic Itō calculus
  Probability: the Fokker-Planck equation

- Currents and time-reversal symmetry
  Path-integral representation



Part II: Non-equilibrium dynamics and Markov chains

- Ratchets: from Feynman to molecular motors
- Lattice-based models and master equations



Credit: Kateryna Kon/Shutterstock.com

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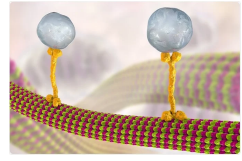

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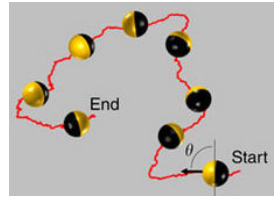
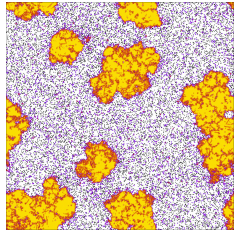
Part III: Active matter

- Active particles: bacteria and self-propelled colloids
- Collective behaviours in active systems: phase separation and collective motion





Course organisation

- Lectures: mostly blackboard
- Recitations:
  - Numerical methods
    - Implementations will be carried out using Julia
    - Bring your laptop! Check calendar
  - Important examples & illustrations
  - Alternative methods
- Four Psets: tentative due dates Jan 9, 15, 21, 27
- Office hours: JT (6C-419)/JM (TBD) on Jan 7/9, 13/14, 20/21, 26/27
- Numerical project: validate its choice with JM by Jan 23, return on Feb 1
- Final exam: Jan 30 (2pm-5pm)
- Grading: Pset/numerical project/final exam: 30/30/40
- Ignore canvas go to **http://www.mit.edu/∼jgt/Content-Web/Teaching/8088308.html**
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