Soft Matter Physics

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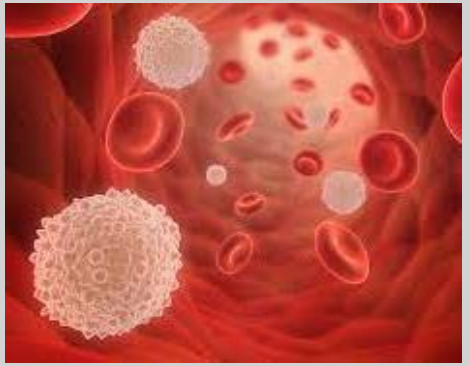
Soft Matter Physics

Passive Materials

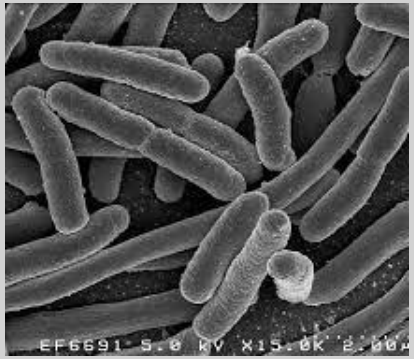




Living systems



Blood



Gut Bacteria

Soft Matter Physics

Soft matter

From Wikipedia, the free encyclopedia

For the journal, see Soft Matter (journal).

Soft matter or **soft condensed matter** is a subfield of condensed matter comprising a variety of physical systems that are deformed or structurally altered by thermal or mechanical stress of the magnitude of thermal fluctuations. They include liquids, colloids, polymers, foams, gels, granular materials, liquid crystals, pillows, flesh, and a number of biological materials. These materials share an important common feature in that predominant physical behaviors occur at an energy scale comparable with room temperature thermal energy. At these temperatures, quantum aspects are generally unimportant.

-Easy to deform (soft)

-Reversible assembly via kT

-Relaxation time(s)

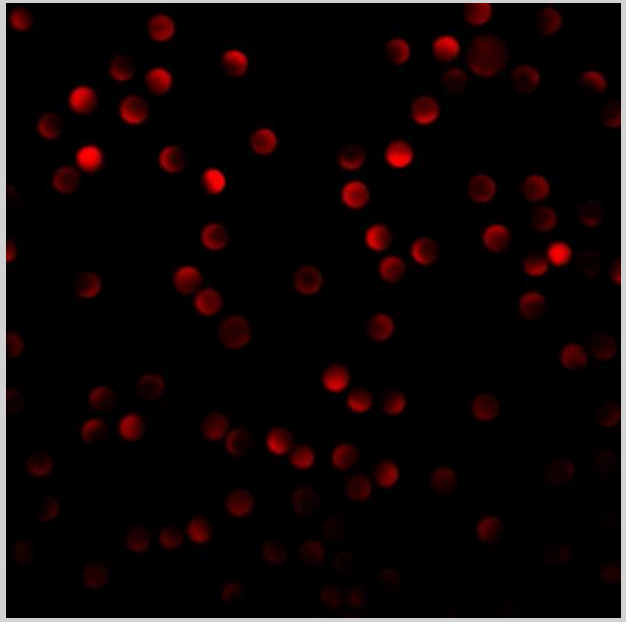
Variety of macroscopic behaviors, originating from microscopic properties

Soft Matter Physics

Driving force for water uptake?
Equilibrium state?
Role of dissolved ions, elasticity?

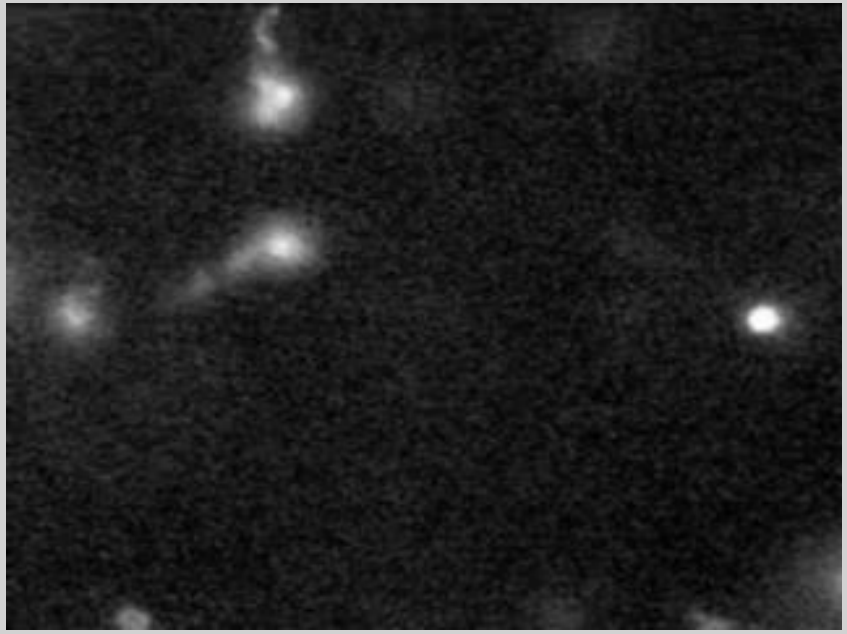
Dependence on flow rate?
How to model the physics?

Soft Matter Physics



How to describe dynamics?
Fluctuation-Dissipation theorem
Influence of external field?

Which propulsion mechanisms?
How to describe motion?
Role of particle geometry?



Main Topics

Thermal fluctuations
- ❑ Brownian motion
- ❑ Molecular machines

Self-Assembly
- ❑ Particle aggregates
- ❑ Polymer gels
- ❑ …

Rheology
- ❑ Visco-elasticity

Out of equilibrium
- ❑ Active soft matter

Charges in liquids
(electricity, salt and water!)
- ❑ Colloids
- ❑ Polyelectrolytes

Study Format and Material

Study Format:

-tutorials

-book club

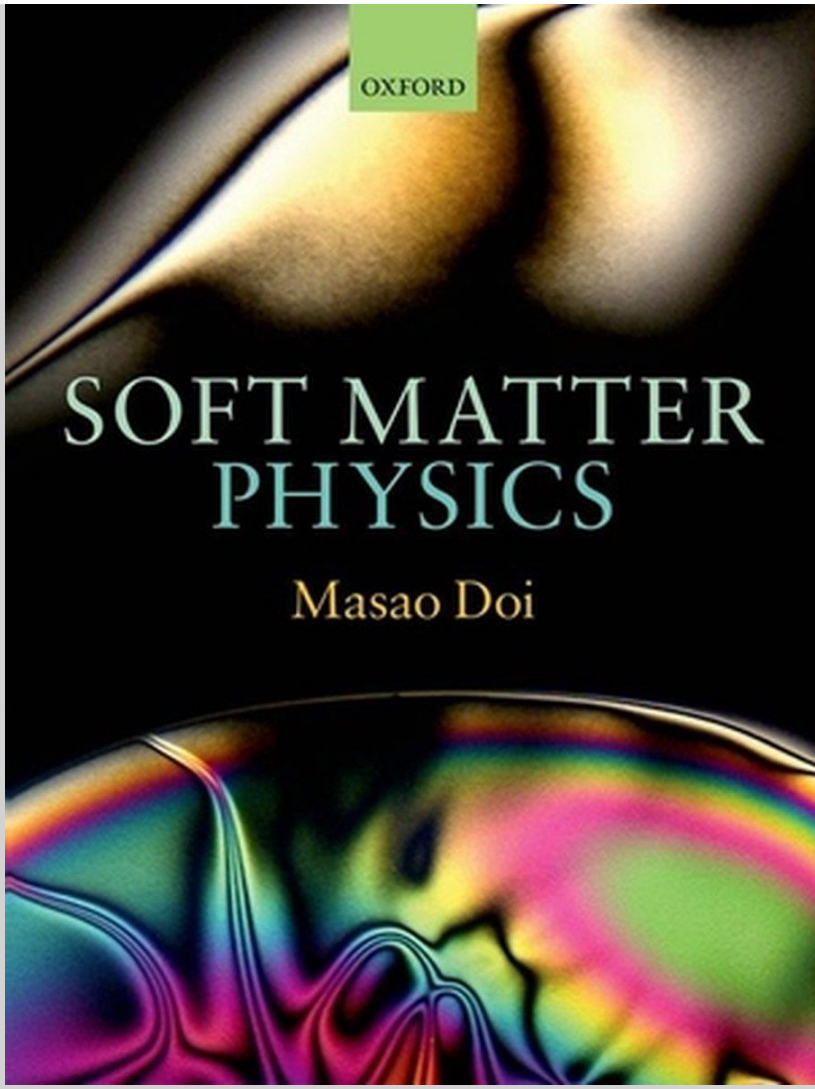
-paper discussion

-(oral) exam

-elements of StaFy

-elements of Fluid mechanics

-book of Doi (+handouts)



Learning Goals

After passing this course the student is able to:

- Explain the link between microscopic descriptions of Brownian motion and macroscopic diffusion laws.
- Describe and solve common physical models of soft matter systems such as polymers, viscoelastic media, surfactants and ionic solutions.
- Describe the key physical characteristics of active soft matter.
- Interpret basic experimental data for techniques such as rheology and light scattering.