Role of molecular motors and forcing in single cell mitotic spindle dynamics

Mechanical properties of cytoskeleton

Mechanosensing in living cells

Correlated Motions in Colloidal Gels and Glasses
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Colloid-polymer mixtures
Depletion attraction


PMMA + polystyrene

$\Delta = 2R_g$

$U_{dep}$

$\Delta z = 0.25 \mu m$
$d = 1.26 \mu m$

3D imaging - typical volume: $(22.6 \times 22.6 \times 10) \mu m^3$

Confocal Microscope

$\int dx_2$
Mechanical properties of cytoskeleton

Complex material!
Mechanical properties of cytoskeleton

Single filament: bending

\[ l_p \approx \frac{\kappa}{k_B T} \]

Elasticity is still entropic
But much more rigid

\[ l_e \sim D_t^{4/5} l_p^{1/5} \]

Thermal fluctuations of a rod:

\[ G_0 \sim \frac{k_B T}{l_e \xi^2} \sim c^{7/5} \]

\[ G(\omega) \sim \omega^{3/4} \]

Network: Mesh \(-\) \( \xi \sim c^{1/2} \)

Many length scales \(\rightarrow\) Many frequency-dependent regimes
Mechanical properties of cytoskeleton
Dynamics of living things

Simultaneous chromosome & spindle pole imaging
Role of molecular motors and forcing during cell division
Mechanosensing in living cells

Cells must react to forces in their environment.
Mechanosensing in living cells

Bacterial cells have mechanisms to partially equilibrate osmotic pressure
Mechanosensing in living cells

Live/Dead Assay

Propidium Iodide - penetrates only bacteria with damaged membranes

Hypotonic solution

H₂O
Mechanosensing in living cells

![Graph showing mechanosensing data.](image)