DNA rotational dynamics far from equilibrium

Roland Netz, Hirofumi Wada
Physics Department
Technical University Munich
85748 Garching, Germany

A stiff cylindrical filament that is rotated at one end undergoes a shape instability at a critical rotational frequency[1], which is the dynamic analogue of the Euler buckling. For a long DNA molecule a similar critical rotational frequency is predicted, where the dominant hydrodynamic dissipation mode changes from speedometer-cable like axial spinning to loop creation/diffusion[2]. This non-equilibrium transition might be relevant for in-vivo DNA replication and transcription processes and could explain twist localization and histone unlocking.

[1] Non-equilibrium hydrodynamics of a rotating filament,
[2] Plectoneme creation reduces the rotational friction of a polymer,
H. Wada and R. Netz, EPL, submitted