Polymers and Filaments: From Variational Problems to Fluctuations

Jan Kierfeld

Max Planck Institute of Colloids and Interfaces. Potsdam. Germany

Abstract

This course will address shapes and patterns of polymers, in particular semi-flexible polymers or filaments which are governed by a bending rigidity. The course will start with an introduction into polymer physics and the physics and biology of filaments.

First a number of subjects related to single filaments are presented, such as their persistence length, the adsorption to adhesive surfaces, shapes of filaments rings and the behaviour of filaments under external force, for example compressive forces in the Euler buckling instability, stretching forces, and desorbing forces.

Many of these problems can be solved at zero temperature using variational energy minimization. However, thermal shape fluctuations play an important role and cannot be neglected in general. In this lecture I will introduce some basic tools of statistical physics, which are needed to discuss the influence of thermal fluctuations. If time permits I will also discuss interacting filaments and pattern formation effects.