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ARNOLD SOMMERFELD
CENTER FOR THEORETICAL PHYSICS



Sommerfeld Theory Colloquium

Dr. Claus Heussinger

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ASC-PhD-Colloquium:

On the elasticity of thin fibers, their bundles, and their networks

The highly anisotropic mechanical properties of thin elastic fibers are of essential importance in many areas of science and technology. The combination of high extensional stiffness and ultra-small torsional stiffness of thin threads, for example, is frequently exploited in high precision experiments and may be of use even for the detection of gravitational waves.

In this talk we discuss some of the consequences of fiber-anisotropy on the elastic properties of systems of many interacting fibers. We focus on two types of assemblies: bundles and random networks.

In the case of fiber bundles, we demonstrate how bundle internal structure leads to qualitatively different dynamical and statistical mechanical properties as compared to single fibers. Structure is also seen to play a key role in the discussion of fiber networks. These systems are of particular importance in biology as, for example, the human skin owes its remarkable elasticity to a random network of long collagen fibers. With the help of a simplified model system ("Mikado model") we pinpoint the role of network architecture in establishing the mechanical properties of the system. A self-consistent effective-medium theory is presented, that allows calculating the elastic moduli of a general class of networks starting from the knowledge of their local structural features.

Wednesday, 16th January 08, 11:15 h, Room 348 / 349, Theresienstr. 37 / III