Fritz-Haber-Institut der Max-Planck-Gesellschaft, Humboldt-Universität zu Berlin, Max-Delbrück-Centrum für Molekulare Medizin, Otto-von-Guericke-Universität Magdeburg, Physikalisch-Technische Bundesanstalt, Technische Universität Berlin, Universität Potsdam

Berlin Center for Studies of Complex Chemical Systems

Seminar

Complex Nonlinear Processes in Chemistry and Biology

Honorary Chairman: G. Ertl
Organizers: M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, J. Kurths, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, and H. Stark

Attention! Change of date and address
Wednesday, April 27, 2016, at 16:15
Adress: Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin, Eugene-Paul-Wigner-Gebäude EW 731

Dr. Len Pismen

Department of Chemical Engineering Technion, Israel Institute of Technology

Nemato-elastic crawlers and swimmers

Liquid crystal elastomers, made of cross-linked polymeric chains with embedded mesogenic structures, combine orientational properties of liquid crystals with shear strength of solids. Their flexibility and sensitivity to chemical and physical signals comes close to that of biological tissues. Nemato-elastic films patterned by isotropic dopants or activated by light can spontaneously acquire variable complex shapes. We show how actuating transitions between different shapes can be used to construct soft crawling and swimming minirobots.

A propagating "beam" triggering a local phase transition sets a nemato-elastic stripe or rod residing on a substrate into crawling motion, which may morph due to buckling. We consider the motion of the various configurations with either uniform or splayed nematic order in cross-section, and detect the dependence of the gait and speed on flexural rigidity and substrate friction.

A similar actuation wave may be used to propel a Stokesean swimmer. A basic example is a flexible artificial flagellum -- a yarn combining a nematic and an isotropic elastomer fibers. As an excitation wave propagates along the yarn, it induces both propulsion and rotation, so that the swimmer follows a helical trajectory highly sensitive to the actuation protocol.

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