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Editorial

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A.T. Skjeltorp and G. Helgesen

Institute for Energy Technology, Kjeller, Norway and Department of Physics, University of Oslo, Oslo, Norway

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Soft condensed matter is characterized by the weak interactions between polyatomic constituents, by important thermal fluctuation effects, by mechanical softness and by a rich range of behaviours[1]. Examples include complex liquids, colloids, granular materials, foams, polymers, gels and various biological materials. These materials thus share an important common feature in that predominant physical behaviors occur at an energy scale comparable with room temperature thermal energy.

Soft matter in confinement is a growing, interdisciplinary research field in systems from biology to physics with many yet unknown basic principles. The dimensions, topology and properties of the confining medium may profoundly modify the behavior, properties and functionality of the confined soft matter. Confinement can include situations such as soft or biological materials at liquid–liquid interfaces, at solid surfaces and adjacent to structures like membranes and porous materials.

For example, for systems that in the bulk can undergo phase separation between two coexisting phases, the behavior can be greatly modified when they are confined in a thin film geometry between parallel, solid walls. For soft matter systems like colloid–polymer mixtures, polymer blends, liquid crystals and biopolymers, a wall could typically prefer one of the phases, and hence the composition of the system in the direction perpendicular to the walls will not be homogeneous.

As material systems are made smaller approaching the nano-scale, changes occur which may affect properties. The number of atoms close to surfaces increases relative to the numbers that are truly in the bulk. At the same time, thermodynamics is no longer controlled by the laws of large numbers, so dynamical fluctuations often cannot be viewed as Gaussian. Liquids flowing through narrow tubes ("microfluidics/nanofluidics") exhibit laminar flow and do not mix in the same way as fluids in macroscopic containers. In many complex fluids the relative importance of various forces depends on system size so that in biological cells, for example, dissipative forces dominate inertial forces. These and other distinctions between the properties of truly macroscopic systems and those whose spatial dimensions are constrained

[1] Definition taken from the introduction to "Phase Transitions in Soft Condensed Matter", edited by Tormod Riste and David Sherrington, Plenum Press, 1989 (New York), the proceedings of a NATO Advanced Study Institute held in Geilo, Norway in 1989. This may have been the first time the term "soft condensed matter" was used in an official capacity. `http://www.softbio.ox.ac.uk/`

will be explored in this Special Topics Issue, with special emphasis on effects which occur in soft matter, where thermal and cohesive forces are of similar magnitude, in many areas of nanotechnology and advanced materials.

The papers in this special topics issue reflect well the diversity of work in this area. It has also relevance for adjacent fields as exemplified by one paper discussing the activity of *Drosophila* in confined domains and another paper dealing with the statistics of co-occurring keywords in confined text messages on Twitter.

This special issue on "Soft Matter in Confinement: Systems from Biology to Physics" stems from a recent "Geilo School" (GS) [1], the twenty-second GS in a series held every two years since 1971 [2]. The objective of this GS was to bring together researchers with various interests and background including molecular biologists, theoretical physicists and soft condensed matter experimentalists to identify and discuss areas where synergism between modern physics and biology may be most fruitfully applied to the study of various aspects of soft matter in confinement. Earlier GS have also discussed related themes in soft matter systems [3–5].

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References

1. Geilo, Norway, 11-21 March, 2013, A comprehensive list of lecturers, poster sessions and participants can be found in *Soft Matter Confinement: Systems from Biology to Physics – Geilo Advanced Study Institute* (2013) IFE Report IFE/KR/E-2013/002, ISBN (Electronic): 978-82-7017-862-9, ISBN (printed): 978-82-7017-861-2
2. A list of previous Geilo schools may be found here: `http://www.ife.no/departments/physics/projects/geilo`
3. *Phase Transitions in Soft Condensed Matter*, edited by T. Riste, D. Sherrington (Plenum, New York & London, 1989)
4. *Soft Condensed Matter: Configurations, Dynamics and Functionality,* edited by A.T. Skjeltorp, S. Edwards (Kluwer, Dordrecht, 1999)
5. *Forces, Growth and Form in Soft Condensed Matter: At the Interface between Physics and Biology*, edited by A.T. Skjeltorp, A.V. Belushkin (Kluwer, Dordrecht, 2003)