

Scientific report on the workshop „Fluctuation-induced forces in condensed matter“ (11-15 October 2010)

Fluctuation-induced effective forces emerge whenever a fluctuating medium is perturbed by the presence of immersed objects. Examples of such forces can be found in rather different contexts ranging from physics and physical chemistry to biology. The main focus of the workshop was to explore and discuss analogies and differences among these various manifestations, with particular emphasis on unifying theoretical and experimental approaches. Bridging the gap among different communities interested in such forces and exploring possible applications were among the main motivations of the meeting. In order to achieve this goal the workshop gathered leading theoreticians (25) and experimentalists (12) who delivered talks on various topics as well as a number (9) of invited senior or junior scientists and several applicants (20). A comprehensive overview of the multifaceted nature of fluctuation-induced forces was presented in the Workshop Colloquium by Mehran Kardar, a renowned and leading contributor to the field. The topics which the experimental and theoretical talks dealt with include van-der-Waals and Casimir forces, the related phenomenon of wetting, solvation and critical Casimir forces, forces induced by fluctuations of interfaces or within fluctuating membranes, effective forces in confined equilibrium and non-equilibrium systems, depletion interactions in colloidal suspensions and their role in biological systems, dynamics of fluctuation-induced forces and their applications in soft matter systems, forces induced by charge fluctuations and related phenomena etc. Important issues such as the geometry-dependence of such forces and the non-trivial associated many body effects, as well as the emergence of universal asymptotic behaviors have also been discussed in the light of recent advances in theoretical and experimental techniques, some of which were reported during the workshop. Virtues and limitations of the various analytical, numerical, and experimental approaches for studying such forces in different contexts were also discussed in detail.

There was a vigorous response of the scientific community for being part of this workshop. On site, the participation in the workshop was very active and enthusiastic, as demonstrated by the lively and collegial discussions which followed each talk or during the poster session as well as in the free time. The meeting provided also an occasion for establishing personal contacts in view of future collaborations and for strengthening existing ones. It was very pleasing to see a sizable group of young scientists taking part in the workshop.

A lasting impact of this meeting is expected to be that the rather diverse subdisciplines of this research area develop a common language and a mutual understanding of the common basis of their research. In addition, the workshop showed that the intensive theoretical efforts attract now an increasing number of sophisticated and powerful experimental studies. This points towards very promising future developments.