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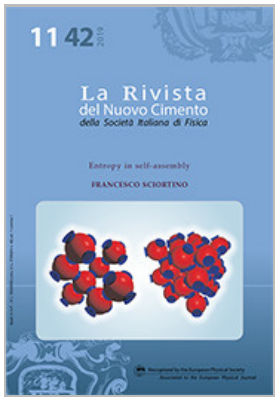
Proceedings of the International School of Physics "E. Fermi" – Course 203
Computational Social Science and Complex Systems

Edited by *J. Kertész, R. N. Mantegna, S. Miccichè*

For many years, the development of large-scale quantitative social science was hindered by a lack of data. Traditional methods of data collection like surveys were very useful, but were limited. The situation has of course changed with the development of computing and information communication technology, and we now live in a world of data deluge, where the question has become how to extract important information from the plethora of data that can be accessed. Big Data has made it possible to study societal questions which were once impossible to deal with, but new tools and new multidisciplinary approaches are required. Physicists, together with economists, sociologists, computer scientists, etc. have played an important role in their development. This book presents the nine lectures delivered at the CCIII Summer Course "Computational Social Science and Complex Systems", of the International School of Physics Enrico Fermi in Varenna, Italy, from 16-21 July 2018, with the aim of presenting some of the recent developments in the interdisciplinary fields of computational social science and econophysics to PhD students and young researchers, with lectures focused on recent problems investigated in computational social science. Addressing some of the basic questions and many of the subtleties of the emerging field of computational social science, the book will be of interest to students, researchers and advanced research professionals alike.

La Rivista del Nuovo Cimento Vol. 42 N. 11 (2019)
Entropy in self-assembly

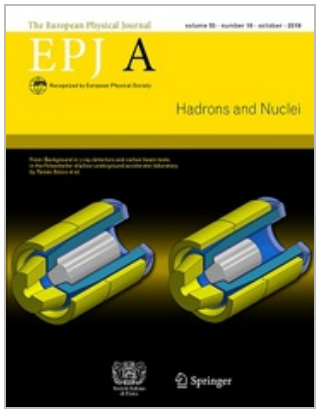


F. Sciortino

Entropy is commonly considered the thermodynamic force driving all systems towards their most disordered state. Ordering with entropy thus sounds like an oxymoron. But order, in the way it is perceived by us, can correspond to states for which the logarithm of the number of microstates concurring to the same macroscopic state is largest. Several beautiful examples of ordering driven by entropy are encountered in the study of colloidal solutions, systems in which sub-micrometer particles are dispersed in a solvent. Learning how entropy controls in a subtle way the self-assembly of colloidal particles offers us a handle on how to exploit it to drive colloids in specific locations, to direct particle aggregation or to select desired material properties.

EPJ A – Highlights

Quarks and light (pseudo-)scalar mesons at finite chemical potential



P.J. Gunkel, C.S. Fischer, P. Isserstedt

The properties of the theory of strong interactions, QCD, at finite chemical potential are of great interest for at least two reasons: (i) model studies suggest a potentially rich landscape of different phases with highly interesting analogies to those found in solid state physics; (ii) the resulting thermodynamic properties have far reaching consequences for the physics of neutron stars and neutron star mergers. Investigating the properties of light scalar and pseudo-scalar quark-antiquark bound states at finite chemical potential by solving coupled sets of Dyson-Schwinger equations, the meson masses, wave functions, and decay constants are computed, as well as changes in the quark dressing functions for chemical potentials below the first-order chiral phase transition while tracing charge-conjugation parity breaking. Eventually, we confirm the validity of the Silver-Blaze property: in observables all dependencies of colored quantities (propagators, wave-functions, etc.) on chemical potential cancel out and we observe constant masses and decay constants up to and into the coexistence region of the first-order chiral phase transition.

EPL – Highlights from the previous volumes

Partial synchronization as a model for unihemispheric sleep
by *L. Ramlow et al.*

Delocalization of edge states in topological phases
by *M. Malki, G.S. Uhrig*

Fractal agglomerates fragment into dissimilar fragments
by *Y. Drossinos et al.*

Light D-wave axial-tensor $K_2(1820)$ meson at finite temperature
by *A. Türkan*

EPL Highlights are published in the first issue of each volume, *i.e.* four times a year, as well as in Europhysics News (EPN).