

Dr. Francesco Sciortino

Professor

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Francesco Sciortino is a full professor at Sapienza Università di Roma. Over the years, he has been interested in the thermodynamics of anomalous liquids, in the glass and gel transitions (in both atomic and colloidal systems), and more recently in the self-assembly of patchy particles, combining theoretical modeling and numerical simulations. His most recent work is supported by an ERC-IDEAS grant.

DATE:

April 22, 2015

TIME:

10:00 am

LOCATION:

106 CCM

“Providing Valence to Colloids: Equilibrium Gels and Ultrastable Liquids”

Beside their technological applications, colloids have provided us with tunable model systems for exploring thermodynamic and kinetic phenomena of fundamental value. The hard-sphere crystallization, the glass transition, the range-controlled thermodynamic existence of the liquid state are beautiful examples of exploiting the "large atom" nature of colloids. In the last ten years, a significant effort has been put in the direction of providing valence to colloids, to move from colloidal atoms to colloidal molecules. A large amount of experimental, theoretical and numerical efforts has been devoted to the synthesis and to the investigation of these anisotropic colloids.

In the talk I will focus on the possibility of exploiting the possibility of controlling the interaction between colloidal particles to tackle fundamental issues in the molecular world. In particular I will discuss some recent experimental tests of the role of the valence in controlling the gas-liquid transition, the dynamics of formation of an equilibrium gel, the thermodynamic stability of the gel phase respect to crystallization. I will show that for patchy colloids with limited valence, conditions can be found for which the liquid phase is stable even in the zero-temperature limit. Limited valence colloids appear to be good candidates for providing insights in the dynamic arrest behavior of strong network forming liquids, like silica and silicon. Finally, if time allows me, I will present some very recent work where we elucidate, using colloidal models, the possibility of a liquid-liquid transition in water.

[1] S. Biffi et al., Proceedings National Academy of Science, 110, 15633-15637 (2013).

[2] F. Smallenburg and F. Sciortino, Liquids more stable than crystals in particles with limited valence and flexible bonds, Nature Physics, 9, 554-558, (2013).

[3] L. Rovigatti et al., Gels of DNA Nanostars Never Crystallize, ACS Nano, 10, 1021/nn501138w (2014)

[4] S. Roldan-Vargas et al., Gelling by heating, Scientific Report, 3, 2451 (2013).

[5] F. Smallenburg, L. Filion and F. Sciortino, Erasing no-man's land: a fully thermodynamically stable liquid-liquid transition in tetrahedral particles, Nature Physics, 10, 653 (2014).