CENTER FOR NEUTRON SCIENCE

UNIVERSITY OF DELAWARE
ENGINEERING

FRIDAY | JULY 29 | 10:00 AM | 366 CLB

ANDREA SCOTTI

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RWTH AACHEN UNIVERSITY

Join in-person in **366 CLB**
Or virtually: https://udel.zoom.us/j/98051682130
Password: Neutron$

PHASE BEHAVIOR AND STRUCTURE OF SUPER SOFT SPHERES IN TWO AND THREE DIMENSIONS

BIO: Andrea Scotti obtained his PhD in 2015 from ETH Zürich (Switzerland) performing his research between the Paul Scherrer Institute (PSI) and the Georgia Institute of Technology (GaTech, USA). His PhD thesis was awarded with the Young Scientist Prize of the Swiss Neutron Scattering Society. After a first postdoc at Lund University, he moved to Aachen where in 2017 he started his Alexander Von Humboldt fellowship. Since 2019, he is a Junior Group Leader at the Institute of Physical Chemistry at the RWTH Aachen university. The main subject of his research is experimental soft matter, with particular focus on the relationship between microscopic architecture of soft building blocks, e.g. microgels, and the macroscopic response of a soft material, both in three and two dimensions. Between the experimental tools he uses there are scattering (neutron, X-ray and light), reflectometry, rheology, computer simulations, interfacial techniques (Langmuir-Blodgett trough) and microscopy techniques (confocal, atomic force).

ABSTRACT: In our recent publications [1-4], we explored the phase behavior of super-soft spheres using solutions of ultra-low crosslinked poly(N-isopropylacrylamide)-based microgels as a model system.

We used SANS with contrast variation to directly access the microgel bulk modulus showing that is one order of magnitude smaller than for regular microgels [5]. In bulk, the samples show a liquid-to-crystal transition at higher volume fraction with respect to both hard spheres and stiffer microgels. Furthermore, stable body-centered cubic (bcc) crystals are observed in addition to the expected face-centered cubic (fcc) crystals. Small-angle X-ray and neutron scattering with contrast variation allow the characterization of both the microgel-to-microgel distance, and the architecture of single microgels in crowded solutions. The measurements reveal that the stable bcc crystals depend on the interplay between the collapse and the interpenetration of the external shell of the ultra-low crosslinked microgels [1]. This peculiar phase behavior is due to strong faceting of the particles, which we determine by combining data from small-angle neutron scattering with contrast variation and computer simulations [2,3].

Then, we confine them at liquid-liquid interface [4]. Atomic force measurements are used to study their phase behavior. In addition, neutron reflectivity and interfacial rheology are used to both their vertical extension of the monolayer [6]. Once confined at interfaces, these ultra-soft spheres show a behavior in between flexible macromolecules and hard particles [4, 6].

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References

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[2] A. Scotti. Soft Matter 17: 5548–5559 (2021).

[3] T. Höfken, C. Strauch, S. Schneider, A. Scotti. Nano Letters 22 :2412-2418 (2022).

[4] A. Scotti, S. Bochenek, M. Brugnoni, M. A. Fernandez-Rodriguez, M. F. Schulte, J. E. Houston, A. P. H. Gelissen, I. I. Potemkin, L. Isa, W. Richtering. Nature Communications 10: 1418 (2019).

[5] J. E. Houston, L. Fruhner, A. de la Cotte, J. Rojo González, A. Petrunin, U. Gasser, R. Schweins, J. Allgaier, W. Richtering, A. Fernandez-Nieves, and A. Scotti. Science Advances 8: eabn6129 (2022).

[6] S. Bochenek, F. Camerin, E. Zaccarelli, A. Maestro, M. M. Schmidt, W. Richtering and A. Scotti, Nature Communications, DOI: 10.1038/s41467-022-31209-3 (2022).