CMET/MSEG Seminar

University of Delaware

Dr. Max Wolff

Professor, Physics and Astronomy, Materials Physics

Uppsala University, Sweden

DATE:

Nov. 2, 2016

TIME:

1:00 p.m.

LOCATION:

366 CLB

Dr. Wolff received his M.S. from the Friedrich-Alexander-Universität Erlangen-Nürnberg in the field of quantum optics. His PhD project was in the field of neutron scattering form sheared liquids and a collaboration between the Ruhr-Universität Bochum and the Friedrich-Alexander-Universität Erlangen-Nürnberg. After his PhD, he was beamline manager at Institut Laue Langevin and assistant professor at Ruhr-Universität Bochum. Presently, he is an associate professor in the Division for Material Physics at Uppsala University. His research interests are on interface, confinement and non-equilibrium effects in condensed matter. In this context, he studies exchange coupling in thin film magnets as well as finite size effects in metal hydride systems. The focus of his research is on complex liquid systems, polymers and colloids, and on their self-assembly and phase behavior close to solid boundaries and under flow. The main research tool for his investigations are neutron and x-ray scattering methods, where he is interested in instrumentation and methods development. He is the author of numerous publications, including featured publications on polymers, simple liquids, and magnetism.

"New Light On An Old Problem: The Solid Liquid Boundary Condition"

Scattering methods are an extremely powerful tool for the determination of structure, dynamics and excitations in condensed matter physics. Depending on the probe used in such experiments surface or bulk properties can be addressed. Neutrons are characterized by a weak interaction for many engineering materials. As a result they can penetrate deeply into matter and are sensitive to light elements and magnetic induction. As a result neutrons offer an ideal probe for the investigation of soft matter, biological systems, as well as magnetic materials and are complementary to other techniques, like e.g. synchrotron radiation, ion or electron diffraction.

If applied under grazing incidence beam geometry (see figure 1, right panel) neutrons can offer surface sensitivity. If in addition to the specular reflectivity, off-specular scattering or the small angle scattering is collected, correlations in the plane of the interface can be analyzed.

After a very brief overview of the activities at the Physics Department and the Material Physics division at Uppsala University, I will focus on neutron scattering experiments probing the solid-liquid interface. Recently, it has been demonstrated that the traditionally assumed non-slip boundary condition does not always hold. The discontinuity at the interface can be quantified by a phenomenological number, the slip length (for definition see figure 1, left panel). However, the microscopic origin of slip is still not understood and different scenarios are proposed. Surface sensitive neutron scattering experiments can probe the density profile at the interface as well as lateral correlations or possibly even surface dynamics. Our recent findings, on polymers, self-assembled surfactants and simple liquids, demonstrate that slip in simple liquids cannot be explained by a density depleted layer alone. The local structure and dynamics in the liquid at the interface, which are highly sensitive to the interfacial energy, have to be taken into account as well.

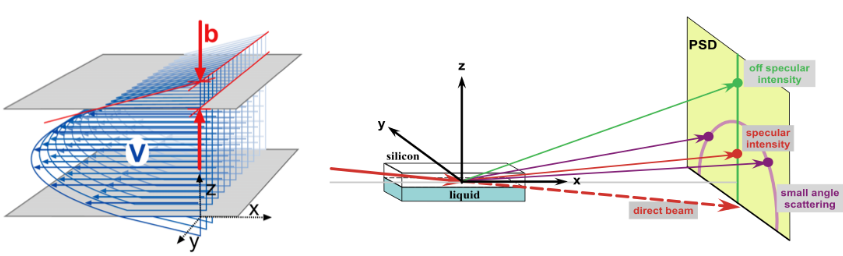

Figure 1: Flow profile for a liquid showing surface slip and definition of the slip length b (left panel). The panel on the right hand side depicts the scattering geometry for gracing incidence scattering experiments from the solid-liquid boundary.