



Joint LLC Seminar

Thursday September 28, 15:15
The Rydberg Lecture Hall, Dep. of Physics

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The Mystery of Water Revealed from X-ray Laser Studies

Water is of extreme importance for our society and the key component of life as we know it but it is also of extraordinary interest due to its remarkable physical properties that differ from almost all other liquids. Deviation of water's properties from a simple liquid exists already in the ambient temperature regime and then becomes strongly enhanced upon supercooling. In particular the finding that the thermodynamic response and correlation functions appear to diverge towards a singular temperature estimated by power-law fits of about 228 K has led to several hypotheses about the origin of water's anomalous properties. One hypothesis to explain the apparent divergence is that there exists a liquid-liquid transition with a liquid-liquid critical point at rather high positive pressures. In this scenario the Widom line, defined as the locus of correlation length maxima in the P-T plane, emanates from the critical point as a continuation of the liquid-liquid transition line into the one-phase region and the divergence in the response functions is towards this line. The challenge is that the temperature T_s lies below the homogeneous ice nucleation temperature 232 K, a region of the phase diagram that has been denoted as "no man's land", since ice crystallization occurs on much faster time scale compared to the experimentally accessible time scale in a typical laboratory setting.

Here I will present how x-rays from XFELs can be used to probe the liquid down to 227 K and thereby accessing the no-man's land providing new insight on supercooled water. I will also demonstrate how we can use coherent x-ray pulses to access equilibrium dynamics on times from seconds to 10th of femtoseconds. In particular I will discuss if a liquid-liquid transition, Widom line and a critical point exists in deep supercooled water causing fluctuations all the way up to ambient temperature.

**The Rydberg Lecture Hall is located at the Department of Physics,
Professorsgatan 1**

**Coffee and refreshments will be served
before the seminar, from 15:00**

