

# Anders Nilsson X-rays Shine Light on the Water Mystery

Water is the key compound for our existence on this planet and it is involved in many important physical, chemical, biological, and geological processes. Although water is the most common molecular substance it is also most unusual, with many anomalies in its thermodynamic properties such as compressibility, density variation, and heat capacity. The deviations of these properties are strongly enhanced upon supercooling water below the freezing point. The question of the structure of the hydrogen bonding network in water has been discussed intensively for over 100 years and has not yet been resolved. This talk will describe recent x-ray spectroscopy and scattering measurements, using both synchrotron radiation at the SSRL and the x-ray laser at the LCLS, at temperatures from deep supercooling to boiling. The results show that the liquid can be described as fluctuations between two types of local hydrogen bonded structures driven by incommensurate requirements for minimizing enthalpy and maximizing entropy. The connection of these results to low- and high-density water and the second critical point model will be discussed.

**Anders Nilsson** a graduate of Uppsala University in Sweden. In 2000, he accepted a faculty position at Stanford University and the SLAC National Accelerator Laboratory where he currently leads a research group of 10 people with a specialty in the utilization of x-rays to probe various aspects of chemical bonds. His research team studies catalytic processes in fuel cells, photoelectrochemical decomposition of water, hydrogen storage in carbon nanotubes, structure of liquid water and aqueous solutions, interfacial processes of relevance to molecular environmental science, electron-driven processes in aqueous systems, and ultrafast processes on surfaces and in water. He is Deputy Director for a new center focused on catalysis at Stanford University. He is also the current chair of the Photon Science faculty, which has a total of 28 faculty members. Recently, Nilsson received the Humboldt Research Award for senior researchers. He is co-author of 250 journal articles.

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