Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Laboratorium für Physikalische Chemie (LPC))

Einladung zu einem Kolloquium

Datum/Zeit:	**Dienstag, 18.02.2025, 09.00 Uhr**
Referent:	**Prof. Claudiu Stan** Physics Department, Rutgers University Newark, Newark, USA
Titel:	*Exploring the microscopic dynamics of spontaneous freezing in water droplets below 0 °C*
Ort:	**HIT F31.2**

Liquid water can be cooled below 0 °C, where is becomes supercooled and can freeze spontaneously. Supercooled water drops occur naturally in clouds, where their spontaneous freezing impacts the formation of precipitation and the radiative balance of Earth. The freezing of supercooled water drops is a complex stochastic process including nucleation, dendritic ice growth, and shape changes. As a result, no two droplets freeze exactly the same. To account for this randomness, we collected snapshot images and X-ray diffraction from tens of thousands of drops freezing in vacuum after homogeneous ice nucleation near −39 °C. Based on the drop images, we developed a seven-stage model of freezing and determined the kinetics of all freezing stages.
The random nature of nucleation limits the time resolution of experiments that aim to capture the dynamics of subsequent freezing. We mitigated this problem by using our freezing model to “time” our X-ray diffraction profiles. These time-resolved profiles captured the formation of long-range order in the ice crystals, which occurred in less than 1 ms. The ice formed just after freezing had a strained hexagonal structure, distinct from the stable hexagonal ice and from other metastable forms of ice. We also observed this type of ice after freezing warmer drops up to −10 °C, which suggests it is a transient but common structure of ice during freezing.

Gäste sind willkommen