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Coherent Bragg Imaging of Ice Growing in Supercooled Water

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ABSTRACT

Crystallization of liquid water and aqueous solutions is a common phenomenon which occurs frequently in our natural environment. Therefore, it is important to understand the dynamics of ice nucleation on a microscopic level. This will significantly promote the progress of science in relevant research fields such as biology, chemistry, atmospheric science and astronomy. The prevention of ice nucleation will reduce crystallization-induced freezing injuries and frost damages of cells and tissues during imaging. It can also be useful for cloud seeding to change the amount or type of participation and to study the effects of clouds on the climate. In astronomy, it can be applied as a potential tool to investigate the behavior of cometary nuclei and their activities in the solar system. In this project, we aim at imaging the ice crystals in supercooled water droplets and analyzing the diffraction patterns to see the changes of the crystal structure. We can get the information about the size and the shape of the crystals by analyzing the diffraction patterns [1]. In order to study the homogeneous and heterogeneous ice nucleation and crystal growth, an experimental setup that is capable of imaging droplets with a diameter size of 10-40 µm has been designed. Handmade gas-dynamic virtual nozzles can produce droplets of 1-10 µm in diameter, smaller than those produced by conventional Rayleigh jets. A liquid jet can be compressed by a gas focusing sheath to form a continuous delivery of microscopic droplets and reduce the clogging problems that are common with solid nozzles when producing small size of droplets.

REFERENCE

[1] J. A. Sellberg et al., Nature 510, 381 (2014).

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