How laboratory ice experiments enable observational analysis of star and planet formation

Melissa Mcclure*†[1]

[1]Leiden Observatory [Leiden] – Netherlands

Abstract

The elemental building blocks of most planets largely originate in the ice-mantled dust grains that grow in dense molecular clouds prior to the collapse of protostars. These astrophysical ice observations are essential to several fields, including ISM astrochemistry, star formation, protoplanetary disks, and ultimately exoplanetology. However, analysis of the astrophysical observations requires comparison with the results of laboratory ice experiments on Earth. These experiments, which take place under a variety of temperature and density conditions, enable the basic identification of various ice species through the assignment of specific spectral absorption bands. Additionally, laboratory experiments can reveal formation networks, reaction rates, and structural changes for ices, simulating their formation in the cold clouds and subsequent chemical evolution during infall to protoplanetary disks. Finally, experiments with heating, radiation, and energetic bombardment can also measure destruction rates by various mechanisms, enabling observers to predict where the influence of ice stops in planetary nurseries. I will introduce the most common types of laboratory experiments, give an overview of how they are used to complement astrophysical datasets, and end with future prospects for new lab experiments.

*Speaker

†Corresponding author: mcclure@strw.leidenuniv.nl