

Spectroscopy Studies on Ices of Astrophysical Relevance

Monday 15 September 2025 16:30 (30 minutes)

To this date, 20 different crystalline and at least 3 distinct amorphous forms of water ice have been discovered. While only hexagonal ice occurs naturally on Earth's surface, a variety of different ices is present in space, e.g. on icy moons, comets or interstellar dust grains. Water ice on these dust particles acts as a catalyst for the formation of complex organic molecules. Therefore, spectroscopic characterisation of water ices enables astrochemical exploration of icy objects.

However, there has been a hiatus of spectroscopic studies on ices after pioneering works from Whalley and co-workers in the 1960s, especially in the near-infrared (NIR) range (10000-4000 cm⁻¹ / 1-2.5 μm). The NIR range, however, is of high importance for the exploration of astronomical bodies, since NIR waves pierce through interstellar clouds, revealing objects lying behind.

Therefore, we here present [1-3] novel spectroscopic data of 11 crystalline and amorphous water ices in the near-infrared range (see Fig 1). The first overtone of the OH-stretching vibration is a powerful marker for density, porosity as well as hydrogen order, allowing for structural distinction of different ice structures present in space by telescopes such as the James Webb Space Telescope (JWST) or the JUICE mission.

REFERENCES

- [1] C. M. Tonauser et al., J. Phys. Chem. A (2021), 125, 1062.
- [2] C. M. Tonauser et al., Astrophys. J. (2024), 970, 82.
- [3] C. M. Tonauser et al., PRL (accepted June 2025)

Keywords

Medium, solid/surface

This abstract is submitted for....

Early-career researchers' workshop

Primary author: Dr TONAUER, Christina (FS-SMP (Spectroscopy of molecular processes))

Co-authors: HUCK, Christian (Universität Innsbruck); LOERTING, Thomas (Universität Innsbruck)

Presenter: Dr TONAUER, Christina (FS-SMP (Spectroscopy of molecular processes))