Laboratory Ice Research in the Era of the James Webb Space Telescope

Linnartz, H.*[,1] and members of the "Ice Age" JWST-ERS team
*linnartz@strw.leidenuniv.nl
[1]Laboratory for Astrophysics, Leiden Observatory, Leiden University, PO Box 9513, NL2300 RA Leiden, the Netherlands

With the recent launch of the JWST and the successful commissioning of all instruments on board, we are expecting to receive first data in the next months. A substantial amount of the observing time will be dedicated to ice features in the interstellar medium, in particular along lines of sight that provide snapshots of different stages in the process of star- and planet formation.
In support of these observations, dedicated laboratory experiments are performed that are the topic of this presentation. High resolution spectroscopic data allow to identify species accreted onto icy dust grains, or species formed there in solid state surface reactions. By systematically measuring selected species in chemically related ice matrices and for astronomically relevant temperatures, it becomes possible to say more about the specific ice conditions[1,2] by comparing observational data to data as collected in LIDA, the Leiden Ice Database for Astrochemistry.[3] LIDA (https://icedb.strw.leidenuniv.nl/) not only lists all relevant spectroscopic data, but also relevant optical constants and allows to fit and simulate astronomical spectra.[4] These comprise both small and simple species (e.g. H_2O, CO_2, NH_3, CH_4 and CH_3OH) and so called COMs, larger (≥ 6 atoms) complex organic molecules, that are considered building blocks of species relevant to the origin of life, i.e., alcohols, lipids, sugars and amino acids. The second part of the talk focuses on solid state (non)energetic processes that are relevant to understand the solid state formation of astronomically relevant species in dark and translucent interstellar clouds.[5,6,7,8] These include atom addition reactions and vacuum UV induced chemistry and the processes that are at play to bridge the grain-gas gap in space, connecting the upcoming JWST observations to data as already available from radio- and submm observatory, such as ALMA.

Note: References address specifically Leiden work. Excellent work by our colleagues is cited in the work listed below.

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[3] LIDA – the Leiden Ice Database for Astrochemistry - W.R.M. Rocha, M.G. Rachid, B. Olsthoorn, E.F. van Dishoeck, M.K. McClure, H. Linnartz, submitted.

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