The role of ices in star and planet formation

Supervision team: Dr Helen Jane Fraser and Prof Carole Haswell

External collaborators: Prof Paule Sonnentrucker (ESA JWST project director) and
Dr Klaus Pontoppidan (JWST science director) (both STSci)
Dr Alistair Glasse (UKATC)

Lead contact: Dr Helen Fraser helen.fraser@open.ac.uk

Overarching aim:-

Our scientific goal is to describe the role of condensed matter (ice) in star- and planet- forming regions.

This PhD:-

Working together with leading JWST scientists, the first aim of this PhD will be to develop unique data reduction, modelling and observational methods to study the formation, evolution and destruction of interstellar and protoplanetary ices, exploiting the capabilities and archival data from space-based IR telescopes such as JWST, SPHERE-X, AKARI and Spitzer, and in preparation for the ground-based ELT-Metis instrument. Significant emphasis will be placed on complimentary observations, particularly of discs and diffuse ISM regions, utilising ALMA and HST (archival and new data). The outcome will be to describe the "very first" and "very last" steps in the interstellar ice cycle – the onset of ice formation at the transition between diffuse and dense ISM, coupled with the incorporation of ices from protoplanetary discs into planetary systems.

Looking to the longer term career of the PhD student, the group are leading the IDEAS JWST cycle 1 proposal, and Co-I (but co-directing one work-package) in the "Ice Age" ERS proposal, with responsibility relating specifically to the software development for the slit-less spectroscopy ice-mapping capability on JWST. The L-M band spectrometer for the ELT-Metis is being built at UKATC, and this PhD will involve collaborative and preparatory modelling and simulations, working with the UKATC engineers and Metis science team. Therefore, opportunities exist for the student to be involved in major teams undertaking observational planning and simulations, alongside their own research on interstellar ices. There is also a small team of researchers at the OU already working on ice mapping and this PhD would be incorporated into this team. On this project we collaborative extensively with colleagues in the USA and UK, so secondments (Covid-pending) are a real possibility.

References:

1. Noble et al MNRAS (2017) 467 4753-4762
2. Noble et al (2013) ApJ 775 85
3. Suutarinen et al MNRAS (2014) 440 1844
4. Perotti et al A&A (2020) 643 23
5. Perotti et al ApJ (2020) *submitted*

Qualifications required: MPhys and not BSc qualification with significant project work / research projects / internships in observational and data-processing / image processing / software development for astronomy undertaken. Some understanding of basic chemistry and spectroscopy preferred but not essential.