IceAge: Chemical evolution of ices during star formation

Scientific Category:	Stellar Physics
Scientific Keywords:	Chemical Abundances, Dust, Interstellar Medium, Molecular Clouds, Pre-Main Sequence Stars
Alternate Category:	Planets and Planet Formation
Instruments:	NIRSPEC, MIRI, NIRCAM
Proprietary Period:	0 months
Allocation Information (in hours):	
Science Time:	13.4
Charged Time:	31.1

Abstract

Icy grain mantles are the main reservoir for volatile elements in star-forming regions across the Universe, as well as the formation site of pre-biotic complex organic molecules (COMs) seen in our Solar System. We propose to trace the evolution of pristine and complex ice chemistry in a representative low-mass star-forming region through observations of a: pre-stellar core, Class 0 protostar, Class I protostar, and protoplanetary disk. Comparing high spectral resolution (R~1500-3000) and sensitivity (S/N~100-300) observations from 3 to 15 um to template spectra, we will map the spatial distribution of ices down to ~20-50 AU in these targets to identify when, and at what visual extinction, the formation of each ice species begins. Such high-resolution spectra will allow us to search for new COMs, as well as distinguish between different ice morphologies, thermal histories, and mixing environments.

The analysis of these data will result in science products beneficial to Cycle 2 proposers. A newly updated public laboratory ice database will provide feature identifications for all of the expected ices, while a chemical model fit to the observed ice abundances will be released publically as a grid, with varied metallicity and UV fields to simulate other environments. We will create improved algorithms to extract NIRCAM WFSS spectra in crowded fields with extended sources as well as optimize the defringing of MIRI LRS spectra in order to recover broad spectral features. We anticipate that these resources will be particularly useful for astrochemistry and spectroscopy of fainter, extended targets like star forming regions of the SMC/LMC or more distant galaxies.

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