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# Marta De Simone - Reveal the chemical history of young protostars combining mm and cm wavelengths

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The early stages of the formation of a planetary system are represented by Solar-type protostars. Recent research suggests planet formation may begin already at these stages. Thus, the chemical content of protostars can be directly linked to what future forming planets can inherit. However, protostars are far to be fully chemically characterized. Indeed, among various protostars, a chemical diversity in their millimeter spectra has been observed and it is not well understood yet. The gaseous chemical content of protostars depends on the composition of the icy dust grain mantles formed before collapse begins. Directly measuring the ice mantle composition in these embedded objects is challenging, but it can be inferred indirectly by observing the ice major species once they are release into the gas phase during the warm protostellar stage. In this contribution, I will show the results from our VLA high spatial resolution (~300 au) observations of NH3 and CH3OH (critical ice mantle tracers). By comparing the NH3/CH3OH ratio with up-to-date astrochemical models, we were able to retrieve the chemical and dynamical history of the NGC1333 IRAS 4 protostars (De Simone et al. 2022, ApJL). The three protostars share the same history, characterized by a rapid collapse triggered by a brutal external event (De Simone et al. 2022, MNRAS), which set the observed chemistry. These findings highlight the crucial role of low frequency observations in retrieving i) the dust contribution in absorbing the molecular emission, ii) the protostellar ice mantle history, and iii) the dynamics of the protostars'birth environment. In this context, the upcoming facilities at lower frequencies (e.g., ALMA Band 1, SKA, and ngVLA) enables the observation of several complex species, with lower abundances than CH3OH, in a wavelength regime where the dust absorption is minimized, fully sampling the planet-forming protostellar region (<50 au).

**Session Classification:** Planet-forming disks