

# Investigating molecular tracers of planet formation in the CI Tau disk

Authors : Axelle Laluyaux<sup>1,2</sup>, Greta Guidi <sup>2</sup>, François Ménard<sup>2</sup>

<sup>1</sup> *University of Reims Champagne-Ardenne, Reims, France*

<sup>2</sup> *University Grenoble Alpes, CNRS, IPAG, Grenoble, France*

Protoplanetary disks around stars are the birthplace of planets, where they form from their solid and gaseous material across a few million years.

The development of a new generation of high-performance instruments has enabled observations of protoplanetary disks with significantly improved resolution and sensitivity, leading to a much more detailed understanding of their internal structures. This has led to the detection of complex substructures, such as rings, gaps, and spiral arms, suggesting that planet formation may occur much earlier than previously thought.

Numerical simulations of planet–disk interactions suggest that embedded protoplanets can induce a highly dynamical and collisional environment within the disk. These enhanced collisions between dust grains can lead to their fragmentation, producing a population of so-called second-generation dust. Unlike primordial dust inherited from the initial molecular cloud, this newly formed dust is a direct consequence of ongoing planet formation processes. Although it cannot be observed directly, it is expected to be associated with specific chemical signatures—so-called shock tracers—released during grain destruction. Detecting these tracers therefore provides an indirect way to probe the presence of forming planets within protoplanetary disks.

The new data of the protoplanetary disk CI Tau, taken at 3 mm by the radio interferometer NOEMA, consists in a deep spectral survey of the main shock tracers that would result from dust grains destruction, such as SiS and SiO. Molecules like HCN or CH<sub>3</sub>OH are also to be found.

I will present the results of my analysis of the high-resolution spectra of all the targeted lines from silicon-bearing species and methanol, as well as other molecular species, in order to assess their potential as tracers of dust destruction and to constrain the presence of ongoing planet formation within the CI Tau disk.