ÖAW — ÖSTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN

PLANET-FORMING DISKS AND ASTROCHEMISTRY

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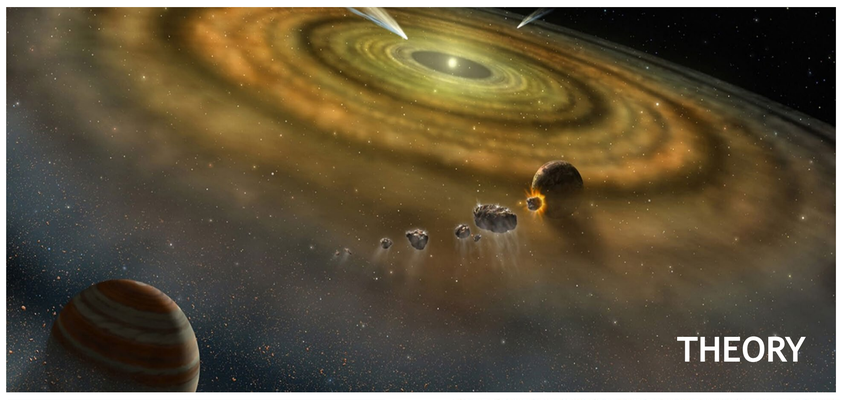
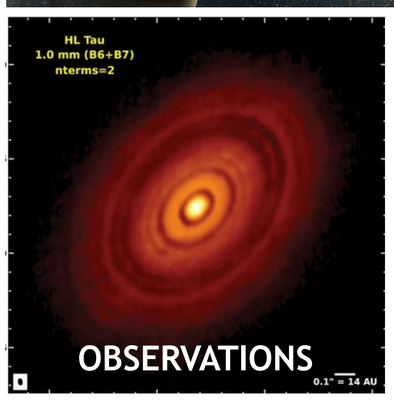
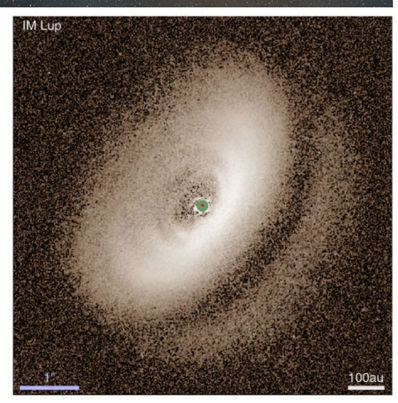
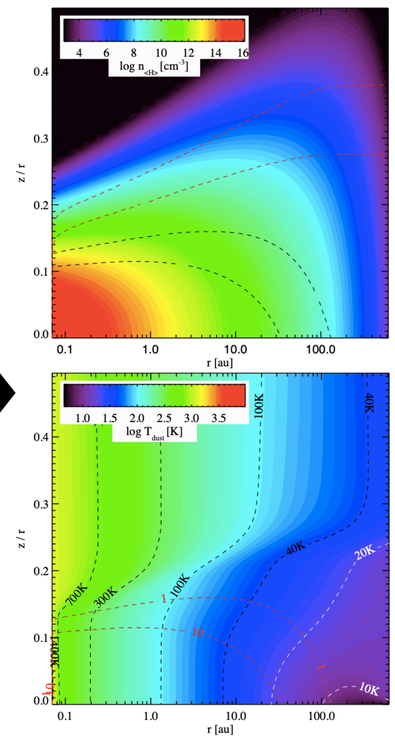
MORE ABOUT US

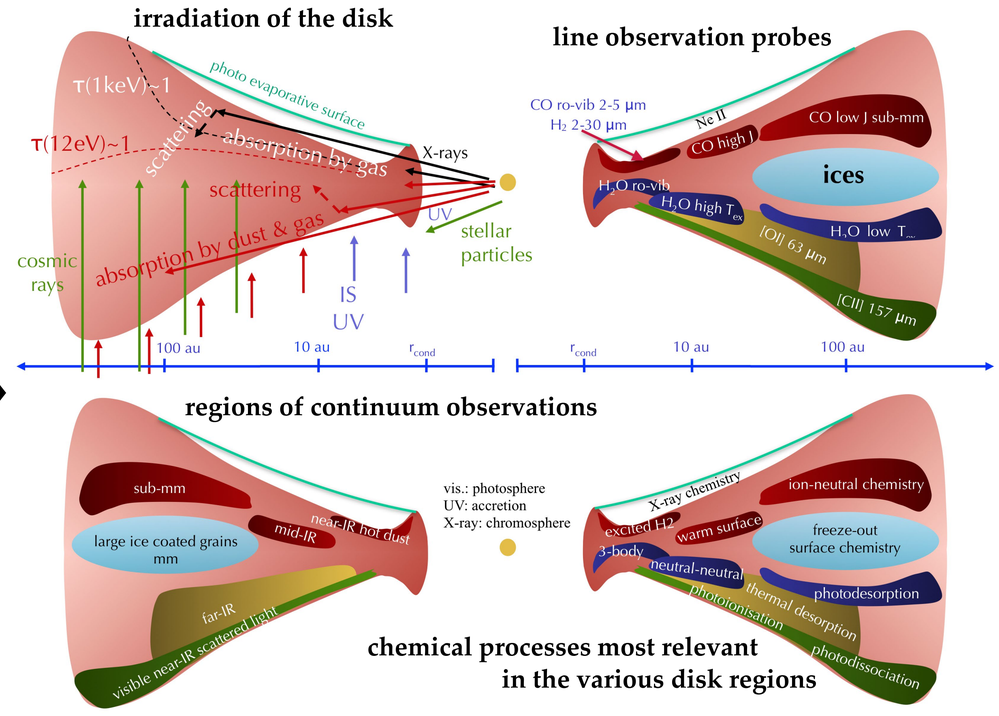








MODELING



PREDICTIONS AND INSIGHTS

MAIN RESEARCH QUESTIONS

We are interested in the physics and chemistry of disks that surround newborn stars, their observational signatures, and conditions for formation of planetary systems. We are working on questions such as:

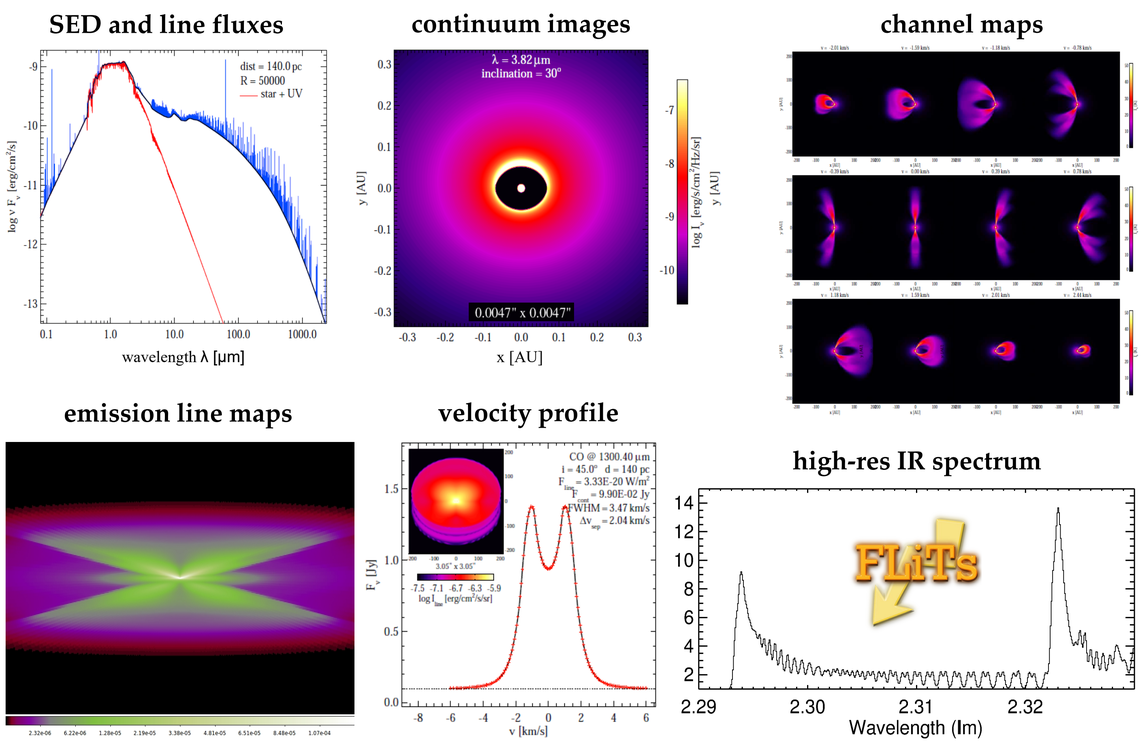
- **What is the chemical and thermal structure in planet-forming disks?**
- **How do complex molecules and ice phases form in disks and evolve in time?**
- **What is the impact of the thermo-chemical structure on dust growth and planet formation?**
- **What is the initial composition of the refractory materials that are formed during the earliest stages of disk evolution?**

THEORY & OBSERVATIONS: PLANET-FORMING DISKS

When molecular clouds collapse under their own gravity to form new stars, the leftover gas and dust will accumulate in such disks and continue to rotate on nearly circular orbits around these new-born stars for a few million years. This sets the stage for planet formation.

ASTROCHEMICAL DISK MODELING

To understand the resulting numbers, sizes, and chemical composition of the resulting planets, we need to understand the physical and chemical evolution in these disks, prior and during planet formation. Our ProDiMo disc models predict the physical and chemical disk structure which are then used to predict an ensemble of multi-wavelength line and continuum observations.

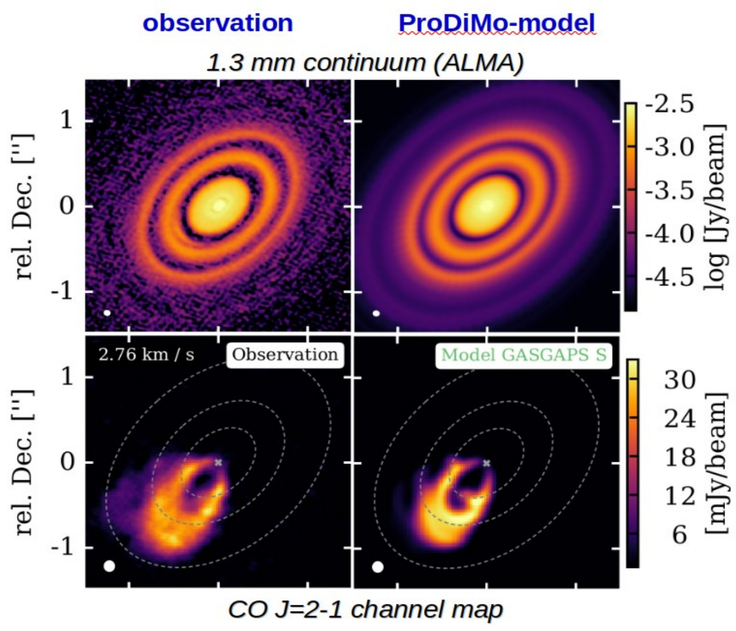


Multiwavelength predicted observations using ProDiMo

PRODIMO FRAMEWORK

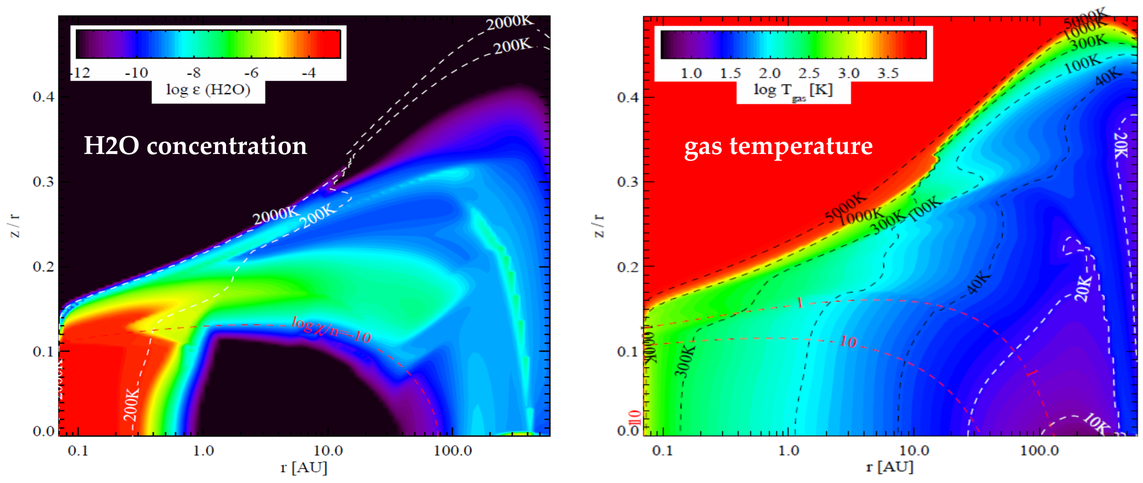
ProDiMo (PROtoplanetary DIsk MOdel) is a scientific software package in FORTRAN 90 to model planet-forming disks including gas phase chemistry, cosmic ray and X-ray processes, UV-photo-chemistry, ice formation, gas heating & cooling balance, disk structure and dust & line radiative transfer.

ProDiMo can predict continuum images and molecular line channel maps at all wavelengths.



ProDiMo collaboration

Left: The figure shows a fit to ALMA observations of HD163296. The CO J=2-1 signal is slightly brighter in the dust gaps, because at 1.3 mm we can see through the dust in the gaps, which we cannot in the rings.



Predicted water concentration and disk gas temperature structure

RECENT PUBLICATIONS

- **Observing Circumplanetary Disks** with METIS Oberg, N.; Kamp, I.; Cazaux, S. et al. (2023) A&A, Submitted
- **Forming Planets** Around Stars With Non-Solar Elemental Composition. Jorge, D. M.; Kamp, I. E. E.; Waters, L. B. F. M.; Woitke, P. et al. (2022) A&A 660, A85
- **Primordial Dusty Rings** and Episodic Outbursts in Protoplanetary Discs. Kadam, K.; Vorobyov, E; Basu, S. (2022) MNRAS.516.4448K
- **Circumplanetary Disk Ices.** I. Ice Formation vs. Viscous Evolution and Grain Drift. Oberg, N.; Kamp, I.; Cazaux, S.; Woitke, P. ; Thi, W. F. (2022) A&A 667, A95
- Mixing and Diffusion in **Protoplanetary Disc Chemistry**. Woitke, P.; Arabhavi, A. M.; Kamp, I. et al. (2022) A&A 668,164
- Observations of PAHs in the **Atmospheres of Discs and Exoplanets**. Ercolano, B.; Rab, C.; Molaverdikhani, K. et al. (2022) MNRAS.512..430E

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