Physicochemical modelling of protoplanetary disks

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Planetary systems just like our own Solar System are born in protoplanetary disks around countless young stars. These systems vary in the initial physical and chemical conditions, which in turn set the physical parameters and chemical budgets of protoplanetary disks. Both have crucial consequences for the elemental abundances of protoplanetary building blocks and the composition of volatiles in the disk. In this project, the goal of the student is to run physicochemical models and to identify the most important initial parameters for the chemical composition of the subsequently formed protoplanetary disk.

Key questions are:

- **How important is the exact prestellar volatile composition for the volatiles in protoplanetary disk midplanes?**
- **Are there any disk chemical tracers that serve as diagnostics of the parent cloud chemistry?**

Main steps of the project:

1. Set up the physical and chemical models, including radiative transfer with RADMC3D
2. Compare the results of the initial test run with published results for water and methanol
3. Vary physical parameters to understand the variety of formed protoplanetary disks
4. Vary chemical and physical parameters to see the variability in the midplane compositions

Skills learned/Knowledge gained by the student during the project:

- Physicochemical structure of low-mass star-forming regions
- Chemistry in the ISM, including grain-surface chemistry
- Physicochemical modelling (semi-analytic physical model and full kinetic chemistry)
- Radiative transfer (RADMC3D)