

Interstellar Methanol from the Lab to Protoplanetary Disks

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Keywords. astrochemistry, stars: formation, (stars:) planetary systems: protoplanetary disks

1. Summary

Interstellar methanol is thought to be the precursor of larger, more complex organic molecules. It holds a central role in many astrochemical models (e.g., Garrod & Herbst 2006). Methanol has also been the focus of several laboratory studies (e.g., Watanabe *et al.* 2004, Fuchs *et al.* 2009), in an effort to gain insight into grain-surface chemistry, which potentially builds chemical complexity already in the cold, dark prestellar phase. The case of methanol is a prime example of experimental work having implications on astronomical scales. Drozdovskaya *et al.* (2014) unified physical and chemical models to simulate infalling material during the birth of a low-mass protostar. An axisymmetric 2D semi-analytic collapse model (Visser *et al.* 2009), wavelength-dependent radiative transfer calculations with RADMC3D (Dullemond & Dominik 2004) and a comprehensive gas-grain chemical network (Walsh *et al.* 2014) were used to study two modes of protoplanetary disk formation. One mode predominantly grows the disk via viscous spreading, while the other by the continuous infall of matter. Drozdovskaya *et al.* (2014) conclusively showed that the abundance and distribution of methanol in the disk is determined by the infall path, leading to regions in which methanol is enhanced and/or depleted relative to what is expected for static models of protoplanetary disks. The results for the comet-forming zone show a level of depletion for methanol commensurate with that observed towards cometary comae (e.g., Mumma & Charnley 2011) showing that chemical processing en route from protostar to protoplanetary disk is important for setting the composition of comet- and planet-building material. The ties between extrasolar systems and Solar System bodies are now being tested by cometary data from the *Rosetta* mission and protoplanetary disk observations by ALMA (Drozdovskaya *et al.* in prep.).

References

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