From Intersetallar Ices to PAHs
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# INVITED TALK

## Grain surface chemistry driven by surface mobility

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The formation of many saturated species that have been observed in a wide variety of astronomical objects cannot be explained by gas phase chemistry alone and it is clear that surface chemistry must play a crucial role. For most of this chemistry diffusion is the rate limiting step. I will show computational results on the thermal diffusion of $H_2O$, CO and $CO_2$ on water ice and how these diffusion rates can be estimated from the binding energy of the species to the surface (Karssemeijer et al. 2012, 2014a-b, Pedersen et al. 2015). Since diffusion barriers are hard to obtain experimentally, this will allow modelers to still have access to this data, since binding energy information is more available. Also to this area Louis Allamandola had a major contribution.

Many species need an elevated temperature to reach an appreciable diffusion rate. Other non-thermal diffusion processes might play a role at low temperatures, where excess energy released through surface reactions, photodissociation reactions or adsorption processes can be applied for diffusion. I will present some first results of energy dissipation studies on this mechanism. These processes impact not only on the surface chemistry but also on thermal and non-thermal desorption rate, such as reactive desorption. Non-thermal desorption is often evoked to explain observed gas phase abundances in cold regions. I will focus on simple molecular species, like $CO_2$, but I aim to make it more general to obtain predictive power for more complex species.

### REFERENCES

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