Simulations of energy dissipation and non-thermal desorption on amorphous solid water

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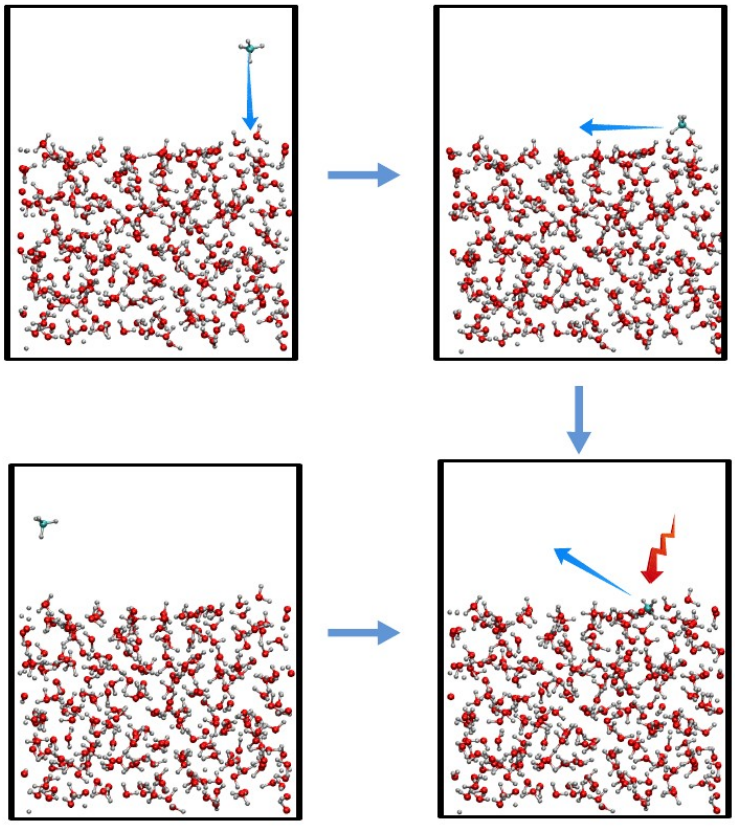
Dust particles covered by icy mantles play a crucial role in the formation of molecules in the Interstellar Medium (ISM). These icy mantles are mainly composed of water but many other chemical species are also contained in these ices. These compounds can diffuse and meet each other to react. It is through these surface reactions that new saturated species are formed. Photodissociation reactions are also thought to play a crucial role in the formation of radical species. Complex organic molecules are formed through an intricated network of photodissociation and surface reactions.



Both type of reactions release energy. Surface reactions are typically exothermic by a few eV, whereas photodissociation reactions are triggered by the absorption of a UV photon, resulting in the formation of highly excited products. The excited reaction products can apply this energy for desorption or diffusion, making products more mobile than predicted when considering only thermal hopping. The energy could further lead to annealing or deformation of the ice structure.

Here we would like to quantify the relative importance of these different energy dissipation routes. For this we performed thousands of Molecular Dynamics simulations for three different species (CO_2, H_2O and CH_4) on top of a water ice surface [2]. We consider different types of excitation such as translational, rotational, and/or vibrational excitation. The applied substrate is an amorphous solid water surface (ASW) [3].

References:
[1] R. T. Garrod, S. L. W. Weaver, and E. Herbst. Astrophys. J, **682,** 238 (2008)
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