

# Formation of formaldehyde through methanol-ice-mantle (CH<sub>3</sub>OH)<sub>10</sub> bombardment by OH<sup>+</sup> cation

Inostroza-Pino N.

Macleod-Carey D.

Heyser C.

Mardones D.

Espinoza C.

Ge J.

## Abstract

**Context.** Formaldehyde H<sub>2</sub>CO was the first organic polyatomic molecule discovered in the interstellar medium to have been detected in a variety of sources. However, pathways to synthesize this molecule under interstellar conditions have yet to be discussed. **Aims.** We carried out a systematic study to analyze the chemical processes that can explain the H<sub>2</sub>CO formation mechanism toward a decamer of methanol (CH<sub>3</sub>OH)<sub>10</sub> as target material to mimic an ice mantle bombarded by an OH<sup>+</sup> cation. **Methods.** We performed Born-Oppenheimer (ab initio) molecular dynamics simulations to obtain the formation mechanisms of complex organic molecules (COMs) such as formaldehyde H<sub>2</sub>CO and its HCOH isomer. **Results.** We found that CH<sub>2</sub>OH<sup>+</sup> and CH<sub>2</sub>(OH)<sub>2</sub> are the main precursors to form H<sub>2</sub>CO and HCOH. We discuss its formation mechanisms and the astrophysical implications in star-forming regions. These processes are likely relevant to the production of COMs. © ESO 2021.

## Author keywords

Astrochemistry; ISM: molecules; Molecular processes