

The excitation of interstellar reactive molecules:

state of the art and challenges

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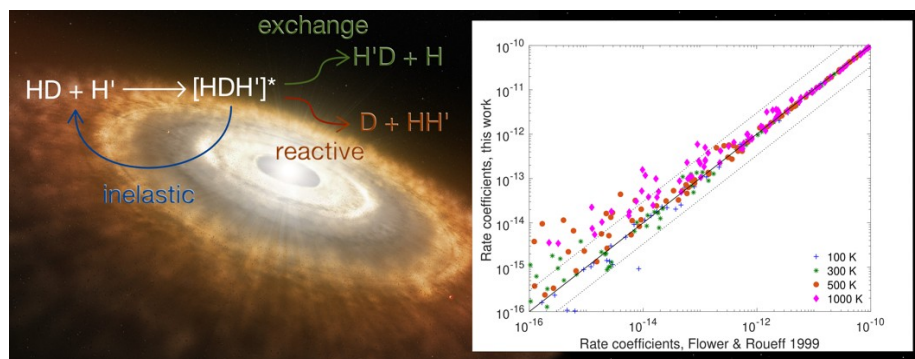
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Accurate determination of physical conditions of interstellar molecular clouds is a crucial step to better understand the life cycle of the interstellar matter and particularly the formation of stars and planets. A key parameter for the determination of these conditions from interstellar spectra is the calculation of accurate collisional rate coefficients of interstellar molecules with the most abundant species.

Whereas the knowledge of collisional processes has reached a certain level of maturity for collisions involving non-reactive molecules, very few reliable data exist for collisions involving reactive radicals and ions. The computation of such data is a real challenge since inelastic and reactive processes compete during collisions. In the COLLEXISM project [1], we plan to overcome this complex problem and to provide collisional data for these radicals and ions in order to derive as much information as possible from the molecular spectra collected by current telescopes.

In this talk, I will review the recent results [2-4] we have obtained in this project and I will highlight the theoretical challenges we have overcome [5]. I will also focus on the astrophysical consequences of our new theoretical collisional data. I will emphasize remaining challenges in the field.

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References

- [1] <https://collexism.com>
- [2] Demes et al. *MNRAS* **509**, 1252 (2022)
- [3] Pirlo et al., *J. Chem. Phys.* **155**, 134303 (2021)
- [4] Desrousseaux et al., *PCCP* **23**, 19202 (2021)
- [5] Konings et al., *J. Chem. Phys.* **155**, 104302 (2021)