LABORATORY INVESTIGATION OF CARBON-SULFUR SPECIES FOR ASTROCHEMISTRY: ONE YEAR LATER

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In this study, we continue our discussion from last year on laboratory investigations of carbon-sulfur compounds. These compounds form a significant part of the chemical makeup found in interstellar gas and dust, making their laboratory characterization highly relevant to the astrochemical community. This year, our focus is on the spectroscopic characterization of the millimeter and submillimeter rotational spectra of two molecular species observed in space: deuterated thioformaldehyde (D_2CS) and the higher energy isomeric form of protonated OCS ($HOCS^+$).

Deuterated thioformaldehyde is a well-known molecule, abundant and widespread in the interstellar medium. In this work we will show our recent extension of its laboratory rotational spectrum into the sub-THz range, accompanied by high-level coupled cluster quantum chemical calculations of the global [D_2,C,S] system.[a]

Protonated OCS has been recently detected in the interstellar medium towards the G+0.693-0.027 molecular cloud in the Galactic Centre[b], in its $HOCS^+$ form, despite being $\sim$5kcal/mol ($\sim$2500K) higher in energy than the $HSCO^+$ isomeric form, still undetected in space. Motivated by this new observational study we have investigated and detected the millimeter rotational spectrum of HOCS+, and we will present here the main laboratory details along with the outcomes of our analysis.

[a] Inostroza-Pino, N., et al., Molecular Physics e2280762 (2023)

[b] Sanz-Novo, M., et al., arXiv:2402.15405 (2024)