A Computational and Observational Investigation of Interstellar Thioformaldehyde

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Interstellar spectroscopy of thioformaldehyde (H$_2$CS) holds substantial promise because of the close relationship between the H$_2$CS molecule and the well-studied formaldehyde (H$_2$CO) molecule. We present here a summary of our computational investigation of H$_2$CS level populations and their relationship to known H$_2$CO masers. The details of a recent observational search for emission and absorption of four H$_2$CS isotopologues will also be discussed. The nonthermal pump model developed by Boland and de Jong (1981) for the 4.8-GHz (J=1) transition of H$_2$CO has been updated and extended to both the analogous ground state transition and the J=2 transition of four thioformaldehyde isotopologues. Preliminary results from our model suggest the possibility of nonthermal maser emission from any of these isotopologues at either transition. Using the Green Bank Telescope, we performed the first search of the Galactic star-forming region NGC 7538 for thermal and nonthermal emission and absorption at the J=1 level from all of the considered isotopologues. Although the search did not result in a detection of the elusive J=1 line of H$_2$CS, it has provided the most sensitive upper-limit to date for the sulfur-to-oxygen ratio in this important region.

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