INTERSTELLAR METHANOL

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Methanol is one of the most prolific interstellar molecules and many hundreds of its rotational transitions have been detected at centimeter, millimeter, and submillimeter wavelengths toward molecular clouds throughout the Milky Way as well as in external galaxies. Most remarkably, various methanol lines show very strong maser action arising from the hot, dense regions surrounding newly born massive stars and are thus important probes of the star-forming process.

Here we summarize the rich phenomenology of interstellar methanol and, in particular, discuss the molecule's excitation under astrophysical conditions, which is dominated by collisions with molecular hydrogen molecules and/or pumping by far-infrared radiation emitted by warm interstellar dust grains.

We emphasize the importance of ever-improving laboratory spectroscopy data for the interpretation of the astronomical observations. In the case of methanol, the fitting of extensive laboratory measurements by a modified internal axis method has resulted in a comprehensive database of line frequencies, which provides invaluable input for the interpretation of the often very complex submillimeter spectra from many astronomical sources.