MILLIMETER WAVE SPECTROSCOPY OF TITANIUM MONOXIDE AND TITANIUM DIOXIDE

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Titanium monoxide, TiO, is a well known astronomical molecule that exhibits prominent electronic absorption lines in the spectra of M and S stars. We present here improved rotational transition frequencies for an astronomical search in the radio band [a]. The recent laboratory detection of TiO_2 in the cm-wave region and its tentative detection in the oxygen-rich supergiant VY CMa [b] prompted us to record its rotational spectrum in the mm-wave region.

The measurements on TiO and TiO_2 were carried out in the frequency range 248-345 GHz using a BWO spectrometer combined with a laser ablation supersonic jet apparatus. Both species were produced by focusing a Nd:YAG laser onto a rod of either pure titanium or titanium dioxide and adding small amounts of oxygen to the He buffer gas. For TiO_2, fifty b-type rotational transitions of the main isotopomer $^{48}TiO_2$ and six transitions of $^{46}TiO_2$ have been measured up to $J = 22$ and $K_a = 8$. For TiO 14 transitions of each of the ^{46}Ti, ^{48}Ti, and ^{50}Ti isotopomers were recorded.

The new transitions have been analysed together with previously reported spectral data and improved rotational and centrifugal distortion constants were obtained, providing accurate transition frequencies for future astronomical searches.

[a] K. Namiki et al., JMS 191, 176-182 (1998)

[b] S. Brünken et al., ApJ, in press (2008)