CALCULATIONS OF CH$_3$D-H$_2$ LINE-BROADENING COEFFICIENTS AND THEIR TEMPERATURE-DEPENDENCE CHARACTERISTICS FOR INFRARED ABSORPTION BANDS

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The role of monodeuterated methane in the studies of terrestrial and planetary atmospheres is well known. It is an atmospheric trace gas that along with the parent methane molecule is one of greenhouse gases and contributes to global temperature rise. The atmospheres of Titan, Jupiter, Neptune, Uranus and Saturn also contain CH$_3$D. Remote sensing and radiative transfer modelling for these atmospheres require therefore a precise knowledge of line-shape parameters (first of all broadening coefficients) for the main atmospheric perturbers N$_2$, O$_2$, H$_2$, etc. together with their temperature dependences.

In the present paper we report calculated CH$_3$D-H$_2$ line-broadening coefficients as well as associated temperature-dependence parameters for a range of temperatures relevant to planetary atmospheres where CH$_4$ and its isotopologues are present in quite high abundances. These calculations are done with the use of a semi-empirical approach [1] based on the straight-line trajectory approximation modified by an empirical correction factor which accounts for the real trajectory curvature, vibrational dependence and realistic scattering matrix. The data are reported for the rotational quantum numbers $0 \leq J \leq 70$ and $K \leq 20$ requested typically for spectroscopic databases and can be useful for astrophysical and planetary-science applications.

This work has been supported by the LIA SAMIA (Laboratoire International Associé "Spectroscopie d’Absorption de Molécules d’Intérêt Atmosphérique et planétoplogique: de l’innovation instrumentale à la modélisation globale et aux bases de données") and by the RFBR (Russian Foundation for Basic Research) under the grant number 17-52-16022.