THE REVISED METHANE DATABASE IN HITRAN 2012

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The new compilation of methane molecular line parameters will be described.[a] Updates incorporate new global analyses and measurements for $^{12}CH_4$, $^{13}CH_4$ and $^{12}CH_3D$. With a minimum intensity (in cm/molecule at 296 K) set to 10^{-37} for the far-IR and 10^{-29} for the mid- and near-IR, the new database contains nearly 650,000 lines between 0 and 11502 cm^{-1}, more than double the 290,000 methane lines in HITRAN 2008. Part of the database size occurs because the minimum intensity criterion for the new calculated infrared transitions is lowered by two orders of magnitude to include weaker transitions important for outer planet and exoplanet atmospheres. Some 74000 lines from the 2008 HITRAN methane database are retained: $^{13}CH_4$ from 6 to 8 μm, ν_6 of $^{13}CH_3D$ near 8.7 μm, $^{12}CH_3D$ (7 - 4076 cm^{-1}) and CH_4 (4800 to 5550 cm^{-1} and 8000 to 9200 cm^{-1}). New global analyses for $^{12}CH_4$ and $^{13}CH_4$ bands provide better predictions of the dyad, pentad and octad vibrational states up through 2.2 μm. For the first time, $^{12}CH_3D$ and $^{13}CH_4$ bands near 2.3 μm are included. Above 5550 cm^{-1}, the new database consists of many more observed line positions and intensities. Some 20,000 of the lines from prior laboratory results are replaced by over 68,000 features measured by new FTIR (5550 to 5852 cm^{-1}) and DAS and CRDS (5852 to 7912 cm^{-1}) studies reported since 2009. Intensities retrieved at cold and room temperatures provide empirical lower state energies for many observed $^{12}CH_4$, $^{13}CH_4$ and $^{12}CH_3D$ features; where possible, confirmed quantum assignments are included. Finally, over 11000 measured positions, intensities and empirical lower state energies from cold CH_4 are compiled for the first time between 10923 and 11502 cm^{-1}. Available Voigt pressure broadening measurements from HITRAN 2008 are transferred into the new compilation, but most lines are given crudely-estimated coefficients. New measured intensities and nitrogen- and self-broadening coefficients are inserted for selected far-IR transitions. In addition, high accuracy measured line positions are used for selected ν_3 and $2\nu_3$ transitions. The substantial contributions from many different investigators will be shown.[b]

[a]This compilation results from the work of many authors whose names will be cited in the oral presentation.

[b]Part of the research described in this paper was performed at the Jet Propulsion Laboratory, California Institute of Technology, under contracts and cooperative agreements with the National Aeronautics and Space Administration.