The HITRAN Molecular Database

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Abstract. This presentation provides an overview of the updates and extensions of the HITRAN molecular spectroscopic absorption database.[1] The new significantly improved parameters for the major atmospheric absorbers (for instance H_2O and O_2) have been given particular attention. For most of the molecules, spectral parameters have been revised and updated. The new edition also features many new spectral bands and new isotopic species. The cross-section part of the database has also been significantly extended by adding new species as well as more temperature-pressure sets for existing species. In addition, HITRAN now provides the collision-induced absorption parameters, including those relevant to the terrestrial atmosphere: N_2–N_2, N_2–O_2, O_2–O_2.[2]

The study of the spectroscopic signatures of planetary atmospheres is a powerful tool for extracting detailed information concerning their constituents and thermodynamic properties. The HITRAN molecular spectroscopic database has traditionally served researchers involved with terrestrial atmospheric problems, such as remote sensing of constituents in the atmosphere, pollution monitoring at the surface, and numerous environmental issues. In collaboration with laboratories across the globe, an extensive effort is currently underway to extend the HITRAN database to have capabilities for investigating a variety of planetary atmospheres. Spectroscopic parameters for gases and spectral bands of molecules that are germane to the studies of planetary atmospheres are being assembled. These parameters include the types of data that have already been considered for transmission and radiance algorithms, such as line position, intensity, broadening coefficients, lower-state energies, and temperature dependence values.

A number of new molecules, including H_2, CS, C_4H_2, HC_3N, and C_2N_2, are being incorporated into HITRAN, while several other molecules are pending. For some of the molecules, additional parameters, beyond those currently considered for the terrestrial atmosphere, are being archived. Examples are collision-broadened half widths due to various foreign partners, collision-induced absorption, and temperature dependence factors. Collision-induced absorption data for H_2–H_2, H_2–N_2, H_2–He, H_2–CH_4, CH_4–CH_4, O_2–CO_2 and N_2–CH_4 were recently released.[2] Partition sums, that are necessary for applications at a wide range of temperatures, have also been calculated for a variety of molecules of planetary interest,[3] and form an integral part of the HITRAN compilation.

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References

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