HIGH-ACCURACY HIGH-TEMPERATURE PRESSURE BROADENING AND LINE POSITIONS FOR MODELING H_2O AND CH_4 IN EXOPLANET ATMOSPHERES

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Infrared line positions and pressure-broadening data of atmospheric key absorbers H_2O and CH_4 strongly impact the interpretation of exoplanetary observational data. The inaccuracy of absorption cross-sections (opacity data) biases atmospheric radiative transfer modeling. The detection of CH_4, for instance, is still under debate, despite extensive endeavors to model the chemical composition of exoplanetary atmospheres. To this end, we are carrying out the following projects.

First, high-resolution high-temperature H_2-pressure-broadened spectra are recorded for the CH_4 ν_3-band P-branch. Measured linewidths for 112 transitions between 2840 and 3000 cm^{-1} with temperature and pressures ranging between 300 and 700 K, and 10 and 933 Torr, respectively, were used to find rotation- and tetrahedral-symmetry-dependent coefficients for pressure and temperature broadening and pressure-induced lineshifts.

Second, we are currently investigating the impact on H_2O absorption cross-sections of various line lists (e.g., POKAZATEL vs. BT2). We assess the potential bias when interpreting the cross-correlation function through Earth-based observations. We report our progress in measuring high-temperature H_2O line positions.