HITRAN AND HITEMP DATABASES IN THE ERA OF JWST (JUST WHEN SPECTROSCOPY THRIVES)

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The HITRAN and HITEMP molecular spectroscopic databases are critical for interpreting and modeling planetary spectra, including those of moons and exoplanets. With the launch of JWST, we have a unique opportunity to observe exoplanetary atmospheres that are very diverse in temperature, pressure, and composition. However, to fully utilize this opportunity, we need to ensure that the spectroscopic databases are up for the challenge.

To this end, the HITRAN2020 edition has made significant improvements to enhance the scientific output of the JWST mission. For example, broadening parameters due to the ambient pressure of He-, H_2-, CO_2, and H_2O gases have been added for many HITRAN molecules. This addition is crucial since hydrogen and helium are the primary constituents in the atmospheres of gas giants, while carbon dioxide and water vapor dominate the atmospheres of many rocky planets. Furthermore, spectral and dynamic ranges for many relevant molecules have been extended, and new isotopologues have been added. Additionally, six new molecules have been included bringing the total to 55. There are also experimental cross-sections for over 300 molecules for which no reliable quantum mechanical models exist yet. Another significant improvement is the substantial update that has been made to the database of collision-induced absorption.

This presentation will highlight the state-of-the-art data available in HITRAN, as well as the significant updates that HITEMP is currently undergoing. We will also discuss the next steps and data demands required to continue advancing our understanding of planetary atmospheres.