Update from the Analysis of High Resolution Propane Spectra and the Interpretation of Titan's Infrared Spectra

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Titan has an extremely thick atmosphere dominated by nitrogen, but includes a range of trace species such as hydrocarbons and nitriles. One such hydrocarbon is propane (C_3H_8). Propane has 21 active IR bands covering broad regions of the mid-infrared. Therefore, its ubiquitous signature may potentially mask weaker signatures of other undetected species with important roles in Titan's chemistry. Cassini's Composite Infrared Spectrometer (CIRS) observations of Titan's atmosphere hint at the presence of such molecules. Unfortunately, C_3H_8 line atlases for the vibration bands v_8, v_{21}, v_{20}, and v_7 (869, 922, 1054, and 1157 cm^{-1}, respectively) are not currently available for subtracting the C_3H_8 signal to reveal, or constrain, the signature of underlying chemical species. Using spectra previously obtained by Jennings, D. E., et al. at the McMath-Pierce FTIR at Kitt Peak, AZ, as the source and automated analysis utilities developed for this application, we are compiling an atlas of spectroscopic parameters for propane that characterize the ro-vibrational transitions in the above bands. In this paper, we will discuss our efforts for inspecting and fitting the aforementioned bands, present updated results for spectroscopic parameters including absolute line intensities and transition frequencies in HITRAN and GEISA formats, and show how these optical constants will be used in searching for other trace chemical species in Titan's atmosphere. Our line atlas for the v_{21} band contains a total number of 2971 lines. The band integrated strength calculated for the v_{21} band is 1.003 cm^{-1}/(cm-atm).
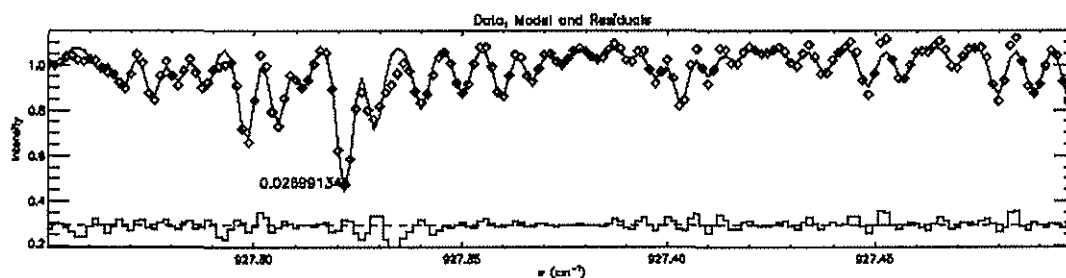

Fig. 1: Demonstration of Gaussian fit for sample spectral region 927.25 to 927.50 cm^{-1} (v_{21}).