REACHING THE LINE CONFUSION LIMIT: ANALYSIS OF THE λ=1.3 mm SPECTRUM OF ORION-KL

MARY L. RADHUBER, JAY A. KROLL, SUSANNA L. WIDICUS WEAVER , *1515 DICKEY DR. ATLANTA, GA 30322*.

With the advent of extremely sensitive, broadband THz observational instruments such as the heterodyne receivers on ALMA, The Herschel Space Observatory, and SOFIA, astronomers are now facing the reality of extracting their observational results from extremely dense spectra containing thousands of unidentified lines. Observation and analysis of the line confusion limited spectra of well-characterized sources will help us better understand the extent of this challenge. We have previously reported on the observation and analysis of a line confusion limited spectral line survey from 223 – 251 GHz of the Orion-KL source using the the Caltech Submillimeter Observatory. Spectral analysis has now been completed for all previously-identified molecules in this source using the information from publicly-available catalogs, including the JPL Spectral Line Catalog, the Cologne Database for Molecular Spectroscopy, and the NRAO Splatalogue database. A new spectral analysis program was written to automate the line identification process through a least-squares comparison between the catalog information and the observational spectra, which yields best-fit values for the column density and temperature based on the assumption of local thermal equilibrium (LTE). A co-added spectral simulation including all known lines for all known molecules can then be compared to the observed spectrum. While this analysis revealed little new information regarding the molecular inventory of this source, it did reveal useful information that gives a glimpse into the future challenges for interpreting line confusion limited spectra in astronomy. Only $\sim$ 1200 lines were assigned to known molecules, which accounts for slightly less than half of those observed. We will present on the results of our analysis, and the implications of this study for future line confusion limited observations using the next generation of telescopes in the THz frequency range.