Resolving Titan's atmosphere with TEXES on IRTF

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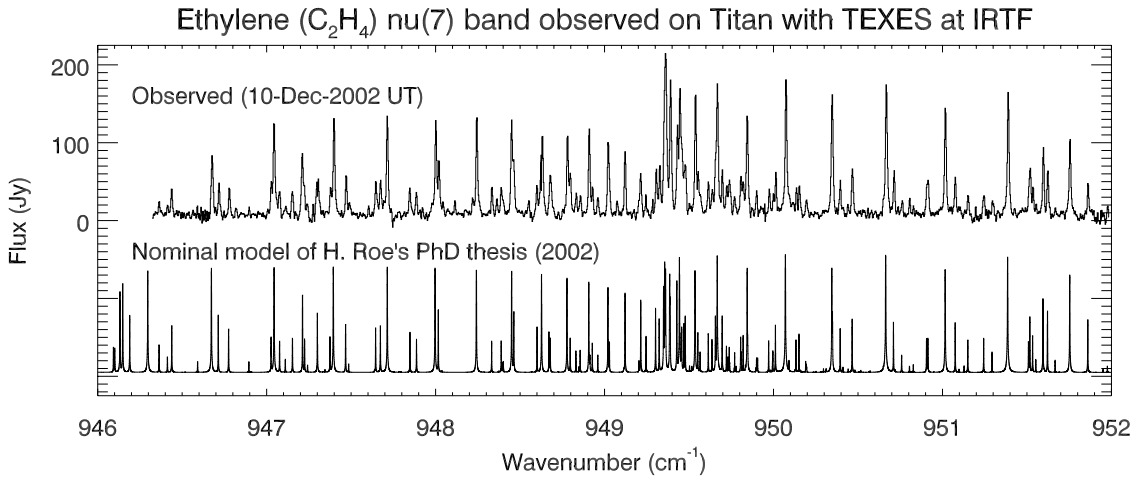
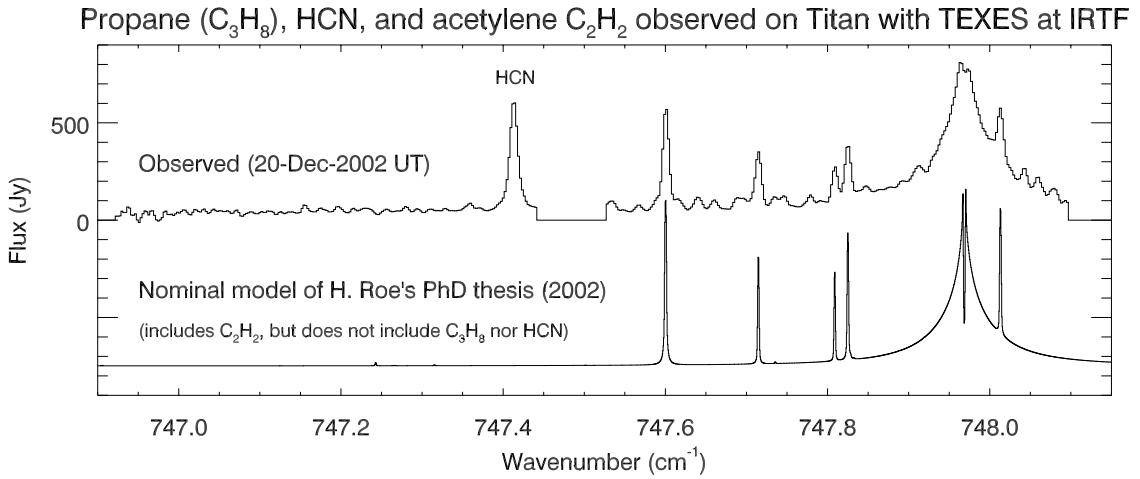
Titan is surrounded by a thick atmosphere of primarily nitrogen with a few percent methane (CH_4). A complicated network of photochemical reactions leads to the formation of numerous heavier hydrocarbons. The high spectral resolution of TEXES resolves many molecular lines on Titan in the mid-infrared, as shown in the example spectra below. With this high spectral resolution we can fit for abundances and vertical distribution profiles. The following figures show example spectra from our observing run in December 2002, along with model predicted spectra from the thesis of H. Roe.



Ethylene (C_2H_4; see figure above) is a particularly interesting species because its abundance varies significantly with season and latitude. The spectrum above is from a single TEXES setting and less than one hour of total telescope time.



All of the lines in the above model spectrum are due to C_2H_2. Fitting the profile of the strongly pressure broadened line will allow us to retrieve the vertical abundance profile of C_2H_2 deeper in the atmosphere, while the narrow lines tell us about the high altitude warmer regions. HCN and C_3H_8 will be added to our radiative transfer model in the near future. The observed spectrum is nearly noiseless in this presentation; almost all of the weak lines missing from the model have been identified as belonging to propane (C_3H_8).