I. Abstract

With the new technology of hot electron bolometers (HEB) low-noise heterodyne observations at THz frequencies are now possible and observations of high frequency molecular transitions as well as ionized material will allow us a detailed study of the far-infrared universe.

II. Atmospheric transmission

The atmospheric transmission at THz frequencies is greatly affected by water vapor at discrete frequencies as well as a water “continuum”, i.e. continuously increasing absorption toward higher frequencies, possibly due to water dimers (Pardo, Wiedner, Serabyn, Cernicharo 2003). The transmission can be measured with Fourier Transform Spectrometers (FTS). Fig. 1 shows one such measurement we obtained of the transmission above Mauna Kea on a particularly dry night (0.27mm PWV). The black curve shows the measurement, the dotted lines are fits from the Atmospheric Transfer Model (ATM, by Pardo et al., 20..) including water line (blue), water continuum (red) and lines from other molecules (green). The result is that the water “continuum” greatly affects the transmission in the THz, that the THz windows at 1.6, 1.3 and 1.5 THz are much more opaque than the windows at 690 and 850 GHz and that astronomical observation will only be possible from the driest sites under good weather conditions.

III. Telescopes

Observations at THz frequencies are only possible from very dry sites. We are currently focusing on using the THz Receiver on two telescopes: the Stratospheric Observatory For Infrared Astronomy (SOFIA) and the Atacama Pathfinder Experiment (APEX).

IV. Astronomy

We are particularly interested in studying high mass star forming regions and the warm ionized medium in the galactic ring, for both of which the THz frequency band is ideally suited. In Fig. 5 we show the most interesting molecular transitions between 1210 and 1400 GHz are indicated. The high CO transitions have upper energy levels between 430 and 580K and critical densities of a few times 10^14 cm^-3.

References:

J.-R. Pardo, J. Cernicharo, & E. Serabyn 2001, IEE Trans on Ant. and Prop., 49/12, 1683
P. Schilke 2002, conference contribution