# INFRARED/SUBMILLIMETER DOUBLE RESONANCE AS AN APPROACH TO ATMOSPHERIC REMOTE SENSING: MEASUREMENTS AND ENERGY TRANSFER MODELING

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While there have been a number of proposals for spectroscopic remote sensing in the millimeter and submillimeter spectral region, pressure broadening at atmospheric pressure has made this difficult. There are two major problems. First the linewidths ( 5 GHz) are so broad that the number of resolution elements in the atmospheric windows is small enough that specificity is severely compromised. Less obviously, without the narrow Doppler limited lines of laboratory spectroscopy, it is difficult to separate the spectral signatures from other much larger power variations. We will show that IR/SMM double resonance is an interesting alternative. In this approach, short infrared pump pulses modify the submillimeter signature, providing a modulation for detection. Moreover, the combination of pump frequency, probe frequency, and time signature provide a three-dimensional identification matrix for significantly increased specificity. Experimental results from a system based on a $CO_2$ TEA laser and fast submillimeter probe will be presented. These results are analyzed in the context of a collisional energy transfer model, with collisions being dominated by the air which dilutes the spectroscopic sample.