# A SUBMILLIMETER CHEMICAL SENSOR

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Rotational spectroscopy has been recognized a potentially powerful tool for chemical analysis since the very beginnings of the field. A typical rotational fingerprint consists of $10^5$ resolvable spectral channels, leading to 'absolute' specificity, even in complex mixtures. Furthermore, rotational spectroscopy requires very small amounts of sample with detection limits as low as picograms. Nevertheless, this technique has not yet been widely applied to analytical science because of the size, cost, and complexity of traditional spectrometers.

A resurgence of interest in spectroscopic sensors has been fueled by increases in performance made possible by advances in laser systems and applications in medicine, environmental monitoring, and national security. Most of these new approaches make use of the optical/infrared spectral regions and their well established, but still rapidly evolving technology base. The submillimeter (SMM) spectral region, while much less well known, has also seen significant technological advances, allowing the design of powerful spectroscopic sensors.

Using modern solid-state multiplier technology we have built a small bench top SMM spectrometer designed for use as a chemical sensor. This spectrometer includes a sample acquisition system including the vacuum equipment to provide the ideal pressures (1–10 mtorr) for SMM spectroscopy and a sorbent tube for analyte collection and preconcentration. The entire spectrometer, including power supplies, frequency synthesizers, a 1.2 m folded sample cell, and a computer for data analysis fits into a cubic foot box.