A PORTABLE, PULSED-MOLECULAR-BEAM, FOURIER-TRANSFORM MICROWAVE SPECTROMETER DESIGNED FOR CHEMICAL ANALYSIS

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Harmony et. al.[a] recently published some design specifications for a smaller version of a FTMW spectrometer. In this work they used a perpendicular nozzle arrangement and found that even though the size of the vacuum chamber and Fabry-Perot cavity mirrors had been greatly reduced, the overall sensitivity was nearly the same as a conventional sized resonator. In an effort to establish FTMW spectroscopy as a viable new technique for analytical chemists, we have constructed a spectrometer of similar size for use as an analytical instrument. The vacuum chamber of the instrument is based on a multi-port 12" sphere. An integral end-flange mirror permits a coaxial nozzle arrangement which greatly improves the sensitivity. The movable cavity mirror rides on a fast motorized stage which allows tuning to any frequency within the range of the spectrometer in 1-2 sec. The entire ! spectrometer is mounted on a mob ile cart for transporting to other laboratories. The per-pulse sensitivity of this smaller instrument is about a factor of 2-3 less than a conventional sized instrument, however the smaller vacuum chamber allows the nozzle to be pulsed much faster without overloading the vacuum pumps. These two factors offset so that the ultimate sensitivity (given one to two minutes of averaging) is approximately the same.

[a] M. D. Harmony, K. A. Beran, D. M. Angst, and K. L. Ratzlaff, Rev. Sci. Instrum. 66, 5196 (1995).