M-DEGENERACY, FABRY-PEROT RESONATOR E-FIELD INHOMOGENEITY, SUPERSONIC BEAM EXPANSION AND THEIR EFFECTS ON MICROWAVE TRANSIENT PHEMOMENA

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The re-birth of time domain microwave spectroscopy as a pulse technique in a waveguide application [a] in 1974 led to the theoretical discussion of microwave transient phenomena [b]. Later the technique was combined with a supersonic jet expansion in a resonator application [c] and the theoretical treatment was extendet accordingly [d].
For the steady-gas waveguide technique the theoretical approaches were subsequently refined to include Doppler broadening [e], M-degeneracy [f], and wall collisions and microwave-field inhomogeneities [g]. The theoretical discussion on the supersonic jet resonator experiment above includes the microwave-field inhomogeneity of the Fabry-Perot resonator but treats the problem numerically. Exept for some special cases of the molecular beam expansion an analytical treatment of the general experiment was not entirely feasible.
In the mean time the introduction of the "coaxially oriented beam-resonator arrangement" (COBRA) [h] has dramatically improved the resolution and sensitivity of current Fourier transform microwave (FTMW) spectrometers [i]. Fortunately, the more favourable symmetry of the COBRA-FTMW experiment compared to the original arrangement allows a complete analytical treatment [j]. The presented discussion on line intensity and shape will also include M-degeneracy.

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