COAXIALLY ALLIGNED ELECTRODES FOR STARK-EFFECT APPLIED IN RESONATORS (CAESAR) USING A COBRA FT-MW SPECTROMETER

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We present a novel setup for Stark-effect measurements using a Fourier transform-microwave (FT-MW) spectrometer with coaxially oriented beam-resonator arrangement (COBRA). Up to now parallel plate electrodes are used in pulsed supersonic jet expansion FT-MW spectrometers for Stark-effect measurements. To avoid line broadening by an inhomogeneous field or even signals from zero-field regions, the valve is normally mounted above the electrodes and not behind one of the reflectors, i.e. a supersonic expansion perpendicular rather than parallel to the resonator axis is used. Thus, sections of the jet which are in inhomogenous regions of the static electric field are also outside the resonator field, i.e. are kept away from effective polarization and sensitive detection. Broadened and zero-field lines are suppressed, but on the expense of the sensitity and resolution provided by the coaxial beam-resonator arrangement. Some recent developments address the disadvantages in different ways[ab], but maintain the conventional parallel plate approach.
The open Fabry-Perot type arrangement of spherical mirrors provides the possibility to mount the reflectors electrically insulated. Since no electrical surface currents of the resonator are inhibited, the propagation of the microwave field remains unaffected. If the microwave antennas and the valve are mounted at the same mirror, the other reflector can be set to a static HV potential. Together with a number of coaxially arranged circular electrodes a homogeneous field along the resonator axis can be achieved, allowing accurate Stark-effect measurements with COBRA FT-MW spectrometers. The arrangement is suitable even at low frequencies, where the microwave field occupies a large volume for propagation in one of its gaussian modes, i.e. a parallel plate arrangement would increasingly interfer with the microwave field. The experimental setup along with electrostatic calculations for the geometry will be presented. The performance of the new Stark-effect arrangement will be demonstrated by spectral examples.

[a] Z. Kisiel, J. Kosarzewski, B.A. Pietrewicz, and L. Pszczolkowski, Chem. Phys. Lett. 325, 523(2000).
[b] D. Consalvo, Rev. Sci. Instrum. 69, 3136(1998).