Invited Lectures N

September 2, Friday, 9:00 – 10:30

Conformer-specific Spectroscopy and Dynamics: From the Microwave to the Ultraviolet

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Molecular spectroscopy faces a daunting challenge whenever the sample of interest contains many components that contribute to the spectrum. This talk will describe a powerful array of double-resonance methods that are being used by molecular spectroscopists to do isomer-specific spectroscopy. Recent studies from the speaker's laboratory on the spectroscopy and dynamics of neutral molecules, ions, radicals, and molecular clusters will be used to illustrate the power and ultimate limits of the methods at hand. Recent progress towards the goal of single-conformation microwave spectroscopy will also be described, based on broadband chirped-pulse Fourier transform microwave methods. The talk will end by looking into the future for some predictions regarding what we might anticipate as the ultimate toolbox for the next generation of molecular spectroscopists.

Precise Line Parameters from Cavity Ring-Down Spectroscopy

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A cavity ring-down spectrometer (CRDS) calibrated with accurate frequency standards was built to retrieve precise line parameters in the near infrared.[1] The spectrometer allows us to detect absorptions with a sensitivity of 10^{-11}/cm and a sub-MHz precision. Ro-vibrational lines in the second overtone of H_2 including the extremely weak $S_3(5)$ line (V=3-0, J=7-5) with a line intensity less than $1x10^{-30}$cm/molecule, which is among the weakest molecular lines detected by absorption in the gas phase.[2,3] The line parameters obtained from fit of the H_2 spectrum were used to verify the high-level quantum chemical calculations including relativistic and QED corrections[3,4], and also applied to investigate collision effects related to the line profiles. Other examples include the high overtones of CO_2 and CO.[5,6] The spectroscopic parameters obtained from CRDS measurements can be used in varies studies, from the atmospheres of the earth-like planets to the test of fundamental physics and physical constants[7]. Finally, our recent progress on comb-linked CRDS and its application in sub-Doppler spectroscopy will also be presented.

References

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