THE BEAUTY AND THE CHALLENGE OF MOLECULAR COMPLEXITY

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Molecular complexity increases according to various coordinates such as (1) the size of the molecule, (2) the frequency of excitation and (3) the spectral resolution. Facing molecular complexity is relevant in itself but also in many fields, for example (1) to monitor volatile organic compounds, (2) to rationalize the mechanisms governing the energy level structure in highly vibrational excited states and/or to challenge always more and more quantum physics and chemistry. In this talk, I will review results obtained in my group and through collaborations on the development of experimental tools and related spectral analysis to go beyond the state of the art following these three coordinates. I will discuss the excitation of van der Waals molecular complexes far beyond the dissociation limit and our attempt to achieve the same success on ionic complexes. For this part of the talk, I will highlight the possible importance of such studies in atmospheric chemistry and how the combinations of those studies could shed new light on fundamental questions. I will also discuss how the study of the spectral signature of a molecule as small as methanol in the first overtone OH stretching range can represent a significant challenge. Finally, I will present the development of different spectrometers and light sources in order to be able to record the spectral signature of any molecular species from the MW to the UV.