MissIons: Missing Ions in Laboratory

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Ions play a key role in the chemical evolution of our universe. The process of star and planet formation is tightly connected to the presence and abundance of these species. Their spectra are diagnostic tools for various astrophysical environments and their temporal evolution. However, laboratory spectra of most ions relevant to astrophysics are not available. Moreover, predicted spectra from ab-initio theory are not nearly accurate enough to guide astrophysical searches. Therefore, laboratory spectra of molecular ions are needed.

We will report on progress towards recording high-resolution spectra from the microwave to visible range using our unique and innovative light induced reactions (LIR) methods in ion traps [1]. It is molecule specific through mass selection, many orders of magnitude more sensitive and less complex due to buffer gas cooling as compared to conventional methods. Examples concern the molecule first observed in space, CH^+ [2] but also ions which can play an important role in the chemical development producing more complex species, e.g., C_3H^+ [3] and $C_3H_2^+$ [4]. For many reasons H_3^+ is the corner stone in ion chemistry. It gives away its proton to most other species. As a result, protonation of more complex species, like methanol, could be another key towards the formation of complex organic species, molecules which are observed with today's telescopes but how they come into existence is under debate. We will discuss the tools to record the spectra and to understand the relevant reactions in the laboratory.

References

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