universität innsbruck
Fakultät für Mathematik, Informatik und Physik

Tenure Track VORTRAG: „Laborastrophysik kalter Ionen“

HS C, Technikerstraße 25a

Dienstag, 26. Mai 2026	
Elisabeth Gruber	
15:30 – 16:30 **HS C**	„**Charged Helium Nanodroplets:** **A Cold Laboratory for Molecular Ions and Astrochemistry**“ The interstellar medium (ISM), the vast region between stars, represents a unique cosmic environment with a rich and complex chemistry. It consists primarily of gas in atomic, ionic, and molecular form, together with dust and cosmic rays, and plays a fundamental role in the evolution of the universe as the birthplace of new stars and planetary systems. At the same time, stellar death recycles chemically enriched material back into the ISM, driving the chemical evolution of galaxies. Our understanding of the physical and chemical properties of the ISM is largely based on characteristic emission and absorption signatures arising from the interaction of light with matter and detected across a broad wavelength range by modern telescopes. To recreate ISM-like conditions in the laboratory and systematically investigate molecular ions and their reactions under controlled conditions, my team and I have developed a novel experimental platform based on charged helium nanodroplets. We use the exceptional properties of helium nanodroplets to form molecular ions with varying complexity and charge states in this cold environment, to study their interactions with other species at low temperature (~ 0.4 K), and to investigate them using mass spectrometry and laser spectroscopy. In this presentation, selected research highlights obtained with this approach will be discussed. To further expand our experimental capabilities and extend observation times from milliseconds to seconds or even minutes, we are currently developing a new platform for trapping charged helium droplets in ion storage devices. First proof-of-principle experiments using a multi-reflection time-of-flight mass spectrometer operated as an ion trap have demonstrated trapping times of up to one minute. Building on these results, we aim to establish a versatile new methodology for nanocalorimetry, fluorescence spectroscopy, and the investigation of chemical reactions on extended timescales. The combination of this new trapping platform with our existing mass spectrometry and laser spectroscopy capabilities will substantially broaden our analytical possibilities and provide new insights into the role of molecular ions in the chemistry of the ISM.

*) Die Veröffentlichung von Namen und Titel erfolgt nur auf Zustimmung der Vortragenden.
Stellungnahmen zu den Vorträgen der Hearing-TeilnehmerInnen richten Sie bitte bis längstens 16:45 Uhr des Vortragstages an Fakultaet-MIP@uibk.ac.at.