SFB/TRR 21 - Seminar

1. Februar 2017, Ulm

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Rotational relaxation processes of molecular ions immersed in a buffer gas and optical trapping of molecular ions

The inelastic collisional processes of molecular ions colliding with a buffer gas of helium is studied from different theoretical approaches in a wide range of temperatures. The atom-molecule scattering properties are calculated by solving the Schrödinger equation employing the coupled-channel method as well as the infinite order sudden approximation (IOS). As a result, we show that for heavy molecular ions the IOS works until T 0.5 K, allowing a fast and accurate way to calculate inelastic cross sections for sympathetic cooling experiments [1]. The main result is a general expression for the rotational inelastic rate as a function of the dipole moment of the molecular ion and the collision energy in a wide range of energy [1]. In the second part of this talk, we will present the physics behind the decay of a single Rydberg atom in a quantum degenerate gas, which turns out to be related with to reactive and non-reactive ultracold chemical processes: l-mixing collisions and chemi-ionization. In particular, we will show that chemi-ionization reactions [2] lead to the formation of molecular ions that may be suitable for optical trapping techniques. ! [1]Rotational relaxation of molecular ions in a buffer gas, J. Pérez-Ríos and F. Robicheaux, Phys. Rev. A 94, 032709 (2016). [2]Probing Ultracold chemical reactions of a single Rydberg atom in a dense gas, M. Schlagmüller, T. C, Liebisch, F. Engel, K. S. Kleinbach, F. Böttcher, U. Hermann, K. M. Westphal, A. Gaj, R. Löw, S. Hofferberth, T. Pfau, J. Pérez-Ríos and C. H. Greene, Phys. Rev. X 6, 031020 (2016).

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