KINETIC AND SPECTROSCOPIC STUDIES OF C_2^- IN A CRYOGENIC WIRE TRAP

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The study of ion-molecule reactions plays a vital role in cold chemistry, thus implying the need of well-controlled ion ensembles in a cold environment. The internal and external degrees of freedom of molecular ions, trapped in multipole radio frequency ion traps, can be cooled via collisions with neutral atoms [1]. Usually the coolant undergoes collisions with a thermal shield mounted on a cryostat attaining temperatures of about 4 K. To overcome this lower temperature limit two approaches have been proposed. Firstly, using a laser-cooled buffer-gas localized at the center of the ion cloud [2]. Secondly, sympathetic cooling via a second laser cooled molecular anion like C_2^- [3]. This, in addition to its potential role in forming carbon chain anions in the interstellar medium, makes C_2^- an important molecule in anion research.

In this contribution we present a newly developed 16-pole cryogenic radio frequency wire trap for spectroscopic and kinetic studies of molecular anions. First results of quenching rates of the first excited vibrational level of C_2^- due to collisions with H_2 are presented. Furthermore, possible reaction pathways with H_2 are discussed and recent spectroscopic measurements of the second electronic excited state of C_2^- are presented.

References:

[1] R. Wester , J. Phys. B 42, 154001 (2009)

[2] B. Höltkemeier et al., Phys. Rev. A 94, 062703, (2016)

[3] P. Yzombard et al., Phys. Rev. Lett. 114, 213001 (2015)