

Buffer-gas cooled velocity selected molecular beams combined with ion trapping for studying cold chemistry

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A source for translationally and internally cold polar molecules has been developed, using cryogenic (6 K) buffer gas cooling combined with a bent electrostatic quadrupole velocity-selecting guide, based on the work of C. Sommer et al. [1] and L. D. van Buuren et al. [2]. The apparatus has been characterised using ND₃ and CH₃F. The velocity distribution of the beam was obtained by pulsing the high voltages applied to the quadrupole guide and a translational temperature of 9 K established. REMPI spectroscopy on the guided beam established that, for ND₃, few rotational states ($J \leq 4$) are populated; further analysis of the spectrum gave a rotational temperature of 10 K.

A small linear Paul trap has been constructed and combined with the cold molecule source. This will facilitate the study and analysis of cold ion-molecule reactions. The combined setup will enable us to determine the role of rotational temperature in the reaction dynamics of ion-molecule reactions.

[1] C Sommer et al. Faraday Discuss., 142, 203–220 (2009)

[2] L.D van Buuren et al. Phys. Rev. Lett, 102, 033001 (2009)