Fragmentation Branching Ratios for small C_nH^{q+} ($n \leq 4$, $q \leq 10$) following electronic excitations in high velocity collisions

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Small hydrocarbons molecules C_nH are abundant species in the interstellar medium. Electronic excitation of these molecules by collisions with free electrons, photons or cosmic ray will generally lead to their fragmentation. Measurements of branching ratios of fragmentation of C_nH following dissociative recombination (DR) have been performed in some cases on these species [1] , whereas very few measurements exist on photodissociation (PD) or collision induced dissociation (CID).

We performed measurements of fragmentation of $C_nH^{(q+)}$ molecules following dissociative electron transfer (DCT, q=0), dissociative electron excitation (DEE, q=1) and dissociative ionization (DI, q=2-10) in high velocity (4.5 a.u) collisions of C_nH^+ ($n \leq 4$) cations with Helium atoms. The experiments were conducted at the Tandem accelerator in Orsay (France) and all dissociation channels were measured for each specific excitation process, using a combination of the recent pulse shape analysis method applied to the fragmentation of carbon clusters [2] and the well-known grid method [1].

For the case of the fragmentation of neutral species, we find an overall agreement with the results of DR. This result could be explained by a statistical nature of the fragmentation, as observed in Cn clusters [3]. The fragmentation of monocharged species C_nH^+ will be presented and we will address the question of the applicability of these branching ratios to predictions of photodissociation branching ratios needed in astrochemical data bases [4]. Finally the fragmentation of multicharged species will be presented and interpreted on the basis of a simple collisional and relaxation model.

[1] Florescu-Mitchell et al Physics Reports 430 (2006) 277
[2] Chabot et al NIMB 197 (2002) 155
[3] Martinet et al PRL 93 (2004) 063401
[4] http://www.physics.ohio-state.edu/~eric/research_files/osu_01_2007