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T Launoy, M Chabot, G Martinet, T Pino, A Le Padellec, et al.. Ion-pair dissociation of highly excited carbon clusters, size and charge effects. *Journal of Physics: Conference Series*, 2015, 635 (3), pp.032085. 10.1088/1742-6596/635/3/032085 . obspm-03990271

**HAL Id: obspm-03990271**

**<https://hal-obspm.ccsd.cnrs.fr/obspm-03990271>**

Submitted on 16 Feb 2023

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To cite this article: T Launoy *et al* 2015 *J. Phys.: Conf. Ser.* **635** 032085

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## Ion-pair dissociation of highly excited carbon clusters, size and charge effects

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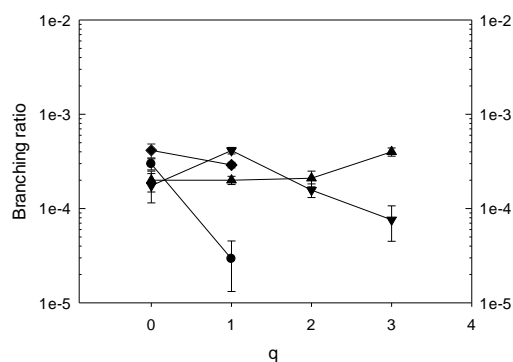
**Synopsis:** Ion-pair dissociation of a highly excited molecule is a relaxation process giving rise to emission of anionic and cationic fragments. We present first measurements of ion-pair dissociation of carbon clusters. We found that ion-pair relaxation is an ubiquitous, although very small, relaxation channel common to all sizes and charges of  $C_n^{q+}$  species produced in high velocity  $C_n^+-He$  collisions. Quantitative interpretation of measured branching ratios is conducted on the basis of a statistical approach i.e through listing of all possible final states.

Anion production in high velocity  $C_n^+-He$  collisions has been shown to proceed by three different mechanisms [1]. One of them is ion-pair dissociation in which a highly excited  $C_n^{q+}$  cluster, neutral ( $q=0$ ) or positively charged ( $q \geq 1$ ), relaxes by emission of one anionic and ( $q+1$ ) cationic fragments. The AGAT set-up, situated nearby the Tandem accelerator in Orsay (France), is an ideal tool for studying this process. Indeed the set-up is based on a coincident recording of all fragments issued from the collision, identified in mass and charge ( $q=-1,0,1,2,3\dots$ ).

In figure 1 are reported measured branching ratios (BR) for ion-pair dissociation of  $C_n^{q+}$  species as a function of the cluster charge  $q$  and cluster size  $n$  (symbols, see legend). The branching ratio is calculated as the ratio between measured cross sections for dissociation with anion and measured cross sections for dissociation without anion ( $v=2.25$  a.u.  $C_n^+-He$  collision). As seen from figure 1 these BR are small ( $\sim$ few  $10^{-4}$ ) and little dependent on ( $n,q$ ) with the exception of ( $n=2, q=1$ ), and, in a lesser extent, ( $n=4, q=3$ ).

Whereas ion-pair dissociation requires a large amount of energy (for instance dissocia-

tion of  $C_2^+$  into  $C^{2+}/C^-$  requires more than 28 eV) the energetic criterion is not sufficient to interpret the results. Clearly the number of final states i.e the phase space open to ion-pair dissociation is playing the major role. We listed all possible final states for dissociation both with and without anions. Results for ( $q=1, n=2$ ) and ( $q=1, n=3$ ) will be presented at the conference and compared to experimental results.



**Figure 1.** Measured ion-pair dissociation BR as a function of the cluster charge. Circles, diamonds, triangles down and triangles up refer to  $n=2,3,4,5$  respectively; lines are to guide the eye.

### References

- [1] K.Béroff et al 2013 *J.Phys.B:At.Mol.Opt.Phys.* 46, 015201

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