



HAL
open science

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

T Launoy, M Chabot, G Martinet, T Pino, A Le Padellec, S Bouneau, G Féraud, N Do Thi, N Vaeck, J Liévin, et al.

► **To cite this version:**

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

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

PAPER • OPEN ACCESS

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

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

View the [article online](#) for updates and enhancements.

You may also like

- [Ion-Pair Conductivity Theory V: Critical Ion Size and Range of Ion-Pair Existence](#)
Andrei Dukhin, Sean Parlia and Ponisseril Somasundaran

- [Anions for Lithium Battery Electrolytes: A Spectroscopic and Theoretical Study of the \$B\(CN\)_4^-\$ Anion of the Ionic Liquid \$C_{2m}^{mim}\[B\(CN\)_4\]^+\$](#)
Johan Scheers, Patrik Johansson and Per Jacobsson

- [A model for charge transfer in ultracold Rydberg ground-state atomic collisions](#)
Samuel Markson and H R Sadeghpour



244th Electrochemical Society Meeting

October 8 – 12, 2023 • Gothenburg, Sweden

50 symposia in electrochemistry & solid state science

Abstract submission deadline:
April 7, 2023

Read the call for papers &

submit your abstract!

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

T.Launoy[§], M. Chabot[†], G. Martinet[†], T. Pino^{*}, A. Le Padellec[#], S.Bouneau[†], G. Féraud[‡], N.Do Thi[§],
N.Vaeck[§], J.Liévin[§], J.Loreau[§], K. Béroff^{*1}

^{*} Institut des Sciences Moléculaires d'Orsay, Université Paris Sud and CNRS F-91405 Orsay Cedex, France

[†] Institut de Physique Nucléaire d'Orsay, Université Paris Sud and CNRS F-91406 Orsay Cedex, France

[#] Institut de Recherche en Astronomie et Planétologie, Université Toulouse 3 and CNRS F-31028 Toulouse, France

[§] Chimie Quantique et Photophysique, Université libre de Bruxelles, Belgique

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.

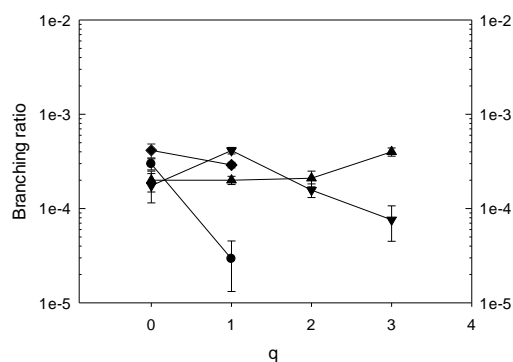


Figure 1. Measured ion-pair dissociation BR as a function of the cluster charge. Circles, diamonds, triangles down and triangles up refer to $n=2,3,4,5$ respectively; lines are to guide the eye.

References

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

¹E-mail: karine.beroff@u-psud.fr

[‡] present address : Département f. Chemie and Biochemie, Universität Bern, 3012 Bern, Suisse

[§] present address : Center for Computational Physics, Institute of Physics, VAST, Hanoi, Vietnam

