

COLLISION INDUCED DISSOCIATION ON ADENINE

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Irradiation of tumour cells with ionizing radiation is now commonly used in cancer treatments. In particular, use of protons or heavier ions allows to deliver doses in a well define region localized in the Bragg peak region.

Physical and chemical processes which come off to DNA strand break and tumour cell's death are not at the present stage satisfactory established. In contrary, atomic and / or molecular mechanisms have already been established. Chetioui *et al.* [1] and Touati *et al* [2] showed that inner shell ionisation followed by Auger decays could play an important role in DNA fragmentation processes and. More recently, Boudaïffa *et al* [3] showed conclusively that low energy electrons, below the ionisation thresholds of the biomolecules, were able to cause DNA stand break, via the dissociative electron attachment mechanism. Others processes might be pointed out such as direct excitation and ionisation, secondary electron emission, and / or radical species formed along the ion track, and combination of those.

In order to investigate the interaction of ionising radiation with nucleic acid bio-molecules, a collision experiment on DNA and RNA bases and small nucleosides is being developed at the LCAR laboratory in Toulouse. Our experimental setup combined a high energy pulsed proton beam (25-150 keV), a time-of-flight spectrometer and an electrostatic cylindrical mirror analyser in order to characterize the electrons and ionic fragments produced. The DNA / RNA bases were produced in gas phase by sublimation in an oven.

Absolute double differential cross sections were already obtained for the emitted electrons from uracil, and published [4]. Recently, dissociation patterns of doubly charged molecules of DNA bases and their corresponding branching ratios were derived, as shown in Figure 1 for adenine.

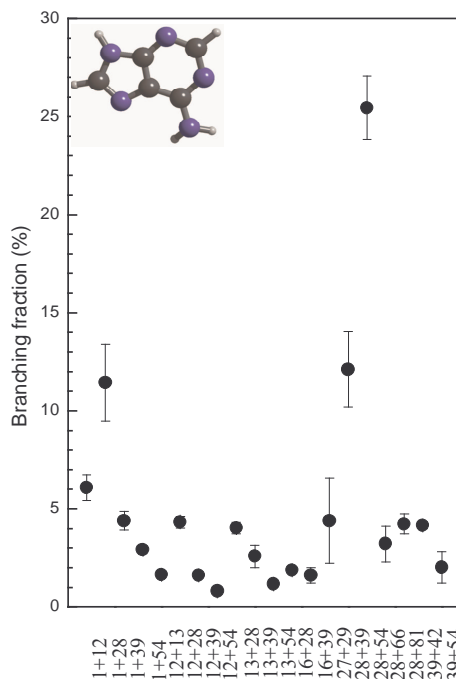


Fig. Branching ratio obtained from correlation spectrum for adenine fragmentation.

These results (Adenine, Cytosine, Guanine and Thymine) molecules will be presented at the conference. They are showing no collision energy dependence in the range investigated.

References

- [1] A. Chetioui *et al.*, in 20th ICPEAC, edited by F. Aumayr and H. Winter (World Scientific, Vienna, 1997), p. 519.
- [2] A. Touati *et al.*, Radiation Protection Dosimetry 9, 83 (2002).
- [3] B. Boudaïffa *et al.*, Science **287**, 1658 (2000)
- [4] P. Moretto-Capelle and A. Le Padellec., Phys. Rev. A **74**, 062705 (2006)