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Ionization and electron capture in 240 keV Kr^{8+} collisions with CO_2

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Synopsis The dissociation of CO_2^{q+} ions is studied in slow Kr^{8+} ion collisions with a CO_2 molecule using the technique of recoil ion momentum spectroscopy and multiple ion coincidence.

In collisions of slow highly charged ions with atoms/molecules, there is a finite probability that one or more electrons from the target atom/molecule are transferred to the projectile. The study of these electron transfer processes is important from fundamental point of view as it provides an insight into the ultra fast dynamics of such collision events and for practical applications as in astrophysics and fusion plasma [1]. Depending on the velocity of the incoming projectile, the processes of electron capture and/or ionization become dominant. Ionization and single electron capture processes are studied widely; multiple electron capture process is a debatable issue, however [2].

To study such fast processes, the techniques of Recoil Ion Momentum Spectroscopy and multiple ion detection are used in present work. The experimental setup described in [3] is modified to study the post collision projectile ions; a parallel plate electrostatic energy analyzer and a channel electron multiplier (CEM) are incorporated to disperse and detect these ions. The collisions of 240 keV Kr^{8+} ions generated from an ECR ion source with CO_2 are used to study the dynamical properties of the CO_2^{q+} (q=2-4) ions. The parent CO_2^{q+} ions and the fragment ions produced from their dissociation are detected by a dual micro channel plate coupled to a position sensitive delay line anode detector; the ejected electrons are detected by a CEM. The post collision Kr^{7+} ions (obtained from the capture of one electron from CO_2 by the incident Kr^{8+}) and the ejected electrons are used to mark the collision event one at a time using an OR gate; these are used to differentiate between the capture and ionization events. The multi-hit capability of the detection system makes possible the detection of all the fragment ions produced in the collision events. Typical time-of-flight (TOF) spectra of the ions produced due to ionization and electron capture events are shown in figure 1.

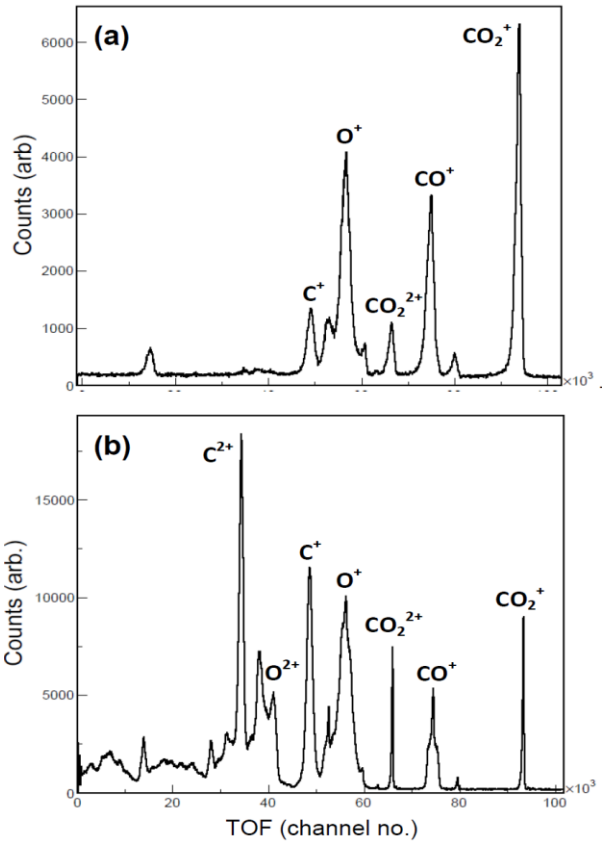

Figure 1. Time of flight spectra generated in 240 keV Kr^{8+} collisions with CO_2 using trigger by (a) Kr^{7+} (single electron capture) and (b) ejected electrons.

The effect of electron capture and ionization reactions on the angular correlation of the produced fragments and the kinetic energy release distribution of the CO_2^{q+} ions will be presented at the conference.

References

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