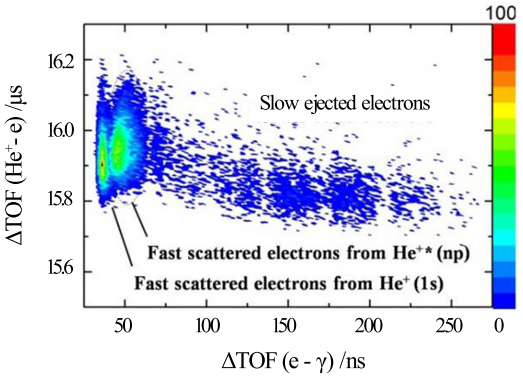

Fig. 1 (color online) 2D plot for γ+e+ion triple coincidence events versus the time of flight differences ΔTOF(e-γ) and ΔTOF(He+-e), theincident energy is 150 eV.

The two electrons, the recoil ion and the photon in the radiative decay from np to 1s state in the final state are recorded either in the (2e+ion) or in the (γ+e+ion) triple coincidence mode. In the (γ+e+ion) case, IE to np state is well isolated from the ns state by the photon signal from decay of np state.

We also decreased the incident energy to several eV above the threshold to examine the near-threshold behaviors of IE to 2p process. As predicted by the famous Wannier model[2,3], the back-to-back pattern of the two outgoing electrons is a key feature for ionization close to the threshold. It is interesting to examine whether the strong correlation from the disturb the emitting pattern of the two outgoing electrons in the IE process. Our preliminary result shows that there is a pronounced distribution beside the back-to-back pattern, which indicates that the strong enrollment bound-to-2p electron would of the 2p electron dramatically influences the behavior of the outgoing electrons.

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4- 17 Sequential and Nonsequential Dissociation of $(CO_2)^{3+}$ by Heavy Ion Impact*

Yan Shuncheng, Zhu Xiaolong, Li Bin and Ma Xinwen

We performed the CO_2 fragmentation experiment in Reaction Microscope, aiming to distinguish the various dissociation mechanisms of $(CO_2)^{3+}$ions. By coincidently detecting the $C^+/O^+/O^+$ ions, the Newton plot representing the momentum relation among the three ions[1], as well as the Kinetic Energy Release (KER) distribution of sequential dissociation (which is the sum of the kinetic energies of all fragment ions), are obtained.

As displayed in Fig. 1, there are two parts in Newton plot, the bright areas represent the C^+ ion taking small kinetic energy and two O^+ ions flying back to back approximately. This indicates two CO bonds break up simultaneously. Therefore, these areas arise from nonsequential dissociation. For the circular ring, the momentum sum of the C^+ and the second O^+ ion is constant. This characteristic is consistent with the sequential fragmentation[2], *e.g.* in the first step, the molecular ion separates into CO^{2+} and O^+. After several rotation periods, another dissociation takes place inducing CO^{2+} fragment into C^+ and O^+.

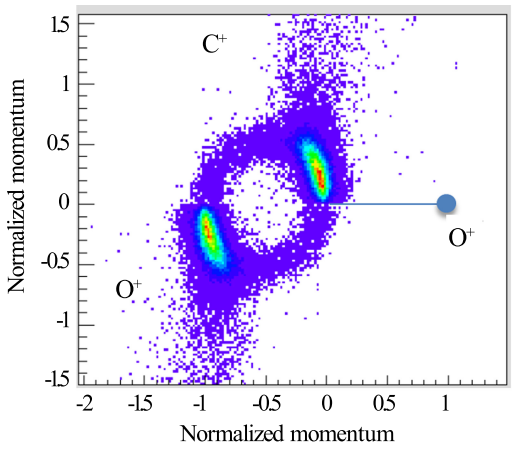

Fig. 1 (color online) Newton plot of the $C^+/O^+/O^+$ ions from the fragmentation of $(CO_2)^{3+}$.

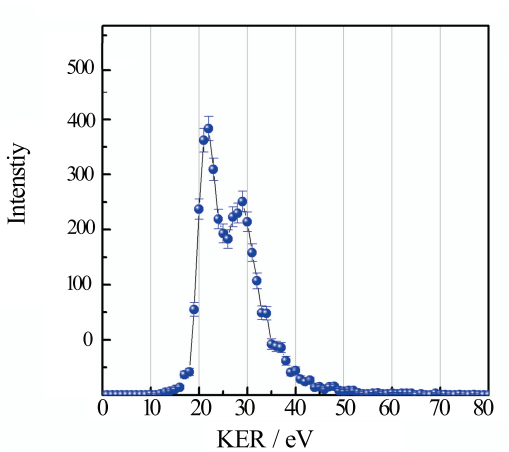

Fig. 2 (color online) KER distribution of the $C^+/O^+/O^+$ ions from sequential dissociation of $(CO_2)^{3+}$.

We chose the events from the sequential dissociation to reconstruct the corresponding KER distribution. As shown in Fig. 2, two narrow peaks are observed, which means that there are two channels can cause the sequential dissociation. Our result suggests that, for the first steps of these channels, the initial $(CO_2)^{3+}$ ions are populated in different states. But for the second steps, both the intermediate states ions $(CO)^{2+}$ are populated in $^3\Sigma^+$ states.

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4 - 18 Single and Double Electron Capture by Fast Xe^{54+} from Kr and Xe

Yu Deyang, Shao Caojie, Lu Rongchun, Wang Wei, Liu Junliang, Xue Yingli,
Song Zhangyong, Zhang Mingwu, Yang Bian, Ruan Fangfang and Cai Xiaohong

When an energetic highly charged ion (HCI) collides with an atom, the target electrons may be captured by the projectile ion, either radiatively or non-radiatively. During a radiative electron capture (REC), a target electron is transferred to the projectile accompanying with a photon emission, which carries away the excess energy and momentum. During a non-radiative electron capture (NRC), the energy and momentum conservations are ensured by the target nucleus[1]. If the captured electrons are populated in excited states, photons maybe emitted during the following stabilization processes, and therefore the X-ray spectrum can provide information about the initial population. However, if a solid target is employed, the single-collision condition cannot be ensured when considering the capture processes, as well as strong background will be produced[2]. With the development of heavy ion cooling storage rings, the experimental luminance is enhanced by the strong ion beams when a gaseous target is prerequisite[3].

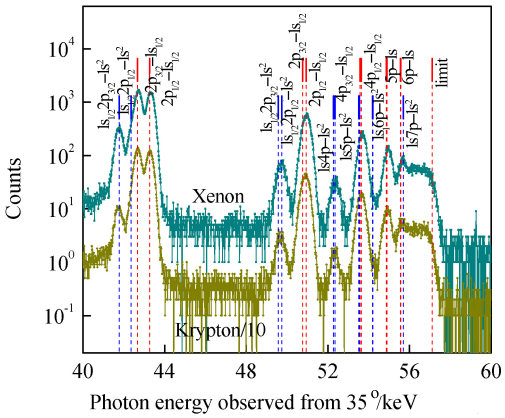

Fig. 1 (color online) Decay X-ray spectrum of the scattered Xe^{53+*} and Xe^{52+*} in 94 MeV/u Xe^{54+} collision with Kr and Xe atoms, observed from 35°. The counts of the Kr target are divided by 10 to shift the plot.

In this work, 52∼197 MeV/u Xe^{54+} ions are employed to collide with krypton and xenon atoms at the internal target of the HIRFL-CSR. The X-ray is measured from 35°, 60°, 90°, 120° and 145°, respect to the beam direction. The decay X-ray spectrum of the scattered ions in 94 MeV/u Xe^{54+} collision with Kr and Xe atoms, which observed from 35°, is shown in Fig. 1. The transitions from the single capture ion Xe^{53+*} and from the double capture ion Xe^{52+*} are observed, both in a single collision. The ratio between double and single capture channel of the Xe target is higher than the Kr target.

Although the single capture is the dominate channel at high energies, when the ion energy is lower (*e.g.*, 52 MeV/u), the double capture becomes dominate, accompany with that the NRC instead of the REC becomes the dominate mechanism[1,4]. Therefore, it is interesting that in a double capture process of Xe^{54+} with Kr and Xe, the channels of double REC, double NRC and REC plus NRC are comparable with each other at some energies between 52 ∼ 197 MeV/u.

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