

Non-sequential and sequential fragmentation dynamics of OCS^{3+} in collision with 500 eV electron

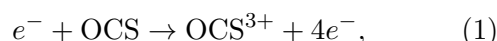
ZhenJie Shen^{*†}, MaoMao Gong^{*†}, EnLiang Wang^{*†}, Xu Shan^{*†}, XiangJun Chen^{*†1}

^{*} Heifei National Laboratory for Physical Sciences at Microscale and Department of Modern Physics, University of Science and Technology of China, Hefei, Anhui, 230026, China

[†] Synergetic Innovation Center of Quantum Information and Quantum Physics, University of Science and Technology of China, Hefei, Anhui, 230026, China

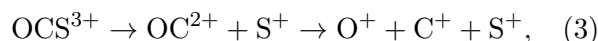
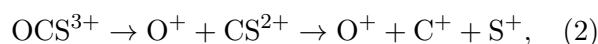
Synopsis Non-sequential and sequential fragmentation dynamics of OCS^{3+} investigated by electron collision at impact energy of 500 eV is reported in this abstract. By using Dalitz plot together with momentum correlation spectrum various dissociative channels are distinguished.

The studies on fragmentation dynamics of simple molecules have been attracting continuous interests with the help of rapid developing momentum imaging techniques [1, 2]. In this work, the three-body fragmentation of triply ionized OCS molecule is reported. The triple ionized OCS molecular ion is created by electron collision,



where, the molecular ion, OCS^{3+} , will dissociate into three ions, O^+ , C^+ and S^+ for which are detected in coincidence in experiment [3].

The fragmentation dynamics of OCS^{3+} is analyzed using Dalitz plot method, as shown in Figure 1 (a). The most intense areas represent direct and molecular bending fragmentation, where the two molecular bonds, O-C and C-S, break simultaneously in the fragmentation process. Besides the above two mechanisms, it is clear that there is "X" structure in the Dalitz plot indicating that there is some probability for OCS^{3+} dissociate through sequential fragmentation mechanism, for which the two molecular bond dissociate stepwisely. In this work, two different sequential fragmentation channels are distinguished,



where channel (2)/(3) corresponding to the right/left part of the "X" structure in the Dalitz plot. To separate the overlap of the sequential and molecular bending fragmentation, the momentum correlation of O^+ and S^+ are further analyzed. As shown in Figure 1 (b), the structures parallel to x or y axis originate from sequential fragmentation.

The momentum correlation of sequential fragmentation processes of channel (2) and (3) are shown in the Newton diagrams in Figure 1 (c) and (d), respectively. Both of the two channels exhibit similar circular structures in the Newton plot. Some differences, however, have also been clearly presented indicating that there maybe different mechanisms controlling the two sequential fragmentation channels.

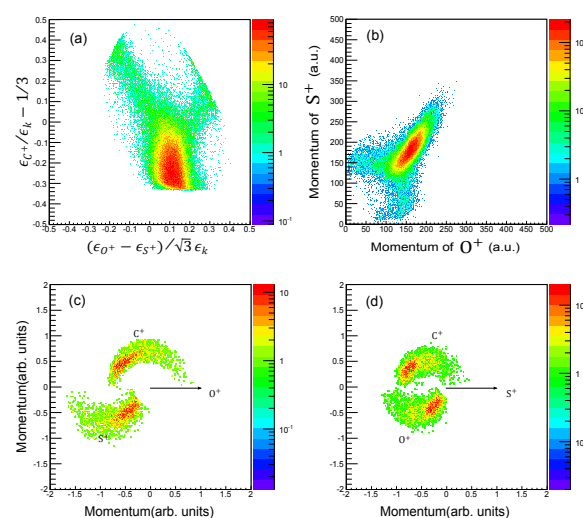


Figure 1. (a) Dalitz plot of OCS^{3+} dissociation. (b) Momentum correlation spectrum of O^+ and S^+ . (c) Newton diagram of sequential fragmentation channel where the C-O bond breaks first. (d) Newton diagram of sequential fragmentation channel where the C-S bond breaks first.

References

- [1] R. Dörner *et al* 2000 *Phys. Rep.* **330** 95
- [2] J. Ullrich *et al* 2003 *Rep. Prog. Phys.* **66** 1463
- [3] E. L. Wang *et al* 2013 *Rev. Sci. Instrum.* **84** 123110

¹E-mail: xjun@ustc.edu.cn

