

# State- and Site-Selective Dissociation Processes of Core-Excited Organic Molecules

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There is an increasing demand for soft x-ray photochemistry from astrophysics and interstellar chemistry with increasing the number of organic molecules identified in the interstellar space where is filled by star-born x-ray. At present, more than 70 organic molecules such as H<sub>2</sub>CO, CH<sub>3</sub>CN, CH<sub>3</sub>OH, CH<sub>3</sub>COOH, and even an amino acid (glycine: NH<sub>2</sub>CH<sub>2</sub>COOH) were identified. However the number of studies on core-excited organic molecules especially on those found in interstellar space are quite limited. Site- and state- selective dissociation processes have been explored for CH<sub>3</sub>CN, CH<sub>3</sub>OH and several other molecules with high mass-resolution partial ion-yield spectroscopy and also their mechanisms are studied with Auger electron-ion(-ion) coincidence (AE(PI)PICO) measurements. From detection of doubly charged ion (CH<sub>2</sub>CN<sup>2+</sup>) and further from AEPIPICO measurements at the  $\pi^*$  core-resonance of CD<sub>3</sub>CN, it was found that auto-ionization steps from singly charged Auger final states take an important role in the partial ion-yields. Ion branching ratio of CD<sub>3</sub>CN, including CH<sub>x</sub><sup>+</sup> (x=0-3) distribution, is mainly determined by "Auger final states energy" regardless of excited atom, C or O, and also of excited state,  $\pi^*$  or above ionization threshold. On the contrary, the partial yields spectra of CD<sub>3</sub>OH clearly exhibits both site- and state-selectivity. For example, suppression of O<sup>+</sup> and CO<sup>+</sup> yields while enhancement of CD<sub>3</sub><sup>+</sup> and DCO<sup>+</sup> yields are observed at the lowest resonance (3sa') from the O 1s. AEPIPICO measurements show that suppression of O<sup>+</sup> and CO<sup>+</sup> is determined at the core-excited state not at the Auger final states. Although most simple interpretation for the suppression of O<sup>+</sup> and CO<sup>+</sup> yields is the repulsive nature of the O-H bond at the O 1s to the 3sa' excited state, enhancement of CD<sub>3</sub><sup>+</sup> and DCO<sup>+</sup> yields at the same excited state need more detailed explanations. At the C 1s region another type of state-selectivity on CD<sub>3</sub><sup>+</sup> and COH<sup>+</sup> yields is found, while the state-selectivity on O-H bond scission found at the O 1s disappears.