Threshold photoelectron photoion coincidence spectrum of Kr$_3$

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Introduction

A study on the photoionization of rare gas dimers and their ions is important to understand the nature of the van der Waals interaction. In the past two decades, many theoretical and experimental studies on the homonuclear rare gas dimers have been performed. We have already observed the threshold photoelectron (TPE) spectrum of Kr gas and measured the vibrational structure of Kr$_2$$^+$$^1$[1]. After that, we also observed the threshold photoelectron photoion coincidence (TPEPICO) spectrum of Kr$_2$. The TPE spectrum of Kr$_3$ has a broad background around 910 Å, though the TPEPICO spectrum does not have.

Experiment

The experiments were performed on the beam line 20A. A 3-m normal incidence monochromator equipped with a 2400-lines/mm grating was used. Photon bandwidths of 0.06 Å could be obtained with 50-µm slit widths.

The experimental setup and technique were same as the experiment for heteronuclear rare gas dimers [2]. In brief, a threshold photoelectron was extracted by the penetrating field, and focused and discriminated by the chromatic aberration of two electrical lens systems. The Time-of-Flight (TOF) ion mass analyzer was used to distinguish Kr$_2$$^+$ from the other ions. The TOF spectra for several pressures were shown in Fig. 1. In the spectrum of higher pressure (d), the peak has a wide tail. It may be comes from the dissociation products of Kr$_3$$^+$. We observed TPEPICO spectrum in the gate of this peak and the tail.

Result

The observed spectra were shown in Fig. 2. The TPE spectrum (a) has a broad background, though the TPEPICO spectrum (b) of Kr$_2$ does not have the background. The TPEPICO spectrum in the gate of the tail of the TOF spectrum (c) has the broad peak around 910 Å. It seems that the origin of the broad peak is the dissociation product of Kr$_3$$^+$ that have a kinetic energy in the ionization region.

References


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