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Photoionization spectroscopy of beryllium atoms

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Introduction

Beryllium atom ($1s^2 2s^2$) has the next simplest electronic structure to two-electron system, helium atom ($1s^2$) [1]. The photoionization dynamics of the outer two electrons can be compared with the helium case [2]. The comparison would reveal the effects of the ionic core of $1s^2$. Furthermore, experimental works of three-electron system, lithium atom ($1s^2 2s$), have activated theoretical treatment for more than two electron system. On the other hand, there exist only few experimental works on Be with synchrotron radiation [3].

Experimental setup

We have made the photoionization spectroscopy of beryllium atoms at BL-3B and 16B. Beryllium atomic vapor is generated by an electron bombardment oven and photo-ions produced by synchrotron radiation are detected through Time of Flight mass spectrometer in order to distinguish between single and double photo-ions.

Results and discussions

Figure 1 shows the spectra of single (dashed, purple line) and double (solid, red line) photoionization of beryllium atoms (BL-16B). The assignments of the resonance peaks are made based on Ref. [1]. The mixing of the ground state $1s^2 2s^2$ with $1s^2 2p^2$ state affects the spectra in this region. For example, it is expected that $1s2p^3$ state is large as shown in the figure.

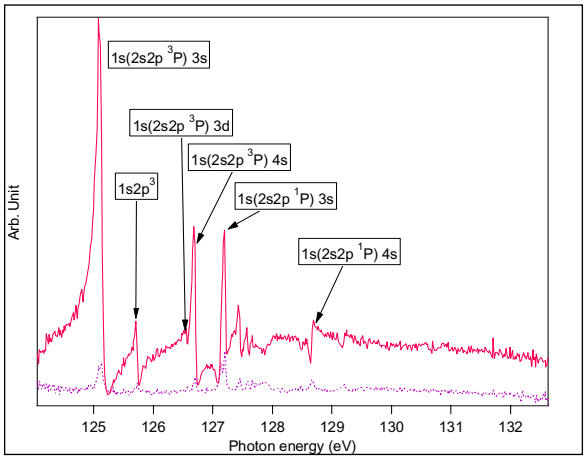

Figure 1: Single (dashed, purple) and double (solid, red) photoionization spectra of beryllium atoms.

Figure 2 shows the spectra of single photoionization of beryllium in the region of 2s excitation (BL-3B). The Rydberg series $1s^2 3snp$ converging to the $1s^2 3s$ limit are measured. The perturbing state $1s^2 3p4s$ is also observed and its effect can be evaluated. The higher order light of the grating can be seen because filters are not used. More detailed information is needed to compare with theoretical data.

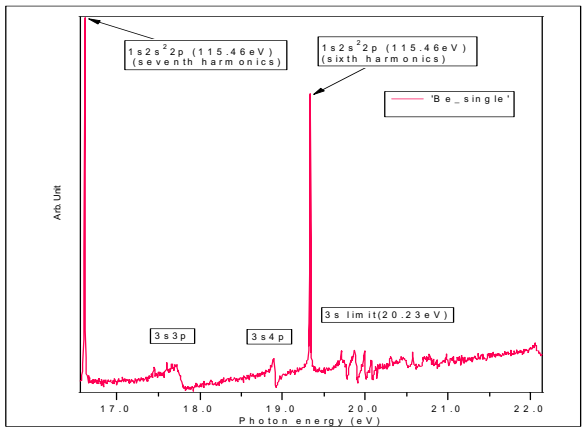

Figure 2: 2s photoionization spectrum of beryllium. Rydberg series converging to the $1s^2 3s$ limit are observed.

References

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