Column Density Dependence of Observed Absorption Cross Section on He with Ultrahigh Resolution

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It is well known that distorted spectra were ascribed mainly to limited instrumental resolution [1], but the effect of column density on absorption spectra was noted recently [2]. As the instrumental resolution is limited, column density will be important in the observed absorption cross section especially for narrow lines. According to the theoretical calculation, higher column density will effectively lower the observed peak cross section.

We used He to be our sample and the U9 undulator beam line in NSRRC as the high resolution light source in this work. The suitable absorption line of He is N3- at 62.75eV by the ultrahigh resolution of U9 down to 2meV. Two Al foils were put-in on the light path to construct the absorption cell and also function as effective optical filter. With the 1.29m long absorption cell, the pressure was controlled at will form 5mTorr up to 800mTorr. In order to compare with ionization cross section, an ion collector of 10cm long was placed in the front end of the cell. The transmitted photon was detected by a pair of micro-channel plates.

Figure 1 shows the absorption cross section of He above N4- resonance line. The resolving power of the light source is magnificent. In Figure 2, the prediction with both Gaussian and Lorentzian instrumental functions were shown in two assumed resolutions. Taking into account of the Doppler effect and pressure broadening, very good agreement between theoretical predication and experimental result were found in this work.

Decipher of pressure broadening effect is underway.

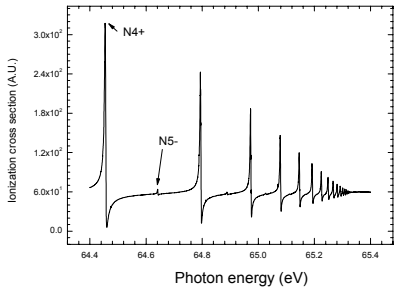

Figure 1. Absorption cross section of above He N4-.

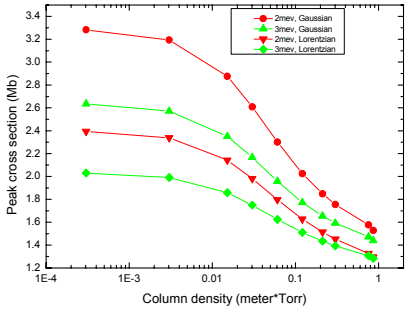

Figure 2. Theoretical predication with Gaussian and Lorentzian instrumental function, respectively.

[1]. T. K. Fang and T. N. Chang, Phys. Rev. A ***57****, 4407 (1998).*
[2]. T. N. Chang, Yuxiang Luo, H. S. Fung, T. S. Yih, J. Chinese Chemical Society, ***48****, 347 (2001)*