The Strong DC Field Effect on Autoionization of Calcium near 3D Threshold

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The single photon-ionization spectra of Ca autoionization state under high DC external electric field near the 3d threshold was observed in the first time. Many distinct variations of doubly resonance of Ca were clearly observed in the experiment as the applied field varies.

One of key futures in our system is its ability to sustain high DC external fields without breaking down even though the separation of two electric plates were filled with high density Ca metal vapor. To our best controlled experimental condition, the applied field strength could reach up to 50,000 V/cm.

The effusive atom beam system was used to prepare our vapor sample and its reservoir can be heated up to 1100C to supply as high density metal vapor as we need. The easy to use and stable Seya beam-line at National Synchrotron Radiation Research Center (NSRRC) provides high photon flux light source to assist this experiment be conducted without a hitch. LiF window mounted between Seya beam-line and ionization system prevents contamination of beam line from metal vapor and also blocks away high order light from entering interaction zone. The transmitted light was monitored by a sodium salicylate film coated glass plus a PMT, and a Chevron mounted MCP was used to measure ion signal. The experimental set-up was shown in Figure 1.

In this work, we observed clearly the progressive changes of ionization spectrum, such as red shift, blue shift as shown with marked dots in Figure 2. It is also noted the changes of 3d10p $^3P^o$ of doubly ionization resonance structures of Ca near the 3d $^2D_{5/2}$ threshold as the external field strength were changed.

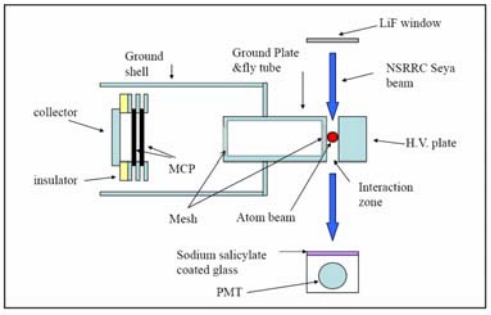

Figure 1. Schematic diagram of the experimental set-up.

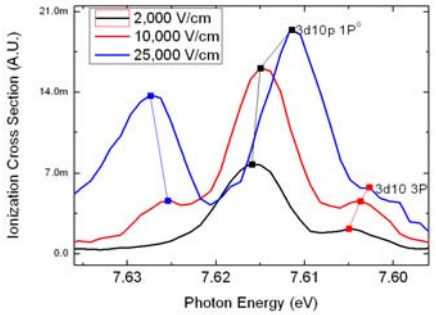

Figure 2. The spectrum of red shift and blue shift of those resonances near 3d10p $^1P^o$ state.