DOUBLE-EXCITED STATES OF Mg BELOW THE $Mg^+(3p)$ THRESHOLD

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The photoionization process from the valence shell of alkaline earth atoms just above the first ionization threshold shows strong deviation from the simple one–electron picture. This is due to electron correlations between the two outer electrons, which can be simultaneously excited into states, which can decay via autoionization. This leads to resonance profiles in the single-ionization cross section and a theoretical description of this process was introduced by Fano [1]. For the case of overlapping resonances we have used the formalism introduced in Ref. [2]. Since Mg is a light, closed-shell atom, it seems to be a system only slightly more complicated than He. However, the series of autoionization resonances starts immediately above the first ionization threshold. Also, the Mg 3*pns* resonances are much broader due to a strong coupling to a rather weak continuum.

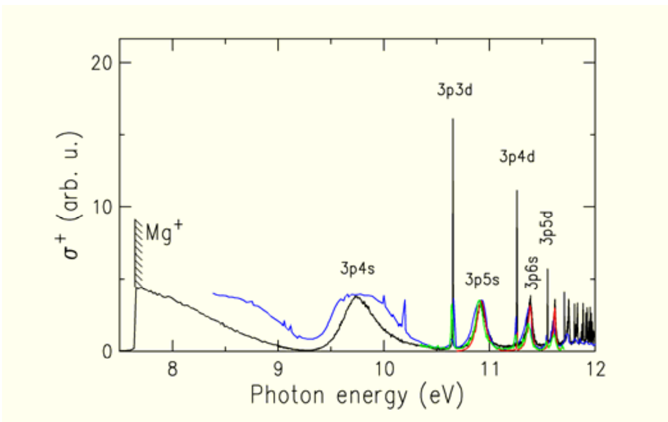

Figure 1: Relative Mg^+ cross section as a function of photon energy.

In the energy region between the first and second ionization threshold the spectra are dominated by two double-excitation series, one broad (*npn's* $^1P_1$, $n' \geq n+1$) and one narrow (*npn'd* $^1P_1$, $n' \geq n$) series. The figure on the left compares our measurement (black line) with previous measurements (blue line: [3]; red line: [4]; green line: [5]) showing the superior energy resolution in this experiment. Previous photoionization measurements were not able to determine the widths of the 3*pnd* $^1P_1$ series due to insufficient energy resolution except for one laser-based experiment [6] using a 3-photon excitation scheme.

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