TRIPLE PHOTOIONIZATION OF NEON AND ARGON NEAR THRESHOLD

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The threshold behavior of the triple photoionization cross-section of neon was investigated using monochromatized synchrotron radiation and ion time-of-flight (TOF) spectrometry. The monochromatized photon beam ionized neon or argon atoms in the experimental chamber. The ions created were accelerated by a pulsed electric field and detected by a Z-stack of microchannel plates [1].

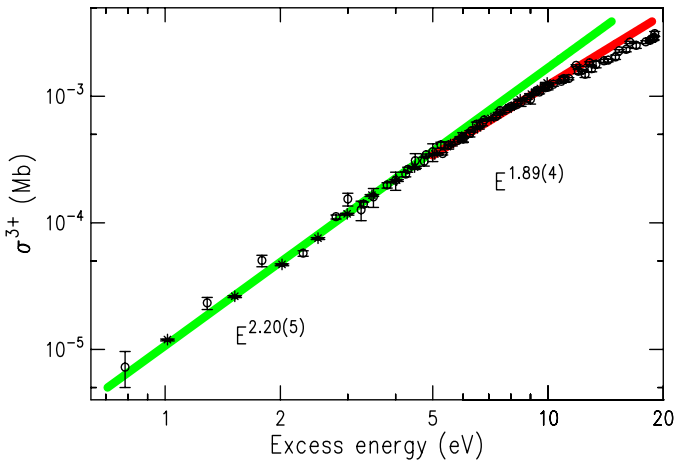

Fig. 1: Triple photoionization cross section of Ne as a function of excess energy with power-law fit curves (open circles: this work, asterisks: [3]).

The absolute cross-section is found to follow the Wannier power law [2], i.e., the partial cross-section σ is proportional to the excess energy E raised to a power α, $\sigma \propto E^{\alpha}$. We obtained an exponent of 2.20 ± 0.05 that has a range of validity of ca. 5eV (green curve in Fig. 1). This result is consistent with the exponent of 2.162 predicted by theory and is also consistent with the finding of Samson and Angel [3].

However, we did not find a secondary power law as in Ref. [3] but observed a smooth decrease of the exponent with increasing excess energy. Nevertheless, we could reproduce the exponent for the "second" power law as reported in [3] with an exponent of 1.89(4) (red curve) if we perfom the fit over the same energy range (5-9 eV) as in Ref [3].

Also for argon, we can confirm the Wannier power law and determined an exponent of 2.21(12) in good agreement with the theoretical prediction. However, the range of validity is significantly shorter than for Ne, namely ca. 2 eV only.

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References:

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