Laser-assisted electron-potassium scattering

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Synopsis We present a progress report on our efforts to experimentally examine dressed-atom effects in laser-assisted free-free scattering. The experiments involve electron-potassium scattering in the presence of an Nd:YAG laser field of 1.17 eV photons.

Laser-assisted free-free (LAFF) experiments examine the absorption or emission of radiation during the collision of charged particles with atoms and molecules. Almost all such experiments have been in agreement with a simple theory (the Kroll-Watson Approximation [1]) which assumes that laser-target interactions can be ignored; i.e., the interaction of the radiation with the atom or molecule itself has no effect on the scattering process. Recently, Morimoto, Kanya, and Yamanouchi [2] carried out LAFF experiments in xenon that, for the first time, observed the unambiguous breakdown of the KWA.

The dressing of the xenon atoms by the laser field was slight, making the breakdown of the KWA extremely difficult to observe since it was only apparent at very small scattering angles. An estimate of the dressing of the target by the radiation's electric field may be made in terms of the electric dipole polarizability of the target.

We have begun to carry out experiments in potassium (a test measurement is shown in figure 1) which has a polarizability an order of magnitude larger than xenon. Estimates show that the dressing effects in potassium should be observed at scattering angles easily accessible to experiments, and without the need for complicated corrections. Here we will present a progress report on these efforts.

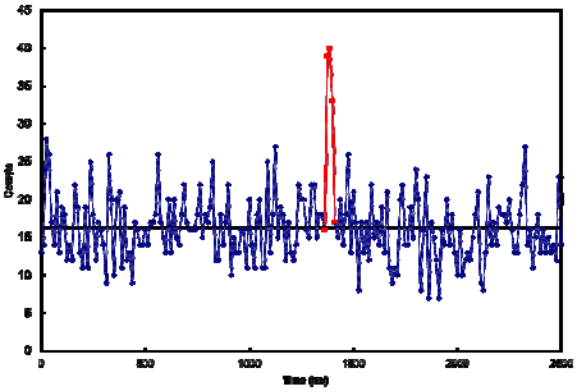

Figure 1. Timing spectrum for single photon absorption by 350 eV incident energy electrons elastically scattered through 90 degrees from potassium. Red points indicate electrons scattered while an Nd:YAG laser field was present. The polarization direction of the linearly polarized laser field was parallel to the momentum transfer direction.

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References

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[2] Y. Morimoto, R. Kanya and K. Yamanouchi 2015 *Phys. Rev. Lett.* **115**, 123201

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