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Out of plane $(e, 2e)$ experiments on helium autoionizing levels[1]

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Out-of-plane $(e, 2e)$ measurements and calculations are reported for the helium autoionizing levels $(2s^2)^1S$, $(2p^2)^1D$, $(2s2p)^1P$, and for direct ionization.[2] We present the data as both angular distributions and energy spectra over the resonances. While the recoil peak almost vanishes in the angular distribution for direct ionization, it remains significant for the autoionizing levels and exhibits a characteristic shape for each orbital angular momentum $L = 0, 1, 2$. These findings can qualitatively be explained by an L-dependent addition to the ionization amplitude. A first order distorted-wave calculation underestimates the recoil peaks, but a second-order model in the projectile−target interaction can quantitatively reproduce their observed magnitudes. As for the angular distributions a second order theory is necessary to reproduce the experimental energy spectra.

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[2]B. A. deHarak, K. Bartschat and N. L. S. Martin, Phys. Rev. Lett. 100, 063201 (2008)