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Variable Entry Biased Paracentric Hemispherical Deflector: Experimental results on energy resolution for different entry positions

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Synopsis A new hemispherical deflector analyzer (HDA) which is designed for electron energy analysis in atomic collisions has been constructed and tested. Using the crossed beam technique at the electron spectrometer, test measurements were performed for electron beam (200 eV) - Helium atoms interactions. These first experimental results show that the paracentric entries give almost twice as good resolution as that for the conventional entry. Supporting simulations of the entire lens+HDA spectrometer are found in relatively good agreement with experiment.

The HDAs are the most widely used electrostatic energy selectors in atomic collision physics. However, the first-order focusing characteristics of these analyzers are impaired due to the fringing fields at the electrode boundaries1. This drawback can be overcome as shown in simulations for the "biased paracentric" HDA2. This HDA has a biased optical axis and an optimized entry position which is offset from the center position used in conventional HDAs1,3,4. The design considerations outlined in our previous simulation work3,4 have been realized experimentally and a new biased paracentric HDA configuration for atomic collisions has been constructed and tested.

Figure 1. Overall analyzer base energy resolution as a function of biasing parameter γ for E0=200 eV and Epass=50 eV.

Here, we report on energy resolution measurements for two different paracentric entry positions R0=84 mm and R0=112 mm, on either side of the mean radius, respectively (Fig.1). These specific R0 positions were suggested by our previous simulation work2,4 to correspond to entry positions of optimal (best) energy resolution. We found the paracentric entries to give almost twice as good resolution as that conventional entry5.

The analyzer does not need fringing field correcting electrodes and thus provides a low cost and more compact alternative to a conventional centric HDA. Our reported experimental resolutions are also compared to new simulations obtained under pre-retardation conditions. Experimental and simulation results will be presented at the conference.

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