Benchmark measurements on $n\ell$-state-resolved cross sections in ion-atom collision processes

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With the improvements of the reaction microscope installed at the 320 kV platform at the Institute of Modern Physics, a series of (n,ℓ) resolved charge exchange cross section has been measured. The models generally used in astrophysical modelling are tested in the projectile energy range from 1 to 70 keV/u, and it is demonstrated that the models are not able to describe the ℓ-population dependent on impact energy. Furthermore, our experimental result and theoretical calculations clearly demonstrate the breakdown of spin statistics assumptions at high impact energies where they are traditionally expected to be valid.