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Charge-changing reaction study via the cross section measurements of 18O on carbon and lead at around 370 MeV/nucleon

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We have performed precise measurements of the charge-changing cross sections (CCCSs) for ^{18}O on carbon (C) and lead (Pb) targets at energies around 370 MeV/nucleon. We evaluate the contributions of nucleon-nucleon (NN) and the electromagnetic (EM) interactions to the CCCSs by explicitly considering the direct proton removal process, the charged particle evaporation (CPE) after neutron removal, and the EM excitation. Our results show that CPE contributes approximately 13% and 5% to the CCCS on C and Pb targets, respectively, while the EM is found to contribute negligibly (less than 1%) to the CCCS for ^{18}O in the investigated energy range. Further investigations of ^{18}O, ^{59}Co, ^{112}Sn, ^{154}Sm, and ^{197}Au on C, silver (Ag), and Pb targets at energies of 300 and 900 MeV/nucleon, indicate that the EM contribution to the CCCS on Ag and Pb targets increases with both the mass of the projectile and incident energy. For example, the EM contribution for ^{197}Au on Pb target at 300 and 900 MeV/nucleon is 6.7% and 10.5%, respectively. In contrast, the EM remains negligible for all projectiles interacting with C target. These findings provide valuable insights into the mechanisms underlying high-energy interactions in nuclear physics, contributing to a deeper understanding of galactic cosmic ray propagation and offering potential applications in medical physics and space science.

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