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Direct and two-step processes in single charge exchange reactions within a unified model

Content

Charge-exchange nuclear reactions provide crucial insights into nuclear structure and reaction dynamics. This study focuses on the ^{40}Ca(^{18}O,^{18}F)^{40}K reaction at 275 MeV, examining the interplay of direct meson exchange (DME) and two-step nucleon transfer (n-p and p-n) mechanisms.
Using the Distorted Wave Born Approximation (DWBA) method, we calculate differential cross-sections incorporating nuclear structure information from the Large Scale Shell Model (LSSM). The results demonstrate a strong agreement between experimental data and theoretical predictions, validating the adopted nuclear reaction model. The analysis confirms that the DME mechanism plays the dominant role, particularly at forward scattering angles, while two-step mechanisms provide relevant contributions at larger angles.
These findings enhance our understanding of nuclear charge-exchange processes and have implications for weak interaction studies, including neutrinoless double-beta decay research.

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