Nuclear reaction cross-section measurements in mirror nuclei ^{7}Li and ^{7}Be using Active-Target Time Projection Chamber.*

M. Kuich[1], J. C. Zamora[1], V. Guimaraes[2], Y. Ayyad[3], S. Ahn[4], S. M. Ali[1], M. Avila[5], S. Bae[4], D. Bardayan[6], A. Barioni[7], D. Bazin[1], J. Chen[8], S. Giraud[1], C. Hoffman[5], B. Kay[5], M. Kim[4], J. Lee[4], R. Linares[9], G. McCann[1], P. McGovern[5], W. Mitting[1], S. Painter[1], B. Saul[10], and Z. Sernikow[1]

[1] *Facility for Rare Isotope Beams, Michigan State University, East Lansing, MI 48824, USA*
[2] *Instituto de Fisica, Universidade de São Paulo, SP 05508-090, Brazil*
[3] *Universidade de Santiago de Compostela, E-15782 Santiago de Compostela, Spain*
[4] *Institute for Basic Studies, Center for Exotic Nuclear Studies, Yuseong-gu, Daejeon, 34126, Korea*
[5] *Argonne National Laboratory, Lemont, IL 60439, USA*
[6] *The University of Notre Dame, Notre Dame, IN 46556, USA*
[7] *Federal University of Sõo Paulo, SP 04021-001, Brazil*
[8] *Southern Univerisity of Science and Technology, Shenzhen, Guangdong Province, 518055, China*
[9] *Federal University of the State of Rio de Janeiro, Niterói, State of Rio de Janeiro, Brazil and*
[10] *Universidade da Coruña, 15001 A Coruña, Spain*

Light mirror nuclei, ^{7}Li and ^{7}Be, exhibit prominent α + t (^{7}Li) and α + ^{3}He (^{7}Be) cluster configurations, providing an ideal testing ground for probing the interplay between mean-field structure and cluster degrees of freedom [1]. Despite their structural similarities, ^{7}Li and ^{7}Be exhibit subtle differences in excitation spectra, transition strengths, and reaction dynamics. Studying these differences yields critical insights into how nuclear forces behave under proton-neutron asymmetry and enhances the predictive power of both cluster and ab initio nuclear models [2,3]. In addition to their structural significance, these nuclei play pivotal roles in nuclear astrophysics, particularly in Big Bang Nucleosynthesis modeling, which has proven remarkably successful in predicting the primordial abundances of deuterium and helium yet struggles with estimating ^{7}Li) abundances in old, metal-poor stars by a factor of three [4]. Accurate knowledge of the internal structure and cluster properties of ^{7}Li and ^{7}Be, as well as reaction cross sections, is therefore essential for refining reaction rate models and resolving key discrepancies such as the "lithium problem" [5].

This contribution outlines the experiment using the Active-Target Time Projection Chamber (AT-TPC) [6] in combination with the HELIOS superconducting magnet conducted with ^{7}Li and ^{7}Be beams and active deuterium target at the Argonne In-Flight Radioactive Ion Separator (RAISOR). The experimental methodology and selected preliminary results on differential cross sections of (d, d), (d, d'), and others will be presented.

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