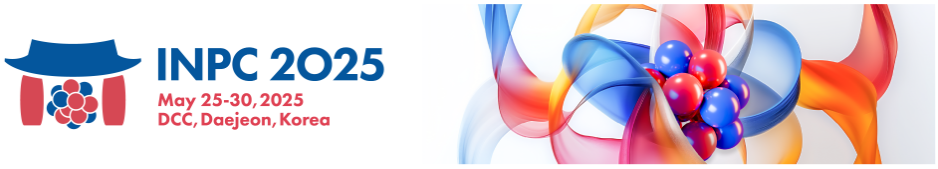

Contribution ID: **338** Type: **Contributed Oral Presentation**

Exotic Three-Body Decay in Open Quantum Systems

Monday, 26 May 2025 17:20 (15 minutes)

Exotic decay beyond the nuclear dripline represents a frontier in understanding the nuclear landscape. Among these phenomena, two-proton ($2p$) radioactivity emerges as a distinctive three-body process, involving the simultaneous emission of two protons from the ground state of even-Z, neutron-deficient nuclei. Recent advancements in measuring proton-proton correlations have reignited interest in this area, highlighting the interplay between structure and reaction dynamics in nuclear open quantum systems. As a complementary process, two-neutron ($2n$) emission—recently observed in certain neutron-rich dripline nuclei—has similarly garnered attention. Comparing these two exotic processes offers valuable insights into the interplay between Coulomb and nuclear interactions in the presence of a low-lying continuum. Our study employs the Gamow coupled-channel method alongside a time-dependent approach, revealing how the structure of the initial wave function, shaped by both initial-state and final-state interactions, crucially influences decay dynamics [1] and proton-proton correlations [2]. Additionally, by analyzing the energy dependence of these correlations, we uncover unique insights into non-exponential decay mechanisms [3], deepening our understanding of open quantum system properties.

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[2] S. M. Wang, W. Nazarewicz, R. J. Charity, and L. G. Sobotka, J. Phys. G 49, (2022) 10LT02.
[3] S. M. Wang, W. Nazarewicz, A. Volya, and Y. G. Ma, Phys. Rev. Research 5, 023183 (2023).

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Session Classification: Parallel Session

Track Classification: Nuclear Structure