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Abstract for an Invited Paper
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Dissertation Award in Nuclear Physics Recipient: Nuclear structure at the Edge: Proton decay and
the invariant-mass Method
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Two-nucleon decay is the most recently discovered nuclear-decay mode. For proton-rich nuclei, most multi-proton decays
occur via sequential steps of one-proton emission. Direct two-proton (2p) decay was believed to occur only in even-Z
nuclei beyond the proton-drip line where one-proton decay is energy forbidden. This has been observed for the ground
states of around a dozen nuclei including 6Be, the lightest case, and 54Zn, the heaviest case. Direct 2p decay has also
recently been observed for isobaric-analog states where all possible 1p intermediates are either isospin allowed and energy
forbidden, or energy allowed and isospin forbidden. For light proton emitters (A < 12), the lifetimes are short enough
that the invariant-mass technique is ideal for measuring the decay energy, intrinsic width, and, for multi-proton decays, the
momentum correlations between the fragments. I will describe recent measurements of proton emitters using the invariant-
mass technique with the High-Resolution Array (HiRA). I will present a new, high-statistics measurement on the decay of the
ground and excited states in 12O. By measuring the momentum correlations between the decay fragments, one can observe
how the decay transitions from direct to sequential as the decay energy increases. I will present data on the isobaric-analog
pair 8C and 8BIAS, which highlight the two known types of direct 2p decay. I will also present the first observation of 11O,
the mirror of the well-known halo nucleus 11Li.