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Beta-delayed two-proton spectroscopy at FRIB

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13 beta-delayed two-proton (β2p) emitters are known today: ^{22}Al, ^{22,23}Si, ^{26}P, ^{27}S, ^{31}Ar, ^{35}Ca, ^{39}Ti, ^{43}Cr, ^{45,46}Fe, ^{50,51}Ni. The Q-value (the energy released in the decay) is a major determining factor for what type of beta-delayed decays occur, and therefore two-proton emitters are found at or close to the dripline. Nuclear structure also plays a role as clustering in light nuclei evolves into competition between single particle and collective (rotational and vibrational) degrees of freedom. The cross-over happens in this interesting region of the chart of nuclei where the known β2p emitters are found. The relation between two-proton emission and many-body nuclear structure is still poorly understood.

Of the 13 known cases, only ^{31}Ar has been studied with sufficient statistics and beam quality to provide a deep study of the mechanism of the two-proton emission, this being the only case possible to produce at an ISOL facility (ISOLDE-CERN). Short-lived isotopes of the elements between Mg and Cl are difficult, or impossible, to produce at ISOL facilities due to the chemical properties of those elements.

With FRIB coming on-line and the Gas Stopping Area working excellently it is now possible to make low energy beams of most of these isotopes with unprecedented yields. With FRIB Experiment 21010 on the decays of ^{22}Al and ^{26}P we have initiated the exploration of this fertile region of nuclear structure and decay phenomena. The experiment is the first successful FRIB Experiment conducted in the Stopped Beam Area with yields of the two species of respectively 10 and 60 particles per second. The experiment provided much improved data both in quality and quantity not only for ^{22}Al and ^{26}P, but also for ^{21}Mg and ^{25}Si (beta-delayed one-proton emitters), which were present as contaminants and/or were used for calibration purposes.

In this contribution I will present results from FRIB Experiment 21010 including a clarification of the mechanism of two-proton emission in the decays of ^{22}Al and ^{26}P. Plans for future studies at FRIB to address more of the 13 known cases of beta-delayed two-proton emitters will also be presented.

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