Measurement of the Beta Decay of ^{26}P to Determine Classical Nova ^{26}Al Production in the Milky Way

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Observation across the Milky Way of a 1809-keV gamma-ray characteristic of ^{26}Al decay provides direct evidence for ongoing nucleosynthetic production of ^{26}Al [1]. Although massive stars and supernovae are likely to be the primary sites for ^{26}Al production, classical novae may also contribute a significant portion of the total amount of Galactic ^{26}Al [2]. At peak nova temperatures of approximately 0.4 GK, the rate of the ^{25}Al$(p,\gamma)^{26}$Si reaction, which bypasses ^{26}Al production and therefore places an upper limit on the amount of ^{26}Al contributed by novae to Galactic abundances, is likely dominated by a single 3^+ resonance. Constraining the energy and strength of this resonance is therefore critical to determining the ^{25}Al$(p,\gamma)^{26}$Si reaction rate [3]. We have used a radioactive ^{26}P beam produced at the National Superconducting Cyclotron Laboratory to populate the 3^+ state via beta decay, and have first evidence for its gamma decay branch, the last piece of information needed to calculate the resonance strength. We find the 3^+ state to have a resonance energy of $E_r = 414.9 \pm 0.6$ (stat) ± 0.3 (syst) ± 0.6 (lit.) keV and a resonance strength of $\omega\gamma = 23 \pm 6$ (stat) $^{+11}_{-10}$ (lit.) meV [4]. We have also used hydrodynamic nova simulations to model ^{26}Al production and we find that novae may contribute up to 0.6 solar masses of the Galactic ^{26}Al – potentially up to 38% of the total Galactic 26Al abundance [5]. Experimental details will be presented and results will be discussed.

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