Beta-decay of proton-rich nucleus $^{23}$Al and astrophysical consequences\textsuperscript{1} Y.J. ZHAI, V.E. IACOB, T. AL-ABDULLAH, C. FU, J.C. HARDY, N. NICA, H.I. PARK, G. TABACARU, L. TRACHE, R.E. TRIBBLE, Cyclotron Institute, Texas A&M University — We will present the results of a $\beta$-decay study that was motivated by a nuclear astrophysics problem. For the first time $\gamma$-rays have been observed following the $\beta$ decay of pure samples of $^{23}$Al. We used the $^1$H($^{24}$Mg,$2n$)$^{23}$Al reaction and the MARS recoil separator of Texas A&M University. $\beta$ and $\beta - \gamma$ coincidence measurements were made with a fast tape-transport system and $\beta$ and $\gamma$-ray detectors. The experiment allowed us to measure $\beta$ branching ratios and deduce logft values for transitions to 14 final states in $^{23}$Mg, including the isobaric analog state, and from them to determine unambiguously the spin and parity of $^{23}$Al ground state to be $J^\pi = 5/2^+$. We will discuss how this excludes the large increase in the radiative proton-capture cross section for the reaction $^{22}$Mg($p,\gamma$)$^{23}$Al at astrophysical energies which was implied by claims that the spin and parity is $J^\pi = 1/2^+$ [1,2], claims that motivated this study in the first place. The reaction is possible candidate to explain why space-based gamma-ray telescopes do not observe $\gamma$-rays from the decay of long-lived $^{22}$Na formed in ONe novae explosions [3]: a larger cross section would be required to divert significant flux from the A=22 into the A=23 mass chain. [1] X. Z. Cai et al, Phys. Rev. C 65, 024610 (2002). [2] H.-Y. Zhang et al., Chin. Phys. Lett. 19, 1599 (2002). [3] M. Wiescher et al., Astrophys. J. 343, 352 (1989).

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Livius Trache
Texas A&M University

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