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Technique and study of β-delayed p-decay of proton-rich nuclei[1]

L. TRACHE, T. AL-ABDULLAH, A. BANU, C. FU, V. GOLOVKO, J.C. HARDY, V.E. IACOB, H.I. PARK, G. TABACARU, R.E. TRIBBLE, Y. ZHAI, Texas A&M University, J. AYSTO, A. SAASTAMOINEN, University of Jyvaskyla, Finland, P.J. WOODS, T. DAVINSON, University of Edinburgh, UK, M.A. BENTLEY, D. JENKINS, University of York, UK — We developed a technique to measure beta-delayed proton-decay of proton-rich nuclei produced and separated with the MARS recoil separator at TAMU. In particular we studied the case of ^{23}Al produced in inverse kinematics. Its β-decay was studied before, using $\beta-\gamma$ coincidence techniques. The states populated in ^{23}Mg above the proton threshold at S_p=7580 keV may proton decay. They are resonances in the proton capture reaction ^{22}Na(p,γ)^{23}Mg, crucially important for the depletion of ^{22}Na in ONe novae. A setup consisting of a thin Si strip detector (p-detector) and a thick Si detector (β-detector) was designed. A HpGe detector outside the chamber detected γ-rays. A rotating energy-degrader was used to implant the source nuclei (from 40 MeV/u) in the middle of the thin p-detector. We have pulsed the beam from the cyclotron, implanted the source, then measured $\beta-$p and $\beta-\gamma$ coincidences off-beam. The technique has shown a remarkable selectivity to β-delayed charged particle emission and would work even at radioactive beam rates of a few pps.

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