Study of the 44Ti(α,p)47V reaction and implications for core collapse supernovae

Alexander Murphy, V. Margerin, T. Davinson, R. Dressler, J. Fallis, A. Kankainen, A. Laird, G. Lotay, D. Mountford, C. Murphy

School of Physics and Astronomy, University of Edinburgh

Space-based gamma-ray satellites such as BeppoSAX, COMPTEL and INTEGRAL have reported detection of ^{44}Ti in the Cassiopeia-A and SN1987a core-collapse supernova remnants. The NuSTAR satellite has recently measured the distribution of ^{44}Ti gamma ray emission in Cassiopeia-A finding a highly asymmetric distribution. In all cases, the amounts of ^{44}Ti inferred in the ejecta are higher than is expected, even assuming a wide range of progenitor models and masses. The dominant nuclear uncertainty within such models is the rate of the ^{44}Ti(α, p)^{47}V nuclear reaction rate. Through radiochemical separation, a sample of ^{44}Ti was obtained from highly-irradiated martensitic steel accelerator components of the Paul Scherrer Institute. Transported to CERN, this material was then developed into a beam at the REX-ISOLDE facility and directed onto a gas filled cell. This enabled a study of the ^{44}Ti(α, p)^{47}V reaction at an energy of Ecm=4.15 MeV, finding an upper limit for the cross section of 40 μ barn (68% c.l.). Implications for core collapse supernovae and plans for future experiments will be presented.