Abstract Submitted
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Search for a Broad 9.11 MeV 2^+ in ^{12}C* W.R. ZIMMERMAN, P.-N. SEO, M. GAI, UConn, M.W. AHMED, S.S. HENSHAW, C.R. HOWELL, S.C. STAVE, H.R. WELLER, P.P. MARTEL, TUNL — Carbon is formed during stellar helium burning in the "triple- alpha process"– the $^8Be(\alpha,\gamma)^{12}C$ reaction that is mostly governed by the 0^+ state at 7.654 MeV. At high temperatures (T > 3 GK) higher lying states in ^{12}C may contribute. A broad ($\Gamma_\alpha = 560\ keV, \Gamma_\gamma = 0.2\ eV$) 2^+ state at 9.11 MeV in ^{12}C was included in the NACRE compilation following theoretical prediction for the 2^+ member of the rotational band built on top of the 0^+ state at 7.654 MeV. It increases the production of carbon at temperatures in excess of 1 GK by up to a factor of 15. An Optical-Readout Time Projection Chamber (O-TPC) operating with CO_2 gas that is being used at the High Intensity γ-ray Source (HIγS) at TUNL is ideally suited for a search of such a state via the identification of triple alpha events from the $^{12}C(\gamma,3\alpha)$ reaction. We have studied this reaction at E_γ = 9.55, 10.54, 10.84 and 11.14 MeV. Only 4 triple alpha events were observed during a 10 hour long measurement at 9.55 MeV which are consistent with the known broad 1^- state at 10.84 MeV in ^{12}C. Using the known cross section of the $^{16}O(\gamma,\alpha)^{12}C$ (= 4.2 μb) we place the upper limit of $\Gamma_\gamma(0^+_{g.s.} \rightarrow 2^+) < 1.28$ meV at $E_\gamma = 9.55$ MeV, hence $B(E2: 2^+ \rightarrow 0^+_{g.s.}) < 4 \times 10^{-3}$ W.u.
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