Proton decay of excited states in $^{12}$N and $^{13}$O and the astrophysical $^{11}$C(p,γ)$^{12}$N reaction rate


Using a $^{13}$O beam, we have observed proton decays of $^{12}$N and $^{13}$O excited states following proton-knockout and inelastic interactions on a 9Be target. The excited states were determined from detected two- and three-body exit channels using the invariant mass method. The width of the second excited state of $^{12}$N was determined to be 55(20) keV, considerably smaller than the value listed in the ENSDF data base. Three new excited states of narrow width (≤50 keV) were observed in $^{13}$O from the p$+^{12}$N and 2p + $^{11}$C exit channels. One of these states ($E_x = 3.67$ MeV) was found to sequentially decay to the second excited of $^{12}$N. We again found these data to be inconsistent with the listed decay width. The ramifications for the astrophysically interesting $^{11}$C(p,γ)$^{12}$N reaction are given. The work has been published in Phys. Rev. C 87, 054329 (2013).