Measurement of neutron source $^{13}C(\alpha,n)^{16}O$ reaction and beta decay of nuclei in rp-process

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$^{13}C(\alpha,n)^{16}O$ reaction is the dominant neutron source for slow neutron captures (the s-process) in asymptotic giant branch (AGB) stars. We present a new measurement of the α-spectroscopic factor for the 6.356 MeV $1/2^+$ subthreshold state of ^{17}O through the $^{13}C(^{11}B,^{7}Li)^{17}O$ transfer. This is used to deduce the reaction rate of the $^{13}C(\alpha,n)^{16}O$ reaction, the main neutron source for slow neutron captures (the s-process) in asymptotic giant branch (AGB) stars. At a temperature of 100 MK, the new rate is roughly two times larger than the CF88 value and two times smaller than that recommended by NACRE. We use the new rate in simulations of AGB stars, and find out that in stars of initial mass lower than 2 solar mass, changes up to 25% for Pb be expected [1].

β decay data are important input to the network calculation of astophysical rp-process. The β decay of $^{53,54}Ni$, $^{52,53}Co$, ^{51}Fe, and ^{50}Mn was investigated. The proton-γ coincidences of ^{53}Ni β-delayed proton emission were observed. It was inferred that the previous assignment of the excitation energy for the isobaric analog state in ^{53}Co may be problematic. The half-lives were evaluated and used in nucleosynthesis calculations of rp-process in an x-ray burst [2].

Finally, the progress of proposed Jinpin underground nuclear astrophysics laboratory (JUNA) will be presented.

[1] B. Guo, Z. H. Li, M. Lugaro et al., Astrophys. J. 756, 193 (2012).
[2] J. Su, W. P. Liu et al., Phys. Rev. C 87, 024312 (2013).