UNDERGROUND NUCLEAR ASTOPHYSICS EXPERIMENT IN JINPING CHINA: JUNA

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Thermonuclear reaction rate is crucial quantity for modeling stellar phenomena. The direct measurement of astrophysical reaction rates presents major challenge of small cross section amid with large natural background. With ultra-low background in deep underground environment, direct measurement of these key reactions becomes possible, as demonstrated by LUNA experiments.

Jinping Underground experiment for Nuclear Astrophysics (JUNA) will take the advantage of China Jinping Laboratory (CJPL) (rock depth 2400 m) and high intensity accelerator with detector to directly study a number of crucial reactions near Gamow window. In its first phase, JUNA aims at the direct measurements of $^{25}Mg(p,\gamma)^{26}Al$, $^{19}F(p,\alpha)^{16}O$, $^{13}C(\alpha,n)^{16}O$ and $^{12}C(\alpha,\gamma)^{16}O$ reactions.

The experimental setup, which includes an accelerator system (400 kV with ECR source) with high stability and high intensity (10 emA for proton, 2.5 emA for $^{4}He^{2+}$), a detector system, and a shielding material with low background, will be established during the above research (with the state of art sensitivity of 10^{-13} mb). The high efficiency detector system is composed of γ (HPGe and BGO), neutron (^{3}He and liquid scintillator) and charged particle arrays.

The main parts of accelerator system and detector arrays are ready, and will be tested on base ground and installed underground in 2017. Some test experiment on base level, such as $^{9}F(p,\alpha)^{16}O$, as well as detector background measurement in CJPL, were performed. One of four experiments will be started in 2018 and the first batch of four experimental results will be released in 2019.