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Reanalysis of ^{13}N$(p,\gamma)^{14}$O reaction and its role in stellar CNO cycle. BEKMURZA BEISENOV, al-Farabi Kazakh National University, 050040, Almaty, Kazakhstan, SERGEY B. DUBOVICHENKO, Fesenkov Astrophysical Institute, 050020, Almaty, Kazakhstan, ROMAN KEZERASHVILI, New York City College of Technology, CUNY, Brooklyn, NY 11201, USA, NATALI A. BURKOVA, al-Farabi Kazakh National University, 050040, Almaty, Kazakhstan, ALBERT V. DZHAZAIROV-KAKHRAMANOV, Fesenkov Astrophysical Institute, 050020, Almaty, Kazakhstan — Within the framework of the modified potential cluster model with forbidden states, the ^{13}N$(p,\gamma)^{14}$O reaction rate and the astrophysical S-factor are considered. It is shown that the first p^{13}N resonance determines the S-factor and contributions of the $M1$ and $E2$ transitions are negligible at energies $E < 1$ MeV, but are significant at high energies. The S-factor strongly depends on the $^3S_1$ resonance parameters. The influence of the width of the $^3S_1$ resonance on S-factor is demonstrated. Results of our calculations for the ^{13}N$(p,\gamma)^{14}$O reaction rate provide the contribution to the steadily improving reaction rate database libraries. Our calculations of the ^{13}N$(p,\gamma)^{14}$O reaction rate along with results for the rates of ^{14}N$(p,\gamma)^{15}$O and ^{12}C$(p,\gamma)^{13}$N processes provide the temperature range $0.13 < T_9 < 0.97$ for the conversion of CNO cycle to the HCNO cycle. Our results demonstrate that at early stages of a nova explosion at temperatures about 0.1 T_9 and at late stages of evolution of supermassive stars at temperatures about 1.0 T_9 the ignition of the HCNO cycle could occur at much lower densities of a stellar medium.

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