Newly Discovered Low Energy Resonances In The 22ne(p,g)23na At Luna

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The neon-sodium cycle of hydrogen burning influences the synthesis of the elements between ^{20}Ne and ^{27}Al in red giant stars, asymptotic giant stars, and novae explosions. In order to reproduce the observed elemental abundances, the cross sections of the reactions involved in the nucleosynthesis process should be accurately known.
The ^{22}Ne(p,γ)^{23}Na reaction rate is very uncertain because of a large number of unobserved resonances lying in the Gamow window.
A new direct study of ^{22}Ne(p,γ)^{23}Na has been performed at the Laboratory for Underground Nuclear Astrophysics (LUNA) in Gran Sasso using a windowless gas target and two different experimental setups.
Three resonances (156.2, 189.5, and 259.7 keV) have been observed for the first time in a direct experiment, using two high-purity germanium detectors. Further investigations have been devoted to the tentative resonances at 71 and 105 keV, using a six-fold, optically segmented BGO detector surrounding the interaction volume. Direct capture measurements were carried out as well at different energies.
The resulting reaction rate is significantly different from the STARLIB 2013 evaluation at temperatures around 0.1 GK, relevant to nucleosynthesis in asymptotic giant branch stars. The newly measured resonance strengths, together with the direct capture contribution to the cross section, will be discussed in detail and the astrophysical implications will be shown.