Study of the ^{22}Ne(p,γ)^{23}Na at LUNA

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The ^{22}Ne(p,γ)^{23}Na reaction, part of the neon-sodium cycle of hydrogen burning, may explain the observed anticorrelation between sodium and oxygen abundances in globular cluster stars. At astrophysical energies, the presence of many resonances dominates the rate. The LUNA collaboration measured for the first time three of them: $E_p = 156.2$, 189.5, and 259.7 keV. Recently, by using an high efficiency setup, made of a 4π-BGO detector and a windowless gas target, the uncertainties related to those three states have been lowered drastically and the direct component of the cross section was also measured at four different energies below 300 keV, in the center of mass. In addition, the two suggested resonances at $E_p = 71$ and 105 keV have been studied and new upper limits were established, leading to a negligible contribution of these two states in the thermonuclear reaction rate. As a result, at a temperature of 0.1 GK the error bar of the ^{22}Ne(p,γ)^{23}Na rate is now reduced by three orders of magnitude. Here, new ^{22}Ne(p,γ)^{23}Nadata and the LUNA recommend reaction rate are reported. The new high efficiency setup provides also the possibility to investigate the branching cascades, despite the limited resolution of the BGO detector. This way new branchings have been found for the above mentioned resonances and the direct component of the cross section.