RATE AND UNCERTAINTY OF THE ^{18}NE(α,p)^{21}NA REACTION FROM MONTE-CARLO SIMULATIONS

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The ^{18}Ne(α,p)^{21}Na reaction is a key for the break-out from the hot CNO-cycles to the rp-process [1]. Here we present an updated reaction rate, which is based on the latest experimental data of transfer experiments to the compound ^{22}Mg nucleus [2,3] and resonant ^{21}Na(p,p)^{21}Na elastic scattering [4,5]. The new rate is calculated within the narrow-resonance formalism using experimental resonance energies E_R and calculated resonance strengths $\omega\gamma = \omega\Gamma_\alpha$. The widths Γ_α have been estimated from the mirror nucleus ^{22}Ne (when reduced widths are available) or from a Porter-Thomas distribution for the remaining states without spectroscopic information [6]. A Monte-Carlo simulation is used for the calculation of the new rate, taking into account uncertainties of all nuclear physics ingredients, including uncertain spin assignments; thus, an improved estimate of the uncertainty of the rate can be provided in a consistent way [7]. The new recommended rate is slightly lower, but close to previous recommendations [3,5]. We find improved consistency between the present approach using experimental resonance energies and calculated resonance strengths and an alternative approach using experimental data of the inverse ^{21}Na(p,α)^{18}Ne reaction with theoretical corrections for the contributions of excited states in ^{21}Na [8,9]. An earlier direct approach [10] is inconsistent with the present result and with the inverse reaction data [8,9] and is thus neglected in the determination of $N_A < \sigma v >$.

This work was supported by OTKA (K101328 and K108459) and in part by the US Department of Energy under contract no. DE-FG02-97ER41041 and by the National Science Foundation under award number AST-1008355.

[1] H. Schatz and K. E. Rehm, Nucl. Phys. A777, 601 (2006).
[2] A. Matic et al., Phys. Rev. C 80, 055804 (2009).
[3] P. Mohr and A. Matic, Phys. Rev. C 87, 035801 (2013).
[4] J. J. He et al., Phys. Rev. C 88, 012801(R) (2013).
[5] L. Y. Zhang et al., Phys. Rev. C 89, 015804 (2014).
[6] I. Pogrebnyak et al., Phys. Rev. C 88, 015808 (2013).
[7] R. Longland et al., Nucl. Phys. A841, 1 (2010).
[8] P. J. C. Salter et al., Phys. Rev. Lett. 108, 242701 (2012).
[9] S. Sinha et al., ANL Annual Report 2005, p.6-7.
[10] D. Groombridge et al., Phys. Rev. C 66, 055802 (2002).