The ^{7}Li(p,α)^{4}He fusion reaction studied via the Trojan Horse Method and its astrophysical implications

R.G. Pizzone[1,2,3], **C. Spitaleri**[1,2], **M. Lattuada**[1,4], **A. Musumarra**[1,2], **M.G. Pellegriti**[1,2], **C. Rolfs**[5], **Đ. Miljanić**[6], **A. Di Pietro**[1], **P. Figuera**[1], **S. Romano** [1,4], **S. Tudisco**[1,2], **A. Tumino**[1,2], **S. Typel**[7], **H.H. Wolter**[8], **V. Castellani**[9], **S. Degl'Innocenti**[9], **A. Imperio**[9]

[1] *Istituto Nazionale di Fisica Nucleare - Laboratori Nazionali del Sud, Catania, Italy*
[2] *Dipartimento di Metodologie Chimiche e Fisiche per l'Ingegneria, Università di Catania, Italy*
[3] *C.S.F.N.S.M, Catania, Italy*
[4] *Dipartimento di Fisica e Astronomia, Università di Catania, Italy*
[5] *Ruhr-Universität Bochum, Germany*
[6] *Institut Rudjer Bošković, Zagreb, Croatia*
[7] *Michigan State University, Lansing, USA*
[8] *Ludwig-Maximilian-Universität, München, Germany*
[9] *Dipartimento di Fisica, Università di Pisa, Pisa, Italy*

The $^7Li(p,\alpha)^4He$ bare nucleus cross section plays a key role in primordial nucleosynthesis and lithium depletion. The presence of Coulomb barrier and electron screening effect makes this measurement at astrophysical energies very hard to perform. Thus experimental S(E)-factors are usually corrected for the electron screening enhancement factor (which depends on the electron screening potential U_e) obtaining the bare astrophysical $S_b(E)$-factor and then extrapolated to nearly zero energies.

The Trojan Horse Method (THM) [1-3] can be applied to extract the energy dependence of $S_b(E)$ at very low energies without any extrapolation, by measuring the cross section of a suitable three body process. We have applied the THM to study $^7Li(p,\alpha)^4He$ reaction through the $^7Li(d,\alpha\alpha)n$ three body process and the value deduced from this experiment, using the DWBA approach, is $S_b(0)$=55 $\pm$ 3 keV·b [4], slightly different from the value reported on the NACRE compilation. From the obtained $S_b(E)$ values it is also possible to measure U_e, by comparing direct and indirect data; the result in this case is $U_e = 330 \pm 40$ eV.

The astrophysical implications of these measurements are discussed in the case of solar lithium problem and primordial nucleosynthesis.

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