statistical model calculations overestimate the measured ^{64}Zn(p,α)^{61}Cu at the lowest studied energies while the agreement becomes fairly good when the energy increases. In the case of the SMARAGD code (and in its predecessor NON-SMOKER) the standard calculations are carried out with the alpha-nucleus optical potential of McFadden and Satchler [11]. This potential was developed based on 25 MeV experimental data and does not have any energy dependence. It is therefore not surprising that experimental evidence is gathering that the potential fails at low energies where an energy dependence of at least the imaginary part of the potential seems to be required.

In order to cure the low energy problem of the McFadden–Satchler potential, an energy dependent modification was recently recommended [12]. The depth of the imaginary part was modified using a Fermi-type function with a diffuseness parameter a_E. Several recent experiments indicate that this modification leads to a better reproduction of the measured data (see e.g. [13] and references therein). In the present paper this modification is tested for the ^{64}Zn(p,α)^{65}Cu reaction. Figure 2 shows the comparison of the experimental data with SMARAGD calculation in the form of astrophysical S-factor. (Calculations with the TALYS code are omitted here as they were presented in [4].) The green line shows the standard calculation using the original McFadden–Satchler potential. The grey band indicates the obtained S-factors by the modified potential with the a_E parameter in the range between 1.5 and 5 MeV. It is evident that the modification leads to a much better reproduction of the experimental data. The best agreement is achieved with $a_E = 2.5$ MeV as indicated by the red curve.

5. Summary and conclusions

The present experimental data prove directly at astrophysical energies that the standard low energy α-nucleus optical potential must be modified. The new data support the recently suggested modification of the potential. The implementation of this modification in the reaction rate calculations for astrophysical models is recommended. The comparison of the measured and calculated ^{64}Zn(p,γ)^{65}Ga cross section data indicate that further experimental effort is needed as only measured data can help find the correct nuclear input parameters of calculations which show highly divergent results depending on the parameters.

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