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^{3}He(α,γ)^{7}Be cross section at high energies

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\AUTHORS{\underline{T. Sz\"ucs}, Gy. Gy\"urky, Z. Hal\'asz, G.\,G. Kiss, Zs. F\"ul\"op}

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%%% Abstract proper starts here.
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The ^{3}He(α,γ)^{7}Be reaction is the starting point of the ppII and ppIII reaction branches in the solar hydrogen burning, therefore its rate has sizeable impact on the solar ^{7}Be and ^{8}B neutrino production. Using the standard solar model [1], the flux of these neutrinos can be calculated. With the known solar parameters and reaction rates, we may have an insight into the solar core. Recently, the solar neutrino detections reached a precision of a few percent [2,3], which would allow for these investigations. However, now the precision of the nuclear physics input has to catch up to have this unique tool for precise solar core diagnostics.

One of the most uncertain reaction rates is that of the ^{3}He(α,γ)^{7}Be, even if many experiments have been done in the last decade clearing up some long standing issues [4,5].
Most of these reaction cross section measurements concentrated on the low energy cross sections and their precision mostly reached the limits. However, there is no experimental data above \mbox{$E_{cm} = 3.1$\,MeV}. It was suggested recently, that the R-matrix models have to be tested with higher energy datasets [6]. In addition, there are conflicting datasets for the ^{6}Li(p,γ)^{7}Be reaction [7,8] having impact on the level scheme of ^{7}Be.

In this work the ^{3}He(α,γ)^{7}Be reaction cross section was measured in a wide energy range between $E_{cm} = 2.5 - 4.4$\,MeV. A thin window gas cell target was used [9], and the cross sections were determined from the activity of the produced ^{7}Be implanted into the catcher foil closing the gas cell. This method is free from any uncertainty of angular distribution effects which can be sizeable in case of resonant capture. Even if the entrance foil broadens the energy distribution of the interacting beam, thus enlarges the energy uncertainty of the measured cross sections or uncertainty of a resonance position, this effect remain small and does not to smear out any possible peak of a resonance.
The final dataset will contain data points in the energy range where experimental data already exists to have possible comparisons, and extends above the proton separation energy of ^{7}Be, thus it can be compared also with the ^{6}Li(p,γ)^{7}Be reaction cross sections.

Preliminary results will be presented and compared with literature data.

\bigskip
{\small

\noindent [1] A. Serenelli \textit{et al.}, Phys. Rev. D \textbf{87}, 043001 (2013);

\noindent [2] B. Aharmim \textit{et al.} (SNO Collaboration), Phys. Rev. C \textbf{88}, 025501 (2013);

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\noindent [4] E. G. Adelberger \textit{et al.}, Rev. Mod. Phys. \textbf{70}, 1265 (1998);

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\noindent [9] C. Bordeanu \textit{et al.}, Nucl. Phys. A \textbf{908}, 1 (2013).
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