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## Measurements of the ${}^7\text{Be}+n$ Big-Bang nucleosynthesis reactions at CRIB by the Trojan Horse method

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%
% Nuclear Physics in Astrophysics 8 template for abstract
%
% Format: LaTeX2e.
%
% Rename this file to name.tex, where 'name' is the family name
% of the first author, and edit it to produce your abstract.
%
\documentstyle[11pt]{article}
%
% PAGE LAYOUT:
%
\textheight=9.9in
\textwidth=6.3in
\voffset -0.85in
\hoffset -0.35in
\topmargin 0.305in
\oddsidemargin +0.35in
\evensidemargin -0.35in

%--- aliases ---%
\newcommand{\benpli}{{}^7\text{Be}(n, p){}^7\text{Li}}
\newcommand{\bena}{{}^7\text{Be}(n, \alpha){}^4\text{He}}
\newcommand{\bedlippi}{{}^7\text{Be}(d, {}^7\text{Li}p){}^1\text{H}}
\newcommand{\bedaap}{{}^7\text{Be}(d, \alpha\alpha){}^1\text{H}}
\newcommand{\bedpbe}{{}^7\text{Be}(d, p){}^8\text{Be}}
\newcommand{\cm}[_]{\rm c.m.}
\renewcommand{\refname}{}

%--- aliases ---%

%\renewcommand{\rmdefault}{ptm} % to use Times font

\long\def\TITLE#1{{\Large\bf#1}}\long\def\AUTHORS#1{ #1\[\[3mm]}
\long\def\AFFILIATION#1#2{{ #2\]}

\begin{document}
{\small \it Nuclear Physics in Astrophysics 8, NPA8: 18-23 June 2017, Catania, Italy}

\vspace{12pt}

\thispagestyle{empty}

\begin{center}
%%
%% Title goes here.
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%%%

\TITLE{Measurements of the  ${}^7\text{Be}+n$  Big-Bang nucleosynthesis reactions  
at CRIB by the Trojan Horse method}\[3mm]

%%%

%%% Authors and affiliations are next. The presenter should be  
%%% underlined as shown below.

%%%

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\vspace{12pt} % Do not modify

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\vspace{18pt} % Do not modify

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%%%

%% Abstract proper starts here.

%%%

It has been known that  
the prediction of the primordial  ${}^7\text{Li}$  abundance by the  
standard Big-Bang Nucleosynthesis (BBN) model %\cite{Coc2014}  
is about 3 times larger than the observation,  
so called the cosmological  ${}^7\text{Li}$  problem.

%

The  ${}^7\text{Li}$  abundance strongly depends on the  ${}^7\text{Be}$  production.

%

The  $\text{p}\alpha$  reaction is considered as the main process to destroy  
 ${}^7\text{Be}$  during the BBN.

%

Although its resonance structure has been well investigated,  
%\cite{Adahchour2003},  
the contribution of the transition to the first excited state  
of  ${}^7\text{Li}$  at the BBN energies ( $\sim 25\text{-keV}-1\text{ MeV}$ )  
has never been discussed.

%

The  $\text{p}\alpha$  reaction might be the second important  ${}^7\text{Be}$  destroyer,  
but its experimental reaction rate has not been investigated until  
the recent studies, %\cite{Hou2015,Barbagallo2016},  
which yet involve uncertainty in the BBN energy region.

%

We performed indirect measurements %of the  $\text{p}\alpha$  and  $\text{p}\alpha$  reactions  
of these reactions simultaneously %at once  
by the Trojan Horse Method (THM) at %\cite{Spitaleri2011} at  
Center for Nuclear Study Radioactive Ion Beam (CRIB) separator.  
%\cite{Yanagisawa2005}.

%

This study is one of the first attempts  
to apply the THM to  $\text{RI}+n$  reactions  
together with a recent collaborating study led by L.~Lamia  
and the INFN-LNS nuclear astrophysics group.  
%\cite{Lamia} in collaboration.

%

The experimental setup consisted of  
two parallel-plate avalanche counters to track the  ${}^7\text{Be}$  RI beam,

a CD<sub>2</sub> target, and six  $\Delta E$ - $E$  position-sensitive silicon telescopes to observe the  $\text{bedlipp}$  and  $\text{bedaap}$  reactions in inverse kinematics, which allows us to approach the  $\text{benpli}$  and  $\text{benaa}$  reactions in quasi-free kinematics, respectively.

We aimed to resolve both the ground and the first excited states of  ${}^7\text{Li}$  by  $Q$ -value spectrum of the 3-body reactions for the first time.

We observed several thousands of valid events in quasi-free kinematics.

Some results including the  $Q$ -value spectrum, the momentum distribution of the spectator, and the preliminary cross sections of the  $\text{benpli}$  and the  $\text{benaa}$  reactions will be presented.

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% \begin{figure}[t]%fig1
% \begin{center}
% \includegraphics[scale=0.5]{q-value.ps}
% \end{center}
% \caption{Q-value spectra of the \bedlipp\ (left) and the \bedaap\ (right) reactions.}
% \label{fig:q-value}
% \vspace{-6mm}
% \end{figure}
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% \vspace{-24pt}
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% \end{thebibliography}

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%% End of abstract.
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