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“Development and use of CR39 Nuclear Track Detectors for the Measurement of the Interaction of (High Flux) Neutron Beams with 7Be and the Primordial 7Li problem

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\long\def\TITLE#1{{\Large{\bf#1}}}\long\def\AUTHORS#1{ #1\\[3mm]}
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\begin{document}
{\small \it Nuclear Physics in Astrophysics 8, NPA8: 18-23 June 2017, Catania, Italy}

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%%% Title goes here.
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\TITLE{“Development and use of CR39 Nuclear Track Detectors for the Measurement of the Interaction of (High Flux) Neutron Beams with [7]Be and the Primordial [7]Li problem*” }\\[3mm]
%%%
%%% Authors and affiliations are next. The presenter should be
%%% underlined as shown below.
%%%
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\end{center}
%%%
%%% Abstract proper starts here.
%%%
The high intensity epithermal neutron beams produced by the Soreq Applied Research Accelerator Facility (SARAF) operating with the Liquid Lithium Target (LiLiT) present significant opportunities in Nuclear Astrophysics. However, major experimental challenges arise when a detector is used with the high flux 50 keV quasi-Maxwellian neutron beams produced by the LiLiT ($\sim 10^{10}$ n/sec/cm^2) as well as the high flux ($\sim 10^{11}$ /sec) of 477 keV gamma-rays from the ^{7}Li(p,p'γ) reaction. We are developing protocols [1] for the use of CR39 Nuclear Track Detectors (NTD) in such high intensity backgrounds. We calibrated CR39 NTD with alpha-particles from standard radioactive sources and by using Rutherford Backscattering of accelerated alpha-particles and protons from a thin gold foil. We used cold neutrons to calibrate the background" ^{17}O(n,α) reaction that occurs inside the CR39 plates. The plates were etched in a standard 6.25 N NaOH solution for 30 minutes at 90°C to produce micron size circular pits. The plates were scanned with a fully motorized microscope. A segmentation algorithm that addresses the challenges posed by the intense neutron beam and gamma-ray background was developed. We used a (phantom") ^{9}Be target produced at the Paul Scherrer Institute(PSI) [2] to measure the background from irradiation with an intense ($\sim 10^{10}$ n/cm^2/sec) neutron beam. Using our calibration we define the radii region of interest (RRI) for detecting alpha-particles and we demonstrate that it is governed by pits generated by the combination of 1.4 - 1.7 MeV alpha-particles and 0.6 - 0.3 MeV ^{14}C from the ^{17}O(n,α)^{14}C reaction that occurs inside the CR39. These backgrounds are the limiting factor in measuring small cross sections with the current setup, as for example is required in the study of the interaction of neutrons with ^{7}Be, which is important for understanding the "Primordial ^{7}Li Problem" [3]. \\
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\bigskip
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\noindent [1] Emily Elizabeth Kading {\em et al.}, to be published, Jour. Instr. (2017).

\noindent [2] Emilio Andrea Maugeri {\em et al.}, in press, Jour. Instr. (2017)

\noindent [3] Moshe Gai, Invited Talk, this conference.
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%%% End of abstract.
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\end{document}

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Presenter: KADING, Emily (Graduate Student)

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