Thesis Summary

Reliable Nuclear Astrophysics: from Big-Bang to Stellar Burning and Beyond

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The thesis presents the main original scientific results obtained by the author after the granting of the PhD title in 2006 at Ohio University, USA.

The first chapter makes an overview of the professional career and introduces the research topics in which the candidate gained expertise after defending the PhD thesis. The scientific activities presented in this thesis can be categorized under the following physics topics: experimental nuclear astrophysics with a subtopic of charged particles detection with silicon-strip detectors and neutron physics, mainly fast neutrons, with associated detectors and metrology, combined with detector development for measuring the parameters of gamma-ray beams. The first chapter also details teaching activities and participation in PhD advisory committees are also mentioned in this chapter.

The second chapter presents the scientific and professional achievements in the two main topics of this thesis: nuclear astrophysics and detector development. The nuclear astrophysics part of the chapter is divided in two sections: one section on stellar burning reactions mainly on $^{12}C(\alpha,\gamma)^{16}O$ and several reactions carried-out at Oak Ridge National Laboratory, second section on Big Bang nucleosynthesis through the $^{7}Li(\gamma,t)^{4}He$, development of ELISSA array at ELI-NP and the p-process reaction research. Our past defines the present and the future. The R-matrix analysis of the influence of cascade transition on the $^{12}C(\alpha,\gamma)^{16}O$ cross section which was carried out after completing the PhD thesis makes its way into the present work on $^{16}O(\gamma,\alpha)^{12}C$. Stellar burning reactions at Oak Ridge National Laboratory during 2006-2009 used ORRUBA and SIDAR arrays which are relevant today for our 2017 measurements for the $^{7}Li(\gamma,t)^{4}He$ reaction at HIγS. ELISSA silicon-strip detector array is the main instrument for nuclear astrophysics with gamma-ray beam at ELI-NP.

Detector development section starts from the author's work for VANDLE neutron detector array at Oak Ridge National Laboratory, follows the SCINTIA array at JRC-Geel, neutron metrology at National Physical Laboratory, and continues with current work on implementing a full lineup of instruments for measuring the parameters of the gamma-ray beam at ELI-NP. The ultimate goal is to bring gamma-ray metrology on the same level of robustness as neutron metrology.

The third chapter presents the current on-going proposals and plans for future work in the fields of the thesis. The author highlights the goal of mentoring PhD students in both nuclear astrophysics and forming a generation of scientists versed in the new field of gamma-ray metrology.