Załącznik nr 6 do wniosku o wszczęcie postępowania habilitacyjnego
Attachment no. 6

Summary of scientific achievements

1 Name and family name:

Marcin Palacz

2 Scientific degrees:

Doctor of physical sciences:

granted in 1997 by the Scientific Council of the Andrzej Sołtan Institute of Nuclear Studies in Świerk
Title of the PhD thesis: „Study of Nuclear Structure in the Vicinity of Doubly Magic Neutron Deficient Nuclei and of the Quasi-Continuum Radiation in ^{143}Eu"
Promoter: prof. dr hab. Ziemowid Sujkowski

Master of physics:

granted in 1988 as a result of completing master studies and presenting a diploma work in the Faculty of Physics of the University of Warsaw

3 Employment:

- 1999–2014 University of Warsaw, Heavy Ion Laboratory adiunkt (research associate)
- 1997–1999 University of Warsaw, Heavy Ion Laboratory
  scientific-technical specialist
- 1989–1997 Institute of Nuclear Studies, Świerk
  in the beginning physicist, later research assistant.

4 Scientific achievement

pursuant to Art.16 Paragraph 2 of the Act on Scientific Degrees

Thesis entitled „Stany wzbudzone jąder atomowych z obszaru ^{100}Sn"
Author: Marcin Palacz
Heavy Ion Laboratory, University of Warsaw
Warszawa 2014
ISBN 978-83-926674-3-8

5 Description of scientific activities[1]

5.1 Before receiving the PhD degree

After completing master studies in the Faculty of Physics in the University of Warsaw, I was employed in the Andrzej Sołtan Institute of Nuclear Studies at Świerk, where I joined the group of prof. Ziemowid Sujkowski. During the first 4 years of my work at Świerk, I was mainly working on the scheme of excited states of ^{131}Ce [26], on possible contribution of the E0 transitions to the quasi-continuum radiation in ^{143}Eu, as well as on possible role of such transitions in the deexcitation of the super-deformed band in this nucleus [27, 28, 30, 39]

In March 1993 I left Świerk for Stockholm, where I joined the group of prof. Arne Johnson. During my 2-years stay in Stockholm I took part in the experiments performed at NBI-TAL in Risø, Denmark using the NORDBALL γ-ray spectrometer. The experiments were focused on investigations of exotic nuclei close to doubly-magic ^{56}Ni and ^{100}Sn. After the return from Stockholm I continued the analysis of data from Risø. This work resulted in my PhD thesis and co-authorship of most of the publications listed in part 2.3 of the included bibliographic list (articles published before PhD).

5.2 After receiving the PhD degree

5.2.1 Investigations of excited states of nuclei in the ^{100}Sn region

In December 1997 I was employed by the Heavy Ion Laboratory, University of Warsaw, and I am an employee of this Laboratory until now. My my main interests during all this period concentrate are investigations of proton-rich nuclei, especially in the ^{100}Sn region, studied by means of γ-ray spectroscopy in fusion-evaporation reactions induced by heavy-ions.

The most important results of my research in the ^{100}Sn region have been obtained in experiments done in the following laboratories: LNL Legnaro, IReS Strasbourg and in GANIL Caen — altogether I took part in 10 such experiments and I was a spokesperson of two of them. The experiments were performed using multi-detector γ-ray spectrometers (EUROBALL or EXOGAM) working together with charged particle detectors (ISIS, EUCLIDES, CUP, DIAMANT) and with an aggregate of neutron detectors Neutron Wall. These studies are summarised in the thesis mentioned in section 4. The results were published in papers [A1] to [A16] ((section 2.1 of the list in attachment 7). The main achievements and my role in respective studies are listed below:

1. Excited states in ^{103}Sn were identified [A1, A2]. This made possible to estimate the energy spacing of the $d_{5/2}$ i $g_{7/2}$ neutron single-particle orbitals and to set constraints on energies of other orbitals. The experiment was performed in 1999 in Legnaro. I joined the experiment right before it started (I was not involved in the preparations and planning). C. Fahlander was a spokesperson and the first author of the proposal. After the experiment, I performed the main part of the

[1] Citations used in this section refer to the list of publication included in attachment 7.

data analysis. I identified the γ-ray lines belonging to ^{103}Sn and I proposed the level scheme.

2. The same experiment allowed to observe new excited states in ^{102}In. Some of these states were interpreted as N=Z=50 core excitations [A4]. Lines from the ^{102}In nucleus were in fact contributing to the background in γ-ray spectrum obtained with the condition of 2 α-particles and 1 neutron, which was used to identify lines from ^{103}Sn. In the reaction used, ^{102}In, comparing to ^{103}Sn, was produced with the emission of 1 additional proton. My contribution to the experiment and the preliminary data analysis was the same as in item 1 above. I also analysed the scheme of excited states of ^{102}In to the extent which was necessary for the identification of ^{103}Sn γ-rays. Further work on ^{102}In was carried on by D. Sohler.

3. The experiment to which items 1 and 2 refer, also lead to obtaining information on excited states in ^{106}Sb. My contribution was similar as in case of ^{102}In.

4. A series of experiments was performed in 2001 in Strasbourg, using the EUROBALL γ-ray array, a charged particle detector EUCLIDES and the Neutron Wall. I took part in the installation of the Neutron Wall in Strasbourg, in the preparations of the setup to experiments, and in all the measurements. The most important result was the identification of a new core-excited isomer in ^{98}Cd [A6]. In case of ^{98}Cd I also took part in the off-line data analysis, which however was mainly done by A. Blazhev and M. Górska. Another experiment in the same series of measurements resulted in the information on the γ-ray radiation of ^{95}Ag [A3].

5. After the above mentioned series of the experiments, an idea of a new experiment aiming at excited states in ^{100}In appeared in my discussions with J. Nyberg. The experiment could be performed using EUROBALL, Neutron Wall and a new, specialised charged particle veto detector. I designed such a detector and run computer simulations. In collaboration with the group of prof. M. Moszyński from Świerk I made test of scintillators and photomultipliers. The mechanical construction of the detector was designed at HIL by eng. E. Kulczycka. The detector was constructed at HIL and tested in beams of the Warsaw cyclotron.

   The proposal to study ^{100}In was accepted by the PAC at Strasbourg. The experiment was run in 2003. I performed the data analysis at HIL, mostly personally, with the contribution of J. Gałkowski, who worked on these data during the preparation of his master thesis. After about 3 years of extensive data analysis work I concluded that identification of γ-ray radiation of ^{100}In is not possible using this data set.

   An extremely large data set collected in this experiment made it possible for me to extend the level schemes of ^{97}Ag and ^{96}Pd and it resulted in the observation in these nuclei of odd-parity core-excited states [A12,A13]. Data analysis is not yet finished — in the coming months I plan to present extended level schemes of another 2 nuclei.

6. In 2005 the Neutron Wall was transferred to GANIL and connected to the EXOGAM γ-ray spectrometer. I took part in the installation of the Neutron Wall at GANIL and in most of the experiment performed there with this setup. In the experiments I assumed co-responsibility for the functioning of the Neutron Wall and for the on-line data analysis.

   The Neutron Wall experiments at GANIL have been performed in series — a few weeks long campaigns. Such campaigns have so far taken place in 2005, 2006, 2009 i 2012. Several important technical issues related to detectors, beams and vacuum in the target chamber occurred during the first two campaigns. Most of the experiments have not achieved expected results. A review of all the Neutron Wall performed in 2005 and 2006 I presented during *EXOGAM Workshop* at GANIL in April 2007.

   Only recently results of one of the experiments from 2005 have been published [A15, A16]. In publications [A15] and [A16] strongly hindered E1 transitions are discussed. Description of such transitions requires N=Z=50 core excitations and presence of proton and neutron holes in orbital lying deep below the Z=50 gap. This has direct connection to the odd-parity core excitation observed in ^{96}Pd and in ^{97}Ag.

7. One of the experiments performed during the campaign in 2009 lead to the observation of γ-rays from ^{92}Pd. The spacing between the states in the established level scheme gives signature of the enhanced isoscalar proton-neutron interaction [A12]. The same experiment resulted also in new information on excited states of ^{91}Ru [A14].

   The same kind of the enhanced proton-neutron interaction seen in ^{92}Pd is also expected in ^{96}Cd. An experiment to study ^{96}Cd was prepared and started in 2012, but had to be aborted due to the accelerator failure. The experiment will be repeated in autumn 2014. Studies of ^{92}Pd and ^{96}Cd are lead by B. Cederwall and his group from Stockholm.

8. In January 2014 an experiment aiming at studies of excited states in ^{102}Sn was performed in Jyväskylä in Finland. The RITU recoil separator was employed. I was a co-spokesperson of this experiment (together with A. Ataç, J. Nyberg and J .Uusitalo). Analysis of data collected during this experiment is in progress.

5.2.2 Participation in the AGATA project

In 2005 I joined the collaboration working on the construction of a new γ-ray spectrometer AGATA (*Advanced GAmma ray Tracking Array*). Within this project in years 2006–2012, I coordinated the task of analysing the impact of ancillary detectors on the AGATA performance. I resigned from the this assignment in 2010 due to lack of time. The master thesis of G. Jaworski which I supervised in 2007 was connected to this activities. At present I am involved in planning experiments in which AGATA will be used together with the Neutron Wall and NEDA detectors at GANIL.

5.2.3 Participation in the construction of a new neutron detector array NEDA

The experience of the Neutron Wall experiments leads to the conclusion that possibilities of obtaining new results on extremely neutron-deficient nuclei to large extent depend on the efficiency and quality of the neutron detection. In 2007 work on a new setup of neutron detectors was initiated. The new array, named NEDA (*NEutron Detector Array*) will have better capabilities than the existing Neutron Wall. A start-up meeting of the new project took place in October 2007 at HIL in Warsaw — I was a co-organiser of this meeting (`http://www.slcj.uw.edu.pl/neutrons`).

Within the NEDA project I am coordinating work on the simulations and design. I am also a member of the Management Board. The PhD of G. Jaworski, who I supervised for the last 7 years is directly related to the NEDA project. This activity also resulted in the publication [A11].

5.2.4 Further scientific plans

I plan to continue investigations of nuclei in the region of ^{100}Sn. An opportunity to perform new experiments will be created when the AGATA γ-ray spectrometer would be connected to the Neutron Wall and NEDA detectors. Such experiment will likely be possible in 2016 at GANIL. I am a first author of a Letter of Intent to study ^{100}In using such a setup.

The new ion-source at HIL, fully operational since February 2014, makes it possible to perform in Warsaw studies in the ^{100}Sn region Beams of metals, like ^{58}Ni, are essential for such studies. In future I plan to setup the Neutron Wall and/or NEDA detectors for an experimental campaign in Warsaw. This project obviously requires many discussions and is a subject to obtaining suitable funding.

Warszawa 14 kwietnia 2014 — Marcin Palacz