

Nuclear Physics Laboratory
Section III
Department of Physics
The University of Ioannina

(www.uoi.gr/physics/npl/profile.htm)

Short REPORT
last 10 years

Ioannina- 12/6/2010

GENERAL

The Nuclear Physics Laboratory (NPL) was founded in 1976. Today, NPL includes 5 faculty staff members, as well as a number of graduate students and associate research fellows.

NPL is a founding member laboratory of the Hellenic Institute of Nuclear Physics established recently with the contribution of NPL's from the Universities of Ioannina, Thessaloniki and Athens.

The research activities of the NPL are in the field of experimental nuclear physics, with focus on fundamental and applied research (nuclear structure, nuclear reactions, environmental studies). Experiments are performed mainly abroad at big European facilities like CERN, CERN-ISOLDE, GANIL, LEGNARO, CATANIA and partly in Greece at the Nuclear Research Centre Demokritos. Applied research is performed at the local laboratory of Ioannina.

NPL is one of the regional laboratories participating in the Xenocrates National Emergency Plan for radiation protection.

The facilities of the NPL are located on the third floor of the Physics Building on the University of Ioannina campus. They cover approximately 400 m² of office and laboratory space. The experimental facilities include three gamma spectrometer stations, one alpha and beta - spectrometer system and an XRF microanalysis laboratory. Experimental work at the NPL is supported by a chemical processing laboratory and extensive local and remote computer capabilities.

The staff of the NPL supports the teaching of basic undergraduate courses offered by the Department of Physics. It also offers elective undergraduate and post-graduate courses in Nuclear Physics, Nuclear Experimentation and Nuclear Applications. Senior undergraduate research projects and research work leading to the M.S. and Ph.D. degrees is also carried out at the NPL facilities under the supervision of members of the NPL staff.

SCIENTIFIC ACTIVITIES

The members of NPL are specialists on subjects related with elastic-inelastic scattering and nuclear reactions with focus either on the reaction mechanisms and the optical potential or on the nuclear structure. Our main interest is located on weakly bound nuclei stable or radioactive and our last 10 year activities are concentrated on nuclei like ${}^{6,8}\text{He}$, ${}^{6,7,8}\text{Li}$, ${}^{8,10}\text{B}$, ${}^{17}\text{F}$ and ${}^{20,25,27}\text{Ne}$. Our experiments with the stable but weakly bound nuclei ${}^{6,7}\text{Li}$ nuclei were performed at Demokritos and attracted the interest of scientists of the European community-France, Italy and Poland. We were the first to show the unusual behaviour of the optical potential for such weakly bound nuclei in comparison with the threshold anomaly noticed for well bound ones and to exhaust the subject of the reaction mechanisms at near barrier energies on silicon targets observing large transfer cross section rates. Our publications on these subjects were rewarded with excellent publications (Pakou et al., PLB556,21(2003), PRL90,202701(2003),PRC69, 054602(2004), PRC71,064602(2005), PRC73,051603(R)(2006), NPA784,13(2007),EPJA39,187(2009),PRC80,017601(2009)). Our last proposals approved in the PAC's of Catania and Legnaro have been proceeding with the performance of the experiments while the analysis of the data is under progress. In more detail this research has to do with:

1. "Elastic backscattering measurements for ${}^{6,7}\text{Li} + {}^{28}\text{Si}$, ${}^{6,7}\text{Li} + {}^{58}\text{Ni}$, ${}^{6,7}\text{Li} + {}^{120}\text{Sn}$ and ${}^{6,7}\text{Li} + {}^{208}\text{Pb}$ at sub- and near-barrier energies as a probe for the optical potential and the reaction mechanisms"
as part of the PhD thesis of our student K. Zerva. The experiments were performed in January 2010 with the collaboration of specialists from LNS Catania, LNL Legnaro and INFN Napoli, the analysis of the data by Zerva is under progress while the theoretical analysis will be performed for the potential at Ioannina and for the reaction mechanisms from our collaborators at the University of Warsaw.
2. "Probing the ${}^{17}\text{F} + \text{p}$ potential by (p, p) and (p, p') reactions at near barrier energies of astrophysical interest"
The experiment was performed in November 2009 with the collaboration of the group of EXOTIC (INFN's and Universities of Napoli, Padova and Milan) with the collaboration of the University of Athens under our wider collaboration in the context of the Hellenic Institute of Nuclear Physics and the collaboration of the University of Warsaw.
The analysis of the data is under progress by our newly appointed Lecturer N. Patronis

Further on, members of NPL collaborate at various experiments performed abroad. The more recent collaborations have to do with:

1. **One nucleon transfer reactions around ${}^{68}\text{Ni}$** performed at CERN ISOLDE in November 2009 by the KU-Leuven group with spokesperson Nicolas Patronis who initiated these measurements during his postdoctoral position at KU-Leuven. In this study the single particle character of the first excited states of ${}^{67}\text{Ni}$ was studied by means of ${}^{66}\text{Ni}(\text{d},\text{p}){}^{67}\text{Ni}$ reaction in inverse kinematics [Pakou, Patronis].
2. **Reaction Dynamics for the system ${}^7\text{Be} + {}^{58}\text{Ni}$ at near barrier energies** with emphasis on the breakup mechanisms by M. Mazzocco et al-EXOTIC group. The experiment will be performed in May 2010 at Legnaro-Italy [Pakou, Patronis]
3. **Near barrier scattering of ${}^8\text{He}$ with heavy targets by I. Martel et al.** The experiment will be performed in September 2010 at Ganil-France aiming to probe the couplings between the different reaction channels and the specific neutron-core correlations, which are intensified at near barrier energies [Pakou, Patronis].
4. **Neutron Time of Flight Measurements (n_TOF).** A series of neutron cross section measurements performed at CERN for nuclear astrophysics and neutron cross section data for energy amplifier and accelerator driven systems: [Ioannides, Patronis]
5. **The CMS Experiment at CERN.** NPL contributed in the construction and operation of the CASTOR calorimeter as part of the CMS detector, at CERN. The calorimeter is designed to

detect Heavy Ion reaction products at small angles, at the LHC experiment. The research and test of different prototypes started at 2003 and the construction of the instrument was completed in 2009. The calorimeter has been integrated in the CMS detector and is currently being tested with p-p data at LHC. [Aslanoglou]

6. **Centrality dependence of isotopic effects in $^{124}\text{Sn}+^{64}\text{Ni}$ and $^{112}\text{Sn}+^{58}\text{Ni}$ reactions at 35 MeV/nucleon.** Yields of emitted light particles and massive fragments were measured in a 4π geometry using the CHIMERA multi-detector system at LNS-INFN, Catania Italy. Experimental data were compared with quantum molecular dynamics calculations (Jagellonian University) and the predictions of the statistical code **MECO**, developed at the University of Ioannina. [Nicolis]
7. **Reaction mechanisms in $^{197}\text{Au}+^{197}\text{Au}$ collisions at 15 and 23 MeV/nucleon.** Experiments were performed with the CHIMERA multidetector at LNS-INFN, Catania Italy. At 15 MeV/nucleon, our analysis of ternary and quaternary break-up events has revealed the existence of a new reaction mechanism, a fast collinear re-separation mode. (Phys. Rev. Lett. 101, 262701 (2008)) Our recently approved proposal at LNS allowed us a continuation of this study at 23 MeV/nucleon with a twofold objective: (a) The study of the evolution of the fast ternary and quaternary break-up at a higher bombarding energy, and (b) The search for toroidal break-up configurations in Au+Au collisions, predicted in BUU and hydrodynamic liquid drop collisions. The optimum conditions for the observation of such structures in quintary events have been investigated with extensive BUU, QMD and static model calculations performed at the Jagellonian University and the University of Ioannina. The experiment was performed on March 21-29, 2010 at LNS [Nicolis]

Some members of NPL were also specialised in **Applied Research** with leading person Professor P. Assimakopoulos (Assimakopoulos^{*}, Pakou, Ioannides, Aslanoglou) related with the radionuclide mobility in the food chain. Nowadays, the research is widely broadened and performed by the Assistant Professor K. Ioannides with the collaboration of two specialists from the Laboratory Network of University of Ioannina: Christina Papachristodoulou and Kostas Stamoulis as well as with the collaboration of the Assistant Professor D. Karamanis from the Energy Department of Agrinio. In the trace element analysis a major contribution comes also from X. Aslanoglou.

This research is performed mainly in the Ioannina Laboratory (NPL). NPL collaborates with other Universities in Greece and in Europe and cooperates with other institutions and organizations: IAEA, CERN and the multinational European Consortia of FARMING), EURANOS and MELODI. The research activities have to do with:

1. Radioecology- Radiochemistry. Assessment of environmental radioactivity through alpha, beta, gamma, liquid scintillation measurements. Participation in the IAEA EMRAS programs.
2. Effectiveness and consequences of a wide range of countermeasures following a nuclear accident. Guidance to emergency management organisations and decision makers on the establishment of an appropriate response strategy. Creation of regional initiatives leading to information exchange based on information technologies. Participation in EU programmes FARMING (5th FW), EURANOS (6th FW) and NERIS (2010).
3. Research on radon and radon applications. Measurements of radon with CR39 detectors, electrets and active detectors. Radon dosimetry and radon measurements' applications in Geology and Seismology.
4. Nuclear Microanalysis through the application of PIGE, PIXE, RBS, EDXRF for applications in materials science and environmental research.
5. Radiochronology of samples, through tritium, thermoluminescence (TL) and optically stimulated luminescence (OSL) measurements for archeometry and geology. Metal concentrations in pottery with XRF spectrometry for archeometry.
6. Dosimetry with CR39 detectors and TL and OSL measurements.

OUR PERSONNEL

* P. Assimakopoulos, Professor (deceased May 2007)
A. Pakou, Professor, chair of HINP (Hellenic Institute of Nuclear Physics)
K. Ioannidis, Assistant Professor
X. Aslanoglou, Assistant Professor
N. Nicolis, Assistant Professor
N. Patronis, Lecturer (appointed Sep. 2009)

OUR GRADUATE STUDENTS

1. Ch. Papachristodoulou, **PhD 2000**, “Radiostrontium binding under acidic conditions by means of pillared layered clays and modified products”.
2. A. Lagoyiannis, **PhD 2001** “Study of the elastic and inelastic scattering of ^6He on protons with the detection assembly MUST”.
3. N. Patronis, **PhD 2004**, “Measurement of the neutron capture cross section of the unstable ^{135}Cs ”
4. D. Roubos, **Msc 2006**, “Radial Sensitivity of the nuclear potential at near barrier energies”.
5. G. Litsios, **MSc 2007**. “Research on factors motivating learning of Physics in Secondary Education”.
6. E. Papageorgakopoulos, **MSc 2008**. “Design and construction of a data acquisition system for the control of a laboratory experiment through the Internet”.
7. A. Lioni, **MSc 2008**, “Proposal on teaching radioactivity using the Geiger counter and materials of common use”.
8. D. Karadimos, **PhD 2008**, “Measurements of the fission cross section of U-234 and Th-232”.
9. D. Patiris, **PhD 2009**, “Study of the behavior of radon daughters in air”.
10. K. Zerva, **PhD** under progress “Reaction mechanisms studies of weakly bound nuclei at near barrier energies”.

PUBLICATIONS (2000-2010)

Basic Reserach-101 publications

2010

1. Scattering of ^{17}F nuclei from ^{58}Ni target at energies around the Coulomb Barrier; M. Mazzocco, A. Boiano, C. Boiano, A. Di Pietro, F. Farinon, P. Figuera, D. Filipescu, L. Fortunato, T. Glodariu, A. Guglielmetti, G. Inglima, M. La Commara, M. Latuada, C. Mazzocchi, P. Molini, A. Musumarra, A. Pakou, C. Parascandolo, N. Patronis, D. Pierroutsakou, M. Romoli, M. Sandoli, V. Scuteri, C. Signorini, F. Soramel, L. Stroe, D. Torresi, E. Vardaci, **Nucl. Phys. A** **834** (2010) 488c.
2. Measuring total reactron cross sections at energies close to the Coulomb barrier by the active target method; A. Musumarra, P. Figuera, F. De Luca, A. Di Pietro, P. Finocchiaro, M. Fisichella, M. Lattuada, A. Pakou; **NIM** 612 (2010)399.
3. Observation of fast, colinear partitioning of the $^{197}\text{Au} + ^{197}\text{Au}$ system into three and four fragments of comparable size, J. Wilczynski, I. Skwira-Chalot, K. Siwek-Wilczynska, A. Pagano, F. Amorini, A. Anzalone, L. Auditore, V. Baran, J. Brzychczyk, G. Cardella, S. Cavallaro, M.B. Chatterjee, M. Colonna, E. De Filippo, M. Di Toro, W. Gawlikowicz, E. Geraci, A. Grzeszczuk, P. Guazzoni, S. Kowalski, E. La Guidara, G. Lanzalone, J. Lukasik, C. Maiolino, Z. Majka, N.G. Nicolis, M. Papa, E. Piasecki, S. Pirrone, R. Planeta, G. Politi, F. Porto, F. Rizzo, P. Russotto, K. Schmidt, A. Sochocka, L. Swiderski, A. Trifiro, M. Trimarchi, J.P. Wieleczko, L. Zetta, and W. Zipper, **Phys. Rev. C****81**, 024605 (2010).
4. Light Fragments Production and Isospin Dependences in Sn+Ni and Sn+Al Central Collisions at 25 MeV/A and 35 MeV/A from REVERSE/ISOSPIN Experiments, K. Schmidt, A. Benisz, A. Bubak, A. Grzeszczuk, S. Kowalski, W. Zipper, F. Amorini, A. Anzalone, L. Auditore, V. Baran, J. Brzychczyk, G. Cardella, S. Cavallaro, M.B. Chatterjee, M. Colonna, E. DeFilippo, M. DiToro, W. Gawlikowicz, E. Geraci, P. Guazzoni, E. La Guidara, G. Lanzalone, J. Lukasik, C. Maiolino, Z. Majka, N. Nicolis, A. Pagano, M. Papa, E. Piasecki, S. Pirrone, R. Planeta, G. Politi, F. Porto, F. Rizzo, P. Russotto, K. Siwek-Wilczynska, I. Skwira-Chalot, A. Sochocka, L. Swiderski, A. Trifiro, M. Trimarchi, J.P. Wieleczko, J. Wilczynski, L. Zetta, **Acta Phys. Pol.** **41**, 387 (2010).

2009

5. Elastic backscattering measurements for $^6\text{Li}+^{28}\text{Si}$ at sub- and near-barrier energies; K. Zerva, N. Patronis, A. Pakou, N. Alamanos, X. Aslanoglou, D. Filipescu, T. Glodariu, M. Kokkoris, M. La Commara, A. Lagoyannis, M. Mazzocco, N. G. Nicolis, D. Pierroutsakou, M. Romoli, K. Rusek; **Phys. Rev. C** **80** (2009)017601.
6. Total reaction fusion and transfer cross sections at sub and near barrier energies for the system $^7\text{Li}+^{28}\text{Si}$; A. Pakou, K. Rusek, N. Alamanos, X. Aslanoglou, M. Kokkoris, A. Lagoyannis, T. J. Merzimekis, A. Musumarra, N. G. Nicolis, D. Pierroutsakou and D. Roubos; **Eur. Phys. J A****39** (2009) 187.
7. Quest for Hyperheavy Toroidal Nuclei, A. Sochocka, A. Benisz, N.G. Nicolis, T. Pietrzak, R. Planeta, Z. Starypan, **Acta Phys. Pol.** **B40**, 747 (2009).
8. β -decay study of ^{77}Cu ; N. Patronis, H. De Witte, M. Gorska, M. Huyse, K. Kruglov, D. Pauwels, K. Van de Vel, P. Van Duppen, J. Van Roosbroeck, J.-C. Thomas, S. Franchoo, J. Cederkall, V. N. Fedoseyev, H. Fynbo, U. Georg, O. Jonsson, U. Koster, T. Materna, L. Mathieu, O. Serot, L. Weissman, W. F. Mueller, V. I. Mishin, and D. Fedorov, **Phys. Rev. C** **80** (2009) 034307.
9. High-accuracy $^{233}\text{U}(n, f)$ cross-section measurement at the white-neutron source n TOF from near-thermal to 1 MeV neutron energy; The n_TOF collaboration, **Phys. Rev. C** **80** (2009) 044604.

10. The n_TOF Total Absorption Calorimeter for neutron capture measurements at CERN; The n_TOF collaboration, **NIMA** **608** (2009) 424-433.

2008

11. Polarization potential for elastic scattering of ${}^{6,7}\text{Li}+{}^{28}\text{Si}$ at near-barrier energies: Athena Pakou, **Phys. Rev. C** **78** (2008) 067601.
12. Fast Ternary and Quaternary Breakup of the ${}^{197}\text{Au}+{}^{197}\text{Au}$ System in Collisions at 15 MeV/nucleon, I.Skwira-Chalot, K.Siwiek-Wilczynska, J.Wilczynski, F.Amorini, A.Anzalone, L.Auditore, V.Baran, J.Brzychczyk, G.Cardella, S.Cavallaro, M.B.Chatterjee, M.Colonna, E.De Filippo, M.Di Toro, W.Gawlikowicz, E.Geraci, A.Grzeszczuk, P.Guazzoni, S.Kowalski, E.La Guidara, G.Lanzalone, G.Lanzano, J.Lukasik, C.Maiolino, Z.Majka, N.G.Nicolis, A.Pagano, E.Piasecki, S.Pirrone, R.Planeta, G.Politi, F.Porto, F.Rizzo, P.Russotto, K.Schmidt, A.Sochocka, L.Swidorski, A.Trifiro, M.Trimarchi, J.P.Wieleczko, L.Zetta, W.Zipper, **Phys. Rev. Lett.** **101**, 262701 (2008).
13. Sequential binary decay of highly excited nuclei, N.G. Nicolis, **Int. J. Mod. Phys. E17**, 1541 (2008).
14. Search for hyperheavy toroidal nuclear structures formed in heavy ion collisions, A. Sochocka, A. Benisz, P. Hachaj, N.G. Nicolis, R. Planeta and Z. Starypan, **Int. Jour. Mod. Phys. E17**, 190 (2008).
15. Re-separation modes of ${}^{197}\text{Au} + {}^{197}\text{Au}$ system at sub-Fermi energies, J. Wilczynski, I. Skwira-Chalot, K. Siwiek-Wilczynska, W. Gawlikowicz, J. Lukasik, F. Amorini, A. Anzalone, L. Auditore, V. Baran, J. Brzychczyk, G. Cardella, S. Cavallaro, M.B. Chatterjee, M. Colonna, E.De Filippo, M. Di Toro, A. Grzeszczuk, P. Guazzoni, S. Kowalski, E. La Guidara, G. Lanzano, G. Lanzalone, C. Maiolino, Z. Majka, N.G. Nicolis, A. Pagano, E. Piasecki, S. Pirrone, R. Planeta, G. Politi, F. Porto, F. Rizzo, P. Russotto, K. Schmidt, A. Sochocka, L. Swiderski, A. Trifiro, M. Trimarchi, J.P. Wieleczko, L. Zetta, and W. Zipper, **Int. Jour. Mod. Phys. E17**, 41 (2008).
16. Observation of Hyperheavy Toroidal Configurations in BUU Simulations of Heavy Ion Collisions, A. Sochocka, R. Planeta, N.G. Nicolis, **Acta Phys. Pol.** **39**, 405(2008).
17. Centrality dependence of isospin effect signatures in ${}^{124}\text{Sn} + {}^{64}\text{Ni}$ and ${}^{112}\text{Sn} + {}^{58}\text{Ni}$ reactions, R. Planeta, F. Amorini, A. Anzalone, L. Auditore, V. Baran, A. Benisz, I. Berceanu, A. Bonasera, B. Borderie, J. Borgenstein, R. Bougault, M. Bruno, J. Brzychczyk, G. Cardella, S. Cavallaro, M.B. Chatterjee, A. Chbihi, M. Colonna, M.D' Agostino, R. Dayras, E.De Filippo, M.Di Toro, J. Frankland, E. Galichet, W. Gawlikowicz, E. Geraci, F. Giustolisi, A. Grzeszczuk, P. Guazzoni, D. Guinet, S. Kowalski, M. Krauze, E. La Guidara, G. Lanzano, G. Lanzalone, N.Le Neindre, J. Lukasik, C. Maiolino, Z. Majka, N.G. Nicolis, A. Pagano, M. Papa, M. Petrovici, E. Piasecki, S. Pirrone, G. Politi, A. Pop, F. Porto, M.F. Rivet, E. Rosato, F. Rizzo, P. Russotto, K. Schmidt, K. Siwiek-Wilczynska, I. Skwira-Chalot, A. Sochocka, L. Swiderski, A. Trifiro, M. Trimarchi, G. Vannini, M. Vigilante, J.P. Wieleczko, J. Wilczynski, L. Zetta, and W. Zipper, **Phys. Rev. C** **77**, 014610 (2008).
18. First performance studies of a prototype for the CASTOR forward calorimeter at the CMS experiment, , Aslanoglou, X., Davis, N., D'Enterria, D., Gladysz-Dziadus, E., Kalfas, C., Musienko, Y., (...), Panagiotou, A.D. **Acta Phys. Polonica B39** (2008) 1429-1453
19. The ${}^{14}\text{C}(n,\gamma)$ cross section between 10 keV and 1 MeV; R. Reifarh, M. Heil, F. Käppeler, R. Plag, C. Forssén, U. Besserer, A. Couture, S. Dababneh, L. Dörr, J. Görres, R.C. Haight, A. Mengoni, S. O'Brien, N. Patronis, R.S. Rundberg, M. Wiescher, and J.B. Wilhelmy, **Phys. Rev. C** **77** (2008) 015804.
20. Nuclear physics for the Re/Os clock; The n_TOF collaboration, **Journal of Physics G.** **35** (2008) 014015.
21. The measurement of the ${}^{206}\text{Pb}(n,\gamma)$ cross section and stellar implications; The n_TOF collaboration, **Journal of Physics G.** **35** (2008) 014020.
22. Neutron capture cross section of ${}^{90}\text{Zr}$: Bottleneck in the s-process reaction flow; The n_TOF

- collaboration, **Phys. Rev. C** **77** (2008) 035802.
23. Experimental study of the $^{91}\text{Zr}(n,\gamma)$ reaction up to 26 keV; The n_TOF collaboration, **Phys. Rev. C** **78** (2008) 045804.

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24. Study of N=16 for ^{20}Ne isotopes; A. Gillibert, Oberteli A., N.Alamanos, M.Alvarez, F.Auger, R.Dayras, A.Drouart, B. Jurado, N. Keeley, V. Lapoux, W.Mittig, X.Mougeot, L.Nalpas, A.Obertelli, A.Pakou, N. Patronis, E.C.Pollacco, F.Rejmund, M.Rejmund, P. Rousel-Chomaz, H.Savajols, F.Skaza, Ch.Theisen; **Eur. Phys. J.: Special Topics** **150** (2007)161.
25. Low-lying states and structure of the exotic ^8He via direct reactions on proton; F. Skaza, V. Lapoux, N. Keeley, N. Alamanos, F. Auger, D. Beaumel, E. Becheva, Y Blumenfeld, F. Delaunay, A. Drouart, A. Gillibert, L. Giot, K. W. Kemper, L. Nalpas, A. Pakou, E. C. Pollacco, R. Raabe, P. Rousset-Chomaz, K. Rusek, J-A. Scarpaci, J. L. Sida, S. Stepantsov, R. Wolski ; **Nucl Phys. A** 788 (2007)260c.
26. Probing the ^8He ground state via the $^8\text{He}(p,t)^6\text{He}$ reaction; N. Keeley, F. Skaza, V. Lapoux, N. Alamanos, F. Auger, D. Beaumel, E. Becheva, Y Blumenfeld, F. Delaunay, A. Drouart, A. Gillibert, L. Giot, K. W. Kemper, L. Nalpas, A. Pakou, E. C. Pollacco, R. Raabe, P. Rousset-Chomaz, K. Rusek, J-A. Scarpaci, J. L. Sida, S. Stepantsov, R. Wolski; **Phys. Lett. B** **646** (2007)222.
27. Structure of exotic nuclei from direct reactions; A.Gillibert, N.Alamanos, M.Alvarez, F.Auger, D.Beaumel, E.Becheva, Y.Blumenfeld, R.Dayras, F.Delaunay, A.Drouart, G.de France, L.Giot, B.Jurado, N.Keeley, K.W.Kemper, V.Lapoux, W.Mittig, X.Mougeot, L.Nalpas, A.Obertelli, N.Patronis, A.Pakou, E.C.Pollacco, R.Raabe, P.Rousset-Chomaz, F.Rejmund, M.Rejmund, H.Savajols, J.A.Scarpaci, J.L.Sida, F.Skaza, S.Stepantsov, Ch.Theisen, R.Wolski ; **Nuclear Physics A** **787** (2007) 423c.
28. Strong transfer channels in the $^6\text{Li}+^{28}\text{Si}$ system at near-barrier energies;A. Pakou, K. Rusek, N. Alamanos, X. Aslanoglou, S. Harissopulos, M. Kokkoris, A. Lagoyannis, T. J. Mertzimekis, A. Musumarra, N.G. Nicolis, C. papachristodoulou, D. Pierroutsakou and D. Roubos; **Phys. Rev. C** **76** (2007)054601.
29. $^6,7\text{Li}+^{28}\text{Si}$ total reaction cross sections at near barrier energies; A. Pakou, A. Musumarra, D. Pierroutsakou, N. Alamanos, P. Assimakopoulos, N. Divis, G. Doukelis, A. Gillibert, A. Lagoyannis, T. Merzimekis, N. G. Nicolis, C. Papachristodoulou, K. Rusek, A. Spyrou, Ch. Zarkadas, **Nuclear Physics A** **784** (2007)13.
30. Dynamics of “Binary” $^{197}\text{Au}+^{197}\text{Au}$ Collisions as a Test of Energy Dissipation Mechanism, I.Skwira-Chalot, K.Siwiek-Wilczynska, J.Wilczynski, F.Amorini, A.Anzalone, L.Auditore, V.Baran, J.Blocki, J.Brzychczyk, G.Cardella, S.Cavallaro, M.B.Chatterjee, M.Colonna, E.De Filippo, M.Di Toro, W.Gawlikowicz, A.Grzeszczuk, P.Guazzoni, S.Kowalski, E.La Guidara, G.Lanzano, G.Lanzalone, C.Maiolino, Z.Majka, N.G.Nicolis, A.Pagano, M.Papa, E.Piasecki, S.Pirrone, R.Planeta, G.Politi, F.Porto, F.Rizzo, P.Russotto, K.Schmidt, A.Sochocka, L.Swidorski, A.Trifiro, M.Trimarchi, J.P.Wieleczko, L.Zetta, W.Zipper, **Acta Phys.Pol.** **B38**, 1509 (2007).
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- Panagiotou and E. Vlasov, *Eur. Phys. J. C* **52**, (2007) 495-506.
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RESEARCH PROGRAMS

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2. ΠΥΘΑΓΟΡΑΣ Ι (ΕΠΕΑΕΚ ΙΙ, Μέτρο 2.2, Ενέργεια 2.2.3 Κατηγορία Πράξεων 2.2.3.στ): «Συγκριτική μελέτη επιπέδων ρύπανσης επιφανειακών υδάτων στην Ήπειρο, Θεσσαλία και Μακεδονία». Συντονιστής: Κ. ΙΩΑΝΝΙΔΗΣ : Διάρκεια: 1/3/2004-31/8/2006.
3. Indoor exposure to radon and gamma radioactivity in areas of elevated radium concentration. (Coordinator: K.G. Ioannides) The General Secretariat of Research and Technology, Bilateral Greek-Romanian cooperation, EPET II, Action 2.5, 9513514. Duration: 1/7/1998 – 1/1/2001.
4. FARMING: Food and Agriculture Restoration Management Involving Networked Groups. (Coordinator of Greek Team: K.G. Ioannides) EU Contract number FIKR-CT-2000-00064.
5. n_TOF-ADS: Accelerator Driven Systems. EU Contract number FIKW-2000-00063. Coordinator of Greek Team: P.A.Assimakopoulos.
6. Measurements of Radon and natural radioactivity measurements. (Coordinator: K.G. Ioannides). The Research Committee of the University of Ioannina. Contract No 1302. Launch: 1/9/2002.

7. Survey of radon concentrations in public buildings. (Coordinator: K.G. Ioannides) The General Secretariat of Research and Technology, Bilateral Greek-Slovenian cooperation. Project No 4210 –Duration: 1/1/2003 – 30/6/2004.
8. EURANOS: European approach to nuclear and radiological emergency management and rehabilitation strategies. (Coordinator of Greek Team: K.G. Ioannides) EU Contract number Contract number F16R-CT-2004-508843. Duration: 1/4/2004 – 1/11/2008.
9. Radon measurements in Greek SPAS. Greek Atomic Energy Commission. Duration: 1/11/2003 – 31/1/2005.
10. IAEA Programme on Environmental Modeling for Radiation Safety (EMRAS). Tritium Working group. Duration: 2003-2006.
11. Experimental study of Th-232 and U-234 fission cross sections. (Coordinator: K.G. Ioannides). National Program Heraclitus. 2003-2005.
12. Study of Surface water pollution in Epirus, Thessalia and Macedonia. (Coordinator: K.G. Ioannides). National Program Pythagoras. 2004-2006.
13. Development of a model Web based virtual observatory of Acherontas, Kalamas and Torre Guaceto ecosystems and its application as a mobile exhibit and permanent environmental kiosk towards public awareness and sustainable development of coastal ecosystems (EcoDonet) INTERREG IIIA GREECE-ITALY PROGRAM PERIOD 2000-2006 (Coordinator of Greek Team: K.G. Ioannides).