

Institute of Plasma Physics  
and Laser Microfusion

# ANNUAL REPORT 2011



Institute of Plasma Physics and Laser Microfusion  
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# 1 Preface

In 2011 the Institute of Plasma Physics and Laser Microfusion celebrated its 35<sup>th</sup> jubilee of research for the future. On this occasion, a ceremony was held in the course of which the IPPLM history and current research conducted in IPPLM were discussed. Professor Jerzy Wołowski celebrated in those days the 50<sup>th</sup> anniversary of his professional activity, which fact was honoured during the ceremony. Let me congratulate Prof. Wołowski on half of a century of fruitful work for science and education of future generations of scientists.

The Institute implemented a reform of science in terms of research institutes. Since the 20<sup>th</sup> of June, 2011, a new Scientific Council, chaired by Professor Urszula Woźnicka from the Institute of Nuclear Physics in Cracow, has been in operation.

In 2011 the Institute began to expand and upgrade a high-power laser laboratory, which houses a 10TW laser of pulse duration of 3-40 femtoseconds. The funds for this purpose come from the Regional Operational Program of the Mazovia Province financial resources. The new infrastructure will enable further development of research on laser thermonuclear fusion and taking up innovative work in the field of high-power laser implementation in various fields of modern science, technology and medicine.

Last year we started to implement a project called "Research and development of technology for controlled thermonuclear fusion". It is part of a strategic research programme „Technologies supporting the development of safe nuclear energy”, financed by the National Center for Research and Development.

The Institute staff participated in an experimental campaign on the community JET tokamak in Culham, near Oxford. Within the framework of the contract with JET, IPPLM together with Warsaw University and Warsaw University of Technology developed a new type of GEM (Gas Electron Multiplier) detector to diagnose X-ray radiation emitted from plasma.

The system of LIBS-type (Laser Induced Breakdown Spectroscopy) regarding the application of laser to carry out scaled measurements of the material deposition and chemical composition of the plasma chamber wall was completed and approved by EFDA. A new method to determine the density of impurities, their contribution to the effective plasma load and to the coefficient of plasma dilution with the use of spectroscopy in terms of VUV (Vacuum Ultra Violet) radiation.

The preparations were underway to participate in research projects on W7-X stellarator, which will be launched in Greifswald, Germany, in 2014. The IPPLM scientists have developed diagnostics to register X-ray radiation by PHA and MFS methods.

The researchers of the Division of Laser Plasma carried out a series of experiments on the PALS system in Prague. The aim was to examine the properties of laser acceleration of dense matter called LICPA and to optimize a new method of laser fusion with shock ignition, as well as to check the new concept of convergent and divergent laser-generated plasma, applied in laser fusion and simulation of astrophysical phenomena.

We continued works regarding Hall thrusters to be applied in space. Financial resources come from the grants of the 7<sup>th</sup> EU Framework Programme. In 2011, ŁμPPT (Innovative Liquid Micro Pulsed Plasma

Thruster system for nanosatellites) project was initiated in collaboration with research centers and industrial companies from Spain, Switzerland, Sweden, and Poland.

Two experimental sessions in the framework of the International Center of Dense Magnetised Plasma were carried out on PF1000 plasma-focus system. The aim was to investigate the relations of neutron emission and the intensity of electric current in the phase of pinch discharge.

Within the framework of technological works, the laser ion source was examined to be applied in semiconductor materials in order to modify their properties.

Because of the Polish Presidency of the European Union, the meeting of the Steering Committee of EFDA (European Fusion Development Agreement) consortium was organized by IPPLM and held in Warsaw. The EFDA consortium coordinates the European programme of nuclear fusion. The main aim of this programme is to prepare the ITER tokamak exploitation, which is built in Cadarache in France by 7 partners: Euratom Community, Japan, United States, Russia, China, Korea and India, for its scientific exploitation.

The Institute of Plasma Physics and Laser Microfusion is highly regarded, both in Poland by the Ministry of Science and Higher Education, and also abroad by the international science community. The reputation rests on its high number of top quality publications in well-known science journals, and effective, broad international cooperation. As a result, in 2011 the IPPLM kept the second best position on the Ministry's list of all the research institutions within the scope of physics and astronomy in Poland. This was mainly thanks to a large number of publications in prestigious journals. In 2011, the IPPLM scientists published 40 papers and presented many contributions to the international scientific conferences.

The Institute co-organized the International Conference on Research and Applications of Plasmas PLASMA'2011 as well as organized the 10<sup>th</sup> International Kudowa Summer School "Towards Fusion Energy" in Kudowa Zdrój.

All those achievements would not have been possible without the involvement, professionalism and passion of the personnel of the IPPLM. I would like to congratulate the staff of the Institute and to thank them for their impressive work.



Andrzej Gałkowski  
Director



## 2 General Information

### Scientific Council (till June 20, 2011)

- **Chairman**

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- **Deputy Chairmen**

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- **Members**

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Dr. Ryszard Miklaszewski Institute of Plasma Physics and Laser Microfusion, Warsaw

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Prof. Urszula Woźnicka PAS Institute of Nuclear Physics, Kraków

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Adam Ziółkowski, M.Eng. Institute of Plasma Physics and Laser Microfusion, Warsaw

### Scientific Council (since June 20, 2011)

- **Chairperson**

Prof. Urszula Woźnicka PAS Institute of Nuclear Physics, Kraków

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## Management of the Institute

- **Director**  
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- **Associate Director / Head of Research Unit Association Euratom-IPPLM**  
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- **Head of Division of Laser Plasma**  
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- **Head of Division of Magnetized Plasma**  
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- **Chief Accountant**  
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- **Head of Technical Section**  
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- **Scientific Office Manager**  
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- **Division of Laser Plasma**  
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  - Department of Laser Fusion  
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  - Department of Laser Plasma Hydrodynamics  
Head of Department: Assoc. Prof. Tadeusz Pisarczyk
- **Division of Magnetised Plasma**  
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The following part of the Annual Report contains information of a preliminary and/or tentative nature and must not be quoted in publications nor listed in abstract journals.  
It is the executive summary of the full annual report, summarizing activities performed by the Institute of Plasma Physics and Laser Microfusion in 2011.