PS PUBLIC SERVICE REVIEW
european union 20

The circle of life

How European health research is coming of age

Cover inspired by

Newcastle University

supported by

Open your mind. LUT.

www.publicservice.co.uk

PS
analysis•opinion•debate

Physics for the third millennium

A response to challenges…

The present day economy requires university centres to deliver a new generation of active, highly educated managers, who will push the ongoing developments along the guidelines worked out together by politicians and scientists. This call is especially strong in the new EU ascension countries, to which Poland belongs. Therefore, the leading Polish high schools adopt their research and educational directions to help the country integrate smoothly into the European Research Area.

Senate Hall in Collegium Maius, the oldest building of the Jagiellonian University, dating back to 1400

Physics at the Jagiellonian University

Since the foundation of the academy in Kraków, more than 600 years ago, liberal arts have been strongly present in its programme. In the 15th Century, schools of mathematics and astrology flourished. Today, physics is cultivated at the Marian Smoluchowski Institute of Physics, which is the biggest unit within the Faculty of Physics, Astronomy and Applied Computer Science.

Many of the everyday activities are much easier and many procedures are significantly more people friendly owing to methods, techniques and tools worked out by generations of physicists. The task is carried further in the field by present day scientists, who also continue to educate the next generations of researchers, teachers, inventors, managers and well-educated, open-minded citizens.

Education

The main goal of any university is to ensure a continuous and smooth transfer of knowledge. This task can be performed seriously and truly only if education is anchored in top quality research. We are proud that this condition is fully met at our institute; we guarantee students at all levels best quality lecturers and tutors, who are active in various research domains. We offer programmes in Physics, Biophysics, Astronomy, Applied Computer Science, Advanced Materials and Nanotechnology, and recently opened Astrophysics and Cosmology. All of them have approval of the State Accreditation Committee and comply with the requirements of EU directives for the Bologna Process. The programmes are delivered at the Bachelor (first), Master's degree (second) and PhD (third) levels. This year we shall start special programmes prepared in close cooperation with the video game development industry, financed by the project WIKING (EU Human Capital Programme). Responding to the renewed interest in nuclear power plants in Poland, we are preparing new programmes: Nuclear Energy and Technologies and Applied Nuclear Physics. We strongly support education of science at the high school level; university classes in physics are organised under our patronage, and special courses for school teachers are prepared. The institute publishes two monthly journals for physics teachers and students promoting physics on a mainstream level, showing it as an interesting and understandable description of our world. A novel programme FENIKS (www.fais.uj.edu.pl/FENIKS) for even younger pupils has been launched to attract them to natural sciences.

Research – overview

The research activity of our institute covers broad areas of experimental and theoretical physics. Together with the fields of long-established history – like solid state, surface, atomic, nuclear, high energy and astrophysics – the research is pursued in many newer branches, eg. laser physics, quantum optics, physics of chaos and nanotechnology. In addition, several interdisciplinary directions are being followed, for example, biophysics, econophysics, medical physics, environmental science or computer science. All research is conducted in a broad international scientific community; our institute

collaborates with over 50 of the best institutions from all over the world. In many projects our scientists are playing key roles as coordinators of large international collaborations. The outcome is around 300 papers yearly, to count only those appearing in the most respected professional journals. Every year around 14 international conferences are organised, most of them on a regular basis.

We continue to upgrade our local research basis – with European funds it is now possible to undertake complex modernisation of the scientific infrastructure. An example is an over €50m project ATOMIN: Atomic Scale Science for Innovative Economy (www.if.uj.edu.pl/ATOMIN), granted to the Faculty of Physics, Astronomy and Applied Science and the Faculty of Chemistry, in the framework of the Operational Programme Innovative Economic: Development of Centres with High Research Potential. The project serves to strengthen the potential of the Institute of Physics to carry out advanced research in biological, technological and information domains.

Examples of our scientific activities have been presented in previous issues of this review; the most important recently rapidly developing directions are sketched below.

Revival of nuclear physics

The document 'Perspectives for Nuclear Physics in Europe', the Nuclear Physics European Collaboration Committee plan for the years 2010-2020, states: 'Paying tribute to its cultural heritage ranging back many thousands of years, Europe should continue to be at the forefront of promoting one of the most vigorous and fascinating fields in basic science, nuclear physics.... With the renewed worldwide interest in nuclear technology, Europe needs to preserve, and even enhance, its nuclear physics knowledge and skills basis in the future. A dedicated effort directed at the training of young people is mandatory.'

In our institute nuclear physics has always been very strong (zfj.if.uj.edu.pl). Basing on fundamental research in the field also numerous application areas have been opened. The detector laboratories develop high-quality elements of experimental infrastructures for various physics centres all over the world. Designing of analog and digital electronics is another field in which achievements of our scientists and engineers are highly valued by international collaborations. The expertise of our colleagues in the sector of precision experiments and careful data analysis, as well as in simulation calculation and theory development, are widely recognised. Recently, two new patent applications have been submitted in the domain of modern medical diagnostics by means of positron emission tomography. Those novel solutions have been awarded with the gold medal at the Brussels Innova 2009 Exhibition.

Synchrotron radiation centre

We are proud that the most important investments in Polish research infrastructure will be closely connected with the activities of our institute: in April 2010 Polish Minister of Science and Higher Education Professor Barbara Kudrycka and the Rector of the Jagiellonian University Professor Karol Musioł signed the contract for the realisation of the 'National Centre of Electromagnetic Radiation for Research Applications' at the Jagiellonian University (www.synchrotron.pl). This project, with a budget of over €35m, will result in the creation of an interdisciplinary scientific centre equipped with modern infrastructure (including a state-of-the-art electron accelerator), serving a user community from all of Eastern Europe.

Studies of complex systems

One of the greatest challenges of contemporary science is to develop a quantitative description of complex phenomena. This area of research is not restricted to fundamental science, but spreads over the plethora of real complex systems. Mark Kac Complex Systems Research Centre at our faculty (www.csrc.if.uj.ed.pl/en) is a unique scientific centre for advanced research, creating the methodology for the developing branches of science connected to computer technologies and, at the same time, promoting this methodology via practical (industrial) applications in the hi-tech sector. Current interdisciplinary research at this centre is focused on five projects: NetLab – fundamental research and applications in the field of large computer and telecommunication networks; RiskLab – financial, market and crises risk management and assessment; BioLab – linking the fundamental research of bioinformatics and genetic computer studies to practical applications; QuantLab – processing of quantum information; and CogniLab – cognitive science, brain signal analysis, computational brain models, and artificial intelligence.

Supported by a long tradition of studying sciences in Kraków and observing all the recently experienced developments, we are sure that our institute is well prepared to face the challenges of the 21st Century.

Stanislaw Kistryn PhD
Professor of Physics, and Deputy Director for Research of the Institute of Physics

Jagiellonian University
Marian Smoluchowski Institute of Physics
ul. Reymonta 4
30-059 Kraków
Poland

Tel: +48 12 663 56 15
Fax: +48 12 633 70 86

stanislaw.kistryn@uj.edu.pl
www.if.uj.edu.pl