

# **Evaluation of the Research and Professional Activity of the Institutes of the Czech Academy of Sciences (CAS) for the period 2010–2014**

## **Final Report on the Evaluation of the Institute**

**Name of the Institute:** Institute of Photonics and Electronics of the CAS, v. v. i.

**Fields, in which the Institute registered its teams:**

Physical sciences

Observer representing the Academy Council of the CAS: Tomáš Kruml

Observer representing the Institute: Hana Lísalová

### **Commission No. 3: Physical sciences**

Chair: Prof. John Dainton

Date(s) of the visit of the Institute: October 15 - October 23, 2015

Programme of the visit of the Institute: see attached Minutes from the visit

Evaluated research teams:

*No. 1 - Optical biosensors; No. 2 - Fiber lasers and non-linear optics*

## **A. Evaluation of the Institute as a whole**

### **1. Introduction**

This evaluation is only partial and it is based on the performance of only two teams of the Institute: Optical biosensors team and Fiber lasers and non-linear optics team.

As such, the institute can certainly be identified as an important player on the international photonics research scene, and in some areas displays a true international leadership. During the meetings of the Panel with the administration and with the researchers it came to our attention that the Institute is extremely well managed, both at the scientific level and at the administrative level. It made a lot of progress since the previous evaluation, and the Direction displays a clever vision of the objectives for the Institute, and of the best ways to achieve them. The Panel also notes the very high level of enthusiasm among the staff, and excellent collaboration between the administration and the researchers.

### **2. Strengths and Opportunities**

The age structure of this Institute is mostly excellent or very good in terms of assuring the proper knowledge transfer and professional growth of the future high quality research personnel, and allows us to look with confidence to their future.

The quality of their publications, which are mostly internationally excellent and sometimes world leading, illustrates very well the strength and the potential of this Institute. Their area of research is very hot at the international scene, has a potential for possible commercialization, but by the same is conducted in extremely competitive environment – the fact that the Direction of the Institute is fully aware of.

Another strength is their apparent ability to direct their fundamental and applied research in some areas towards practical implementations while taking care of properly protecting their intellectual property. However, this ability is not equally distributed among the teams.

### **3. Weaknesses and Threats**

In some areas a care has to be taken to increase the number of journals with the impact factor, as compared to the number of conference publications. To increase the global competitiveness of the Institute this ratio has to be improved.

### **4. Recommendations**

Address the weaknesses and maybe re-think your research orientations in some areas to be more connected to the industrial needs.

### **5. Detailed evaluations**

Declaration on the quality of the results and share in their acquisition

The majority of evaluated outputs of this Institute is internationally excellent or very good, and some of them are world leading. In some areas of research there is a need to increase the number of journal publications. In all cases the share of the team members in the evaluated publications is very significant.

#### Declaration on the involvement of students in research

The Institute is very active in supervising students (currently 10 PhD) with 4 PhDs graduated during the evaluation period. The researchers give regular lectures at local universities and gave three at the international scene in Italy, Finland and in Mexico.

#### Declaration on societal relevance

The Institute is exceptionally active in the scientific activities at the international scene in Europe and elsewhere, and also in science and research popularization, including frequent media interviews to present their research. It organizes the Open Days for the public regularly on the yearly basis and participated in the Week of Science and Technology.

#### Declaration on the position in the international and national context

The Institute has established exceptional and successful collaboration at the international level mostly in Europe but also in USA, and at the national level, with both academia and industrial partners.

#### Declaration on the vitality and sustainability

The age profile of the Institute is very good and guarantees continuing and further developing its current research activities.

#### Declaration on the strategy and plans for the future

The plans for the future and strategy of the Institute are well thought out and inspired by its highly successful current research achievements, however in some areas they are facing very strong international competition.

## **B. Evaluation of the individual teams**

### **Evaluation of the Team No. 1: Optical biosensors**

#### **1. Introduction**

The main directions of the research conducted by this group are focused on plasmonic and photonic nanostructures and phenomena, on optical platforms, on microfluidic effects and devices, on functional coatings and on a variety of biosensor-based methodologies. This combination of research is well chosen and looks very promising, although it is conducted in a very competitive international environment. The research is well supported by the available team expertise and by their impressive infrastructure. The research includes fundamental as well as applied aspects, and their efforts to develop new Intellectual Property and to increase the cost effectiveness of the SPR technology they are proposing should be highly appreciated.

#### **2. Strengths and Opportunities**

The quality of their publications which are mostly internationally excellent and sometimes world leading illustrates very well the strength of this group. Equally important is a high ratio between their numbers of journal and conference publications (about 3), which is much higher and better than for a typical research group of their size. Another strength is their apparent ability to direct their fundamental and applied research towards practical implementations while taking care of properly protecting their intellectual property.

The group remarkably well couples research in the fields of optics, laser technology, nanotechnology and photonics.

Such a strong group and with such a healthy approach to research has an excellent opportunity to successfully compete on the global market, where the interest and need for the novel photonic biosensing technologies is growing fast.

The age structure of this team is excellent in terms of assuring the proper knowledge transfer and professional growth of the future high quality research personnel, and allows to look with confidence to their future.

#### **3. Weaknesses and Threats**

No particular weaknesses has been observed in this team, and the Committee sees no threats to its present direction of research

#### **4. Recommendations**

Continue this interesting and competitive research, with even more focus on cost effectiveness of the novel photonic sensing technologies under development. Continue collaboration with industry.

## 5. Detailed evaluations

### *Declaration on the quality of the results and share in their acquisition*

The majority of evaluated outputs of this team is internationally excellent and some of them are world leading. In all cases the share of the team members in the evaluated publications is very significant.

### *Declaration on the involvement of students in research*

The team is very active in supervising students (currently 8 PhD and 2 MSc) with 2 PhDs graduated during the evaluation period. The team gives regular lectures at local universities and gave two at the international scene in Italy and in Finland.

### *Declaration on societal relevance*

The team is exceptionally active in the scientific activities at the international scene, and also in science and research popularization, including frequent media interviews to present their research. It organizes the Open Days for the public regularly on the yearly basis.

The team has good connections with international industry and significant achievements in commercialization of the scientific research.

### *Declaration on the position in the international and national context*

The team has established exceptional and successful collaboration at the international and national level, with both academia and industrial partners. The team play the main position / leadership role in specific research directions in the international collaborations.

### *Declaration on the vitality and sustainability*

The age profile of the team is very good and guarantees continuing and further developing its current research activities.

### *Declaration on the strategy and plans for the future*

The plans for the future and strategy are well thought out and inspired by highly successful current research achievements

## **Evaluation of the Team No. 2: Fiber lasers and non-linear optics**

### **1. Introduction**

The main research directions of this group are centered around development of more efficient rare-earth-doped fiber lasers and amplifiers, mid-infrared light sources and some specific methods of numerical simulations. This research is in the mainstream of world effort on fiber lasers, and therefore has to be conducted in a very competitive international environment, while the field is very crowded. It is therefore quite difficult to achieve a significant breakthrough and most of the international research papers describe just incremental progress. Still, the most of the outputs of this group are internationally recognized.

The current research scope of the team was formulated in 2013, in the middle of the evaluated period.

The research is well supported by the available team expertise and by their infrastructure, includes both fundamental as well as applied aspects.

### **2. Strengths and Opportunities**

The age structure of this team is very good in terms of assuring the proper knowledge transfer and professional growth of the future high quality research personnel. The quality of their publications is mostly internationally recognized and in some cases internationally excellent. Due to a very strong international competition in their area, the opportunities of this team are however limited.

The team is capable to model and produce fiber structures thanks to its technological capabilities and laboratory equipment that is of great advantage.

The team Fiber Lasers and Nonlinear Optics has a facility for special fiber preform preparation and fiber drawing that is amongst ca. 8 academic research facilities in the EU and it is unique in the Czech Republic. The facility is equipped with Special Gas MCVD, two 6.5m long fiber drawing towers, preform and fiber analysers from Photon Kinetics and a fiber strength tester.

### **3. Weaknesses and Threats**

The most of the outputs of this team are conference papers, with much smaller number of journals with impact factor. To increase the competitiveness of this team this ratio has to be improved.

### **4. Recommendations**

Pay more attention to publishing your research in the high quality journal papers. Maybe re-think your research orientations to be more connected to the industrial needs.

As an example a possible research on supercontinuum “all-in-fiber” generators within MWIR and/or LWIR ranges could be taken into consideration among other options.

## 5. Detailed evaluations

### *Declaration on the quality of the results and share in their acquisition*

The majority of evaluated outputs of this team are internationally recognized and some of them are internationally excellent. In all cases the share of the team members in the evaluated publications is very significant.

### *Declaration on the involvement of students in research*

The team is very active in supervising students (currently 2 PhD and 6 MSc) with 2 PhDs graduated during the evaluation period. The team gave many lectures at local universities and gave one series at the international scene in Mexico.

### *Declaration on societal relevance*

The team is active in the scientific activities at the international scene in Europe and elsewhere, and also in science and research popularization, including numerous media interviews and booklets to present their research. It participated in the Week of Science and Technology.

### *Declaration on the position in the international and national context*

The team has established very strong and successful collaboration at the national level, and internationally mostly in Europe but also in USA, with mostly academic partners

### *Declaration on the vitality and sustainability*

The age profile of the team is very good and guarantees continuing and further developing its current research activities.

### *Declaration on the strategy and plans for the future*

The plans for the future and strategy are well thought out and inspired by current research, however this research will still be conducted in the conditions of strong international competition

**Date:** January 13, 2016

**Commission Chair:** Prof. John Dainton