

Doctoral Program – How to Make It More Attractive

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Abstract: The highest academic degree awarded is the Doctor of Engineering. The doctoral degree requires completion of a research project at a professional level as well as excellent performance in the courses. At Department of Physics of Technical University in Ostrava we try to solve the theoretical and experimental doctoral research projects in the framework of domestic and international grants. This contribution summarizes the experiences obtained during years 1995-2000 from leadership of postgraduate students of science group at Department of Physics. The aspects with the preparation of the doctoral thesis on the base of the international cooperation are discussed in detail.

Keywords: education, academic degree, Ph.D. study

Introduction

The science group consisted of one full professor (leader), two assistants, three Ph.D. students and two undergraduate students. During mentioned period seven doctoral thesis have been realized. The activities have been concentrated both on the basic research (magneto-optics of planar and periodic structures, dark mode spectroscopy and magneto-optical ellipsometry) and the applied research and realization (magnetic nondestructive defectoscopy and diagnostics).

To improve and make the doctoral study more attractive we can make steps both on national and international level. These steps are following:

- incorporation of Ph.D. students to international research teams and the interchange of students
- realization of the doctoral thesis under the supervision of two or more advisors from different countries
- preparation of the common experimental arrangements
- publication advancement in the referee journals
- compatibility of the doctoral programs
- international examining boards

A) International research teams and Ph.D. study

The work of research group has especially experimental character. That is the reason why it was necessary to start and widen the international partnerships with European and non-European universities. This policy deals with following questions:

- study of choice students on top workplaces
- compatibility of study programs
- provision of technical background (experimental samples)
- extension of experimental possibilities

In Europe the contacts have been created e.g. with research group of Prof. A. R. Fert (INSA Toulouse), Prof. B. Hillebrands (Kaiserslautern University), Dr. A. Domanski (Warsaw University of Technology) and Dr. I. Shvetsem (University of Dublin). Out of Europe the partnerships with workplaces especially in Japan – Kyushu University (Prof. K. Yasumoto), Tohoku University (Prof. T. Shoji) and Shizuoku University (Prof. K. Yamaguchi) – have been developed. The length of student's scholarships is different for each research program and varies between three and thirty six months. Adjoining programs (e.g. language training) are the important part of these scholarships. The students can acquire by this approach the maximum of experiences and theoretical and experimental knowledge. These scholarships are paid from national and international projects and grants (Grant Agency of the Czech Republic, Kontakt, Barrande, Japan grants, etc.).

B) Doctoral thesis under the supervision of two advisors from different countries and the international examining boards

The completely new eventuality of doctoral study (Ph.D.) is the possibility to have two advisors from different co-operating countries. This eventuality was realized in the frame of project Barrande (Czech-French co-operation) “Etudes magnétiques et magnétooptiques des couches ultra minces et multicouches magnétiques. Application à l’enregistrement massif réinscriptible d’informations”. Graduate student got a chance to obtain enlarged theoretical base and experimental results both in French (INSA Toulouse) and Czech (VŠB-TU Ostrava) laboratories. The achieved results were presented in more than ten collective papers in international journals. The doctoral study was successfully finished by the vindication of doctoral thesis “Light propagation in magneto-optical multilayers. Magnetization behavior.” to Czech-French board (eight members, four people from each country). The academic councils of relevant universities awarded to the doctoral student Ph.D. degree that is valid both in Czech Republic and France. On the base of obtained experiences with this form of study there is an effort of both sides to continue and develop collective leadership of doctoral students.

C) Preparation of the common experimental arrangements

Experimental physics requires expensive devices and systems for measurement and also costly experimental samples. Our experiments are oriented on investigation of magneto-optical ultrathin periodical structures with magnetic ordering. Technological processes for the preparation of these materials are difficult and very expensive. Usually it is also not possible to measure whole collection of parameters of these materials on one workplace (magneto-optical constants, absorption, thickness of thin films, refractive indices, etc.). There is a problem to have enough money again, but it is also not easy to find proper people with relevant specialization. In our optical laboratories are realized three experimental configurations for measurement of magneto-optical materials at this time (dark mode spectroscopy, Kerr effect measurements at longitudinal and transversal configurations and ellipsometry measurements). These experimental configurations fill the existing foreign configurations and enable the measurements of the samples from co-operating workplaces (Institute of Electrical Engineering, SAV, Bratislava, INSA Toulouse, etc.). Mobility and interchange of graduand and Ph.D. students brings new inspirations for development of measuring systems and faster application of new elements in experimental praxis. One example: 2D generator of rotating magnetic field (Maltese cross model) for magneto-optical study was developed and manufactured in laboratories of Department of Physics VSB-TUO and consecutively used in experimental configuration in laboratories of INSA Toulouse (Fig. 1).

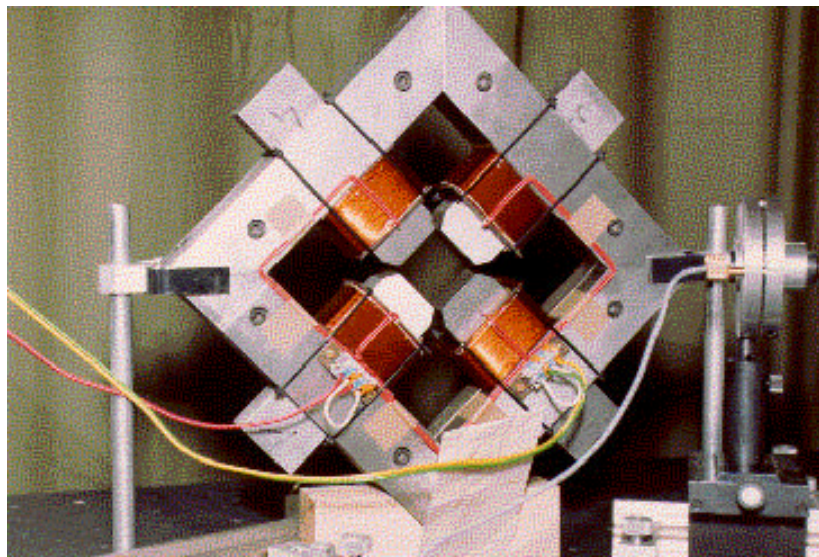


Fig. 1. 2D generator of rotating magnetic field

D) Publication advancement in the international journals

Important attention is concentrated on presentation of theoretical and experimental results by graduand and Ph.D. students. This presentation has three levels:

- presentation on domestic seminars
- lecture (poster) in the frame of international conferences
- paper for presentation in journal

The great attention is concentrated on the preparation of science papers for international reviewed journals. There are selected some papers of the last period in the supplement (students' names are set off)

E) Participation of top international experts on doctoral study

We distinguish two ways of international experts' performance at post gradual and doctoral study. Short time scholarships and visits pertain to the first group. Scholarships longer than one month belong to another group.

Short time scholarships

More than thirty top academic experts from twelve countries of Europe, USA, Canada and Japan have visited research group at Department of Physics during the years 1995-2000. We can divide the activity of the experts during their visits into following groups:

- realization of skilled seminars
- consultation of some special problems with students
- experimental samples and data replacement
- preliminary of collective projects concentrated on the students' mobility and on the cooperation in basic and applied research
- preliminary of collective science publications and presentations

Long time scholarships

In this case we take advantage of long period activity of international experts at our department in the frame of "sabbatical year". This activity brings following advantages:

- participation of international expert on running theoretical and applied research
- realization of set of lectures dealing with concrete problem
- leadership of students' seminar works

It is also important that students have to use foreign language to talk with international experts.

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