

MILMI – an international collaborative program on teaching and research in Photonics

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ABSTRACT

Photonics is a modern science at the frontier between Physics and Chemistry based on laser-matter interactions and always requiring new advanced interdisciplinary skills in Optics and Lasers and in Materials science. To answer this challenging request, we have built a very innovative transatlantic program from a long term collaborative work between our research groups.

Thanks to this program, selected students are offered many opportunities to get a research experience abroad: summer lab internship for undergraduates, double-degree of Master especially emphasized in this paper and PhD cotutelle on collaborative research projects.

Moreover, new methods of long-distance teaching through web-based technology and both internal and external assessments have been successfully implemented.

This program finally allows students to design their own profile with high interdisciplinary scientific skills in addition to unique cultural and social international experience.

Keywords: Master Double-degree, undergraduate, cotutelle PhD, transatlantic, Laser, Photonics, Materials.

INTRODUCTION

The collaboration of the consortium started in 1994 with a professor exchange from University of Central Florida to University of Bordeaux on a NATO- CRG contract. Students and faculty exchanges followed the next year, each time

included in common research and education projects aimed at developing and maintaining strong collaborations with meaningful outcomes, between the partners. These collaborative projects have induced more than 50 joint publications and 60 joint presentations in international conferences from last 10 years. Beside these collaborative actions in research, the consortium has built a strategy of education from undergraduate to PhD levels, operating since 1998 through different programs.

- International Research Experience for Undergraduates (REU) program funded by the NSF from 1998 up to now. To date, 47 French and 80 US students have participated. A new proposal to this program, is currently pending (for award in 2012) and beyond.
- Exchange program funded by FACE (French American cultural exchange) during the period 2004-2007. A new proposal to this program (PUF) is also pending for award in 2012.
- US/EU Atlantis program (MILMI) funded by EACEA and FIPSE for the period 2008-2013. This program to-date has resulted in 5 double degrees of Master, and 6 in progress and will be detailed in this paper.
- A co-tutelle agreement for joint doctoral supervision between University of Central Florida and University of Bordeaux was signed in 2005. To date, this program has resulted in 6 graduates and 1 will graduate next year.

In this paper, we especially emphasize the MILMI program which is offering a double-degree of Master with specific skills in photonics, i.e. in a strongly interdisciplinary field between physics (optics, laser science) and chemistry (materials science).

1. DOUBLE DEGREE CURRICULA

In 2009, a general agreement has been signed between the four partner universities of the MILMI program. Thanks to this agreement, a student is expected to spend one year in his home university and one year in one partner university and finally obtain a double-degree of Master. As discussed above, photonics is a science between physics and chemistry and consequently, two kinds of partnership have been established: Clemson University and University of Bordeaux are partners to offer a double-degree in materials science, while two curricula in optics/physics are offered by University of Central Florida and University of Bordeaux on one hand and by University of Central Florida and Friedrich Schiller University on the other hand. The students' mobilities are financially supported by the bilateral US-EU Atlantis program.

Up to now, five students have graduated and six are expected to graduate in 2012.

In addition to regular courses, the MILMI curriculum is completed by annual summer schools (see §2), hold in a different country each year, which are considered not as optional but as part of the program.

In addition, faculty exchanges and long-distance teaching constitute a major added-value of this program (see §3).

2. SUMMER SCHOOLS

The MILMI program is based on annual summer schools. The first one was hold in Bordeaux (France) in 2010 and offered an intensive program of one week on entrepreneurship, including patents and start-up knowledge. The main idea was to teach to students enrolled in scientific track complementary skills to be able to complete transfer from university to industry.

The second summer school was hold in Orlando (USA) in 2011 and was focused on cutting-edge technologies in photonics. Pairs of students of different nationalities were asked to innovate during one week on a series of topics proposed by alumni of our universities who are currently working into companies. They finally presented their project at the end of the week, developing not only the scientific points of interest but also the constraints of product including size, weight and prize.

The next summer school will be organized in Jena (Germany) in 2012. Visits of companies are already scheduled and objectives are currently discussed by the Board. For each summer school, several students and faculty present their research work. This is a perfect opportunity to share new ideas and to reinforce the collaborations.

3. LONG-DISTANCE TEACHING

In 2011, an experience of long-distance teaching has been successfully conducted. An American teacher from Clemson University came to University of Bordeaux during one month where she gave her regular class of materials science to French students. Meanwhile, her US students attended this series of lectures via a live internet connection. Questions/Answers were thus possible between the teacher and the two groups of students located on each side of the Atlantic Ocean.

In addition, these lectures were recorded and are up to now accessible via internet on the website of Clemson University. And finally a common exam has been passed by all the students revealing a good homogeneity of the results between the French and the US students. Here, let us emphasize that the difference of culture was significant during the classes since the American students are used to ask questions while French students usually don't ask any question during a lecture. Mixing the two populations of students was a very good experience for everyone and clearly an added value for this curriculum.

4. ASSESSMENT

Both internal and external assessments have been conducted. The Board of this program composed of faculty members of each partner university is in charge of the internal assessment. This one is conducted during the annual meetings of the consortium. It consists on evaluating the academic results of the students and more generally their scientific skills including their research experience in laboratory. It also consists in a full evaluation of the organization and management of the program, including mobility, registration, housing, language courses, etc...Due to this internal evaluation, few difficulties with the registration of European students to the US universities were identified, especially due to the GRE and TOEFL requirements. This was helpful to improve the registration process thanks to the adoption of a strict agenda for the registration steps.

In addition, an external assessment has been conducted in 2010 and 2011 by a specialized and independent department of the University of Central Florida. Students were asked to answer a series of questions for a survey. The conclusion is that all the students are very satisfied with this international program and they have even created their own network with strong interactions between them through a facebook group.

CONCLUSION

In this paper, we have reported on the development of collaborative curricula between four partner universities, two in Europe and two in the United States. Based on the principle of one year in the home institution and one year abroad, the students are offered to award a double-degree of Master in the field of photonics, at the frontier between physics (laser, optics) and chemistry (materials science).

This transatlantic program offers many advantages. Beside students and faculty exchanges, it has permitted to experiment long-distance teaching and we are currently working on its amplification through exchanges of other teachers.

Both internal and external assessments have been conducted and significant improvements have already been performed. As a result, current students and alumni have built a strong network between them and benefit from the worldwide network offered by the faculty members.

Even if this paper was especially focused on the double-degree of Master, let's emphasize that our strategy is to multiply the exchanges of students not only for Master's students but also for undergraduates and for PhD candidates thanks to lab internship.

After years, our collaborative research activities have finally generated a strong collaborative program in education and for our consortium, the two actions – research and education – are definitely interconnected and benefit from each other.