Undergraduate Program in Nanoscience and Nanoengineering: 5 Years after the NSF Grant

(EEC 1343673 NUE Grant)

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PROJECT OVERVIEW (see a left diagram above)

Supported by the NSF NUE educational grant EEC-1343673 “NUE: Development of Multidisciplinary Nanotechnology Undergraduate Education Program at the University of Rochester Integrated Nanosystems Center” (2014-2016), a coherent \underline{undergraduate educational program} at the University of Rochester (UR) in nanoscience and nanoengineering, based on the \textbf{Institute of Optics and Integrated Nanosystems Center (UR Nano)} resources was created. It continues after ending this NSF project and currently the Institute of Optics administration, Dean’s office of Hajim School of Engineering and Applied Sciences support this program financially (paying URNano fees, materials’ cost and adjunct instructors’ and teaching assistants’ salaries).

A very important part of the project is participation of a local Monroe Community College (Prof. Paul D’Alessandris). One challenge facing Physics courses at community colleges is the lack of student activities centered on modern experiments. The lab of the typical course consists predominately of replicating nearly 100-year-old experiments (photoelectric effect, hydrogen spectroscopy, etc.). Addition of a state-of-the-art lab experience makes the course truly modern and provides a strong motivating force for future STEM study.

Certificate in Nanoscience and Nanoengineering

The program on a Certificate for undergraduate students started in 2014 with 41 students awarded the Certificate by May 2021, has following requirements for its completion:

- A required 4 credit hour laboratory course OPT 254/PHY 371 “Nanometrology Laboratory”. This new course started in Spring 2015 was specially prepared for this program.
- On students’ selection, two other courses containing nanotechnology content (see the list of some possible courses in a right diagram on the top of this poster).
- Full semester research or design project connected with nanoscience or nanotechnology.

IMPORTANT ACHIEVEMENTS (see details in Ref. [1])

- the Certificate for Nanoscience and Nanoengineering program (41 students were awarded the Certificate and several other students are working in this direction);
- creating a \textit{reproducible} model of collaboration in nanotechnology between a university with state-of-the-art, expensive experimental facilities, and a nearby, two-year community college (CC) with participation of a local Monroe Community College (MCC). 52 MCC students carried out two labs at the UR on the atomic force microscopy and a photolithography in a clean room;
- developing \textit{reproducible} hand-on experiments on nanophotonics ("MINI-nano-LABS”), learning materials and pedagogical methods to educate students with diverse backgrounds, including freshmen and non-STEM-major CC students. These minilabs on nanophotonics were also introduced in some Institute of Optics required classes.

OPPORTUNITIES FOR COLLABORATION

We have a big experience in teaching advanced labs in Pandemic (see Ref. [2] ) and will be happy to share it.

WEBSITE: http://www2.optics.rochester.edu/workgroups/lukishova/QuantumOpticsLab/

KEY REFERENCES:

1. S.G. Lukishova “Undergraduate Program in Nanoscience and Nanoengineering: 5 Years after the NSF Grant, paper F1A.6, Proceedings, session Curriculum Development and Improvement in Optics and Photonics II, 16th International Conference Education and Training in Optics & Photonics (ETOP), 8–10 September 2021, Washington. DC.