COMSOL CONFERENCE 2018 BOSTON

Foundational Undergraduate Teaching And Research Tools In Thermoelectrics Using COMSOL Multiphysics

D. Buna, L. Hoxha, D. Tafone
School of Theoretical and Applied Science, Engineering Physics, Ramapo College of New
Jersey, Mahwah, NJ, USA

Premise

- COMSOL Multiphysics® can play a crucial role in jumpstarting undergraduate research programs in physics and engineering at colleges with limited financial support and small faculty size.
- Approx. 6000 students
- Engineering Physics program
- 48 majors
- 4 full time faculty

New Science and Nursing buildings

New facilities

- 2 100 level laboratories
- 1 level 200
- 1 level 400 (Funded by NSF grant 2011-2013
- 1 Optics and Condensed Matter research lab, NSF grant 2017 with FTIR and metalizer
- Materials science lab funded by private donor - building only, limited equipment funding: 3-zone furnace, network analyzer, 15MHz NMR small bore unit

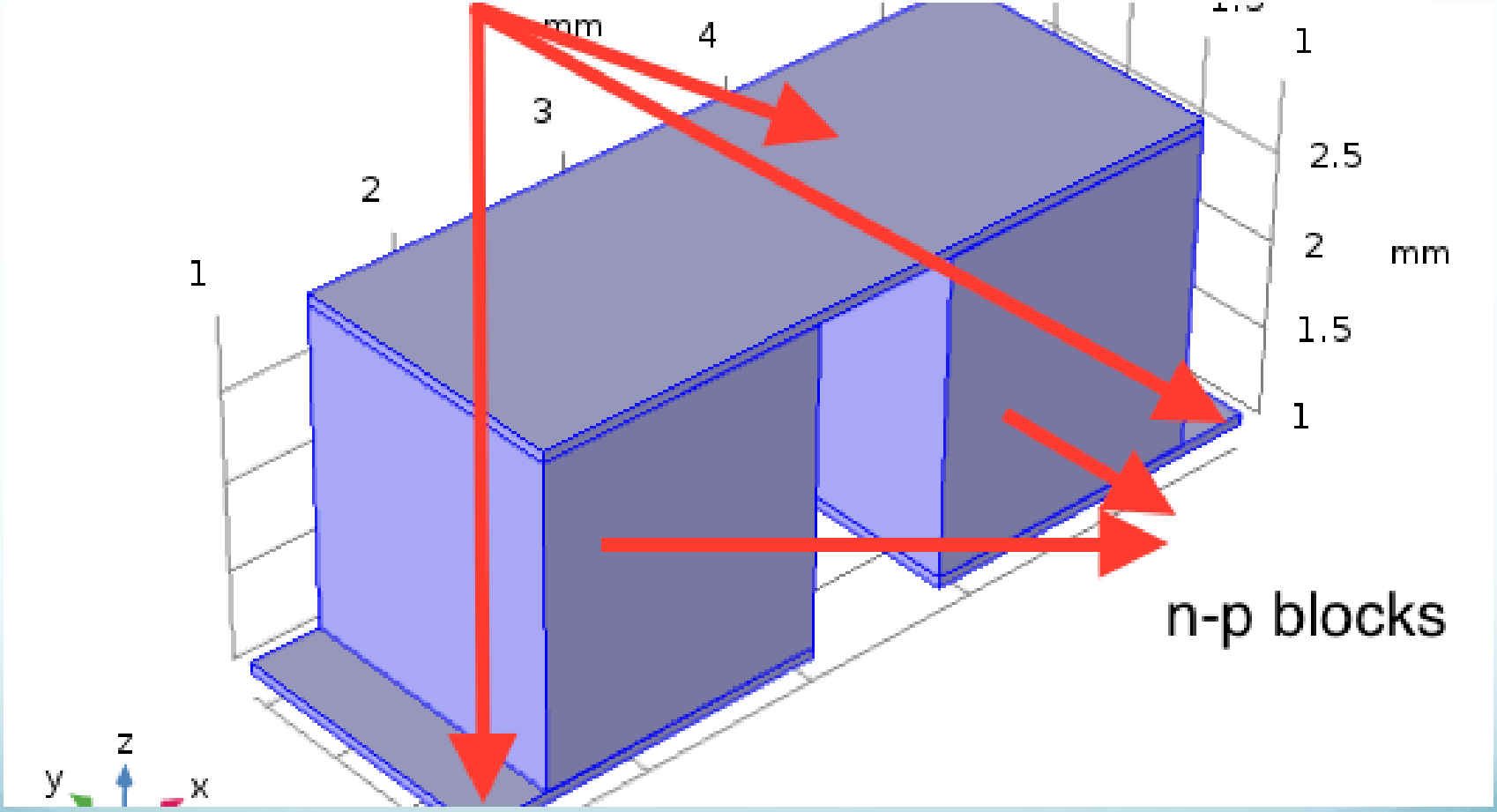
Materials science: undergraduate research program

- Identify project of interest and collaborators
- Identify software, measurements and equipment
- Work out a timetable to work with students and help them apply for summer REU programs
- Support their efforts for graduate school admission and job search
- Constantly update and refine the curricular offerings to incorporate new skills

Curricular offerings

- Medical Physics
- Semiconductors and Optoelectronic devices
- Photonics
- Labview
- Electronics
- Experimental research methods
- 3D Printing and Entrepreneurship

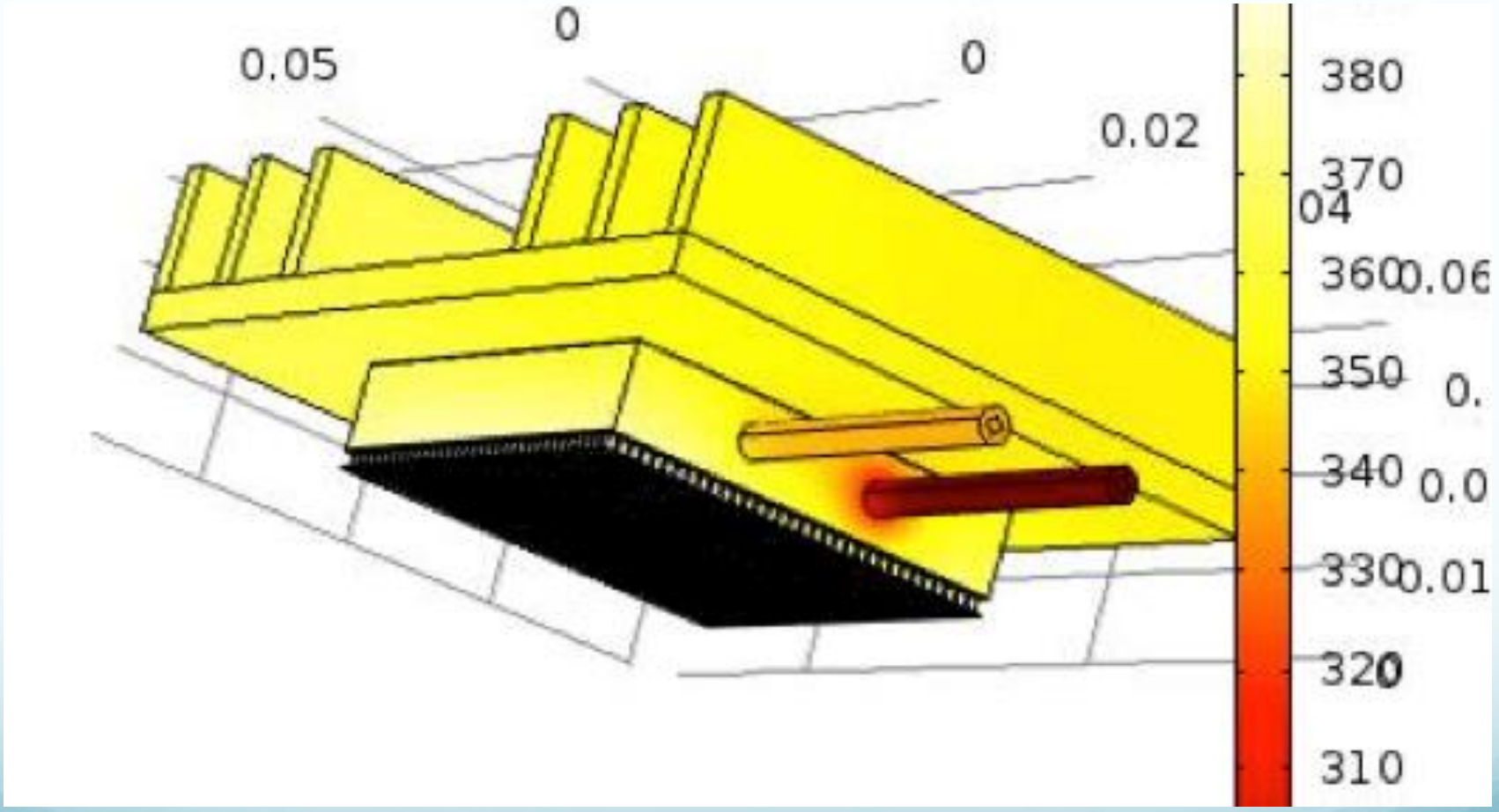
Thermoelectric generators



Design a small research project and build on it

- Thermoelectric generators with practical applications
  - Develop a model and compare its performance to an existing system; seek improvements
  - Fabrication, characterization and prototype

Comsol Model



Microwave absorption in metamaterials

Conclusions

- The work presented is the first step in the development of an undergraduate materials science laboratory. It is also used to develop teaching apps for the engineering physics curriculum and to develop COMSOL Multiphysics® modeling skills for faculty and students.
- Grant applications: Exxon 2018, NSF 2018

References:

Comsol applications library,

Ying He ad et al, High thermoelectric performance in copper telluride, NPG Asia Materials, Vol 7, 1-7

Acknowledgements

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