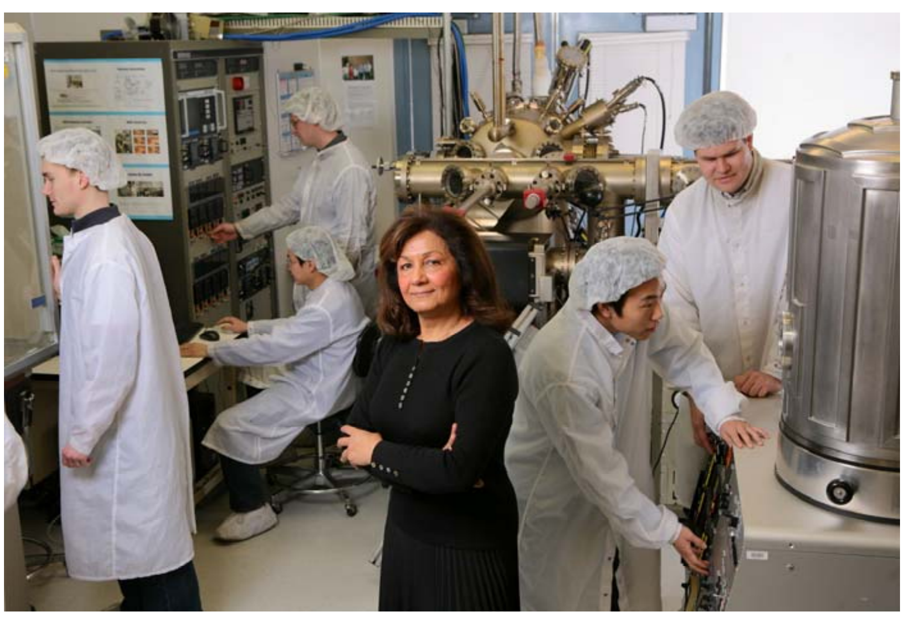
THE FRANKLIN INSTITUTE *Awards*

High-Power Room-Temperature THz Frequency Sources

honoring Manijeh Razeghi
recipient of the 2018 Benjamin Franklin Medal in Electrical Engineering

Leading international scholars are assembled in a symposium dedicated to the technical contributions of Prof. Razeghi, founding Director of Center for Quantum Devices of Northwestern University, for her innovative design of *high-power, room-temperature THz sources using nonlinear optics, and for developing the epitaxial manufacturing techniques to produce them*. Spectroscopy operates on the principle of using electromagnetic spectrum for characterization of materials for the study of various natural phenomena, and relies on availability of tunable high-power frequency sources and sensitive detectors. The THz frequency region has been quite an elusive portion of the electromagnetic spectrum, even though molecular vibration frequencies of most materials - with their distinct spectroscopic signatures – fall into this domain. The development of THz frequency sources has been of great interest for quite some time due to their scientific and engineering applications in sensing, imaging, and telecommunications with significant societal implications.

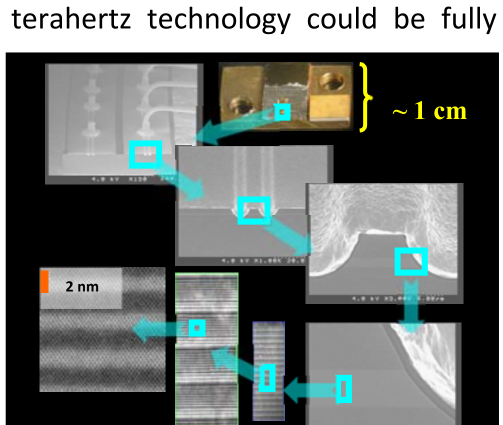


The frontier of the trillion-cycles per second is the terahertz (THz) realm, which bridges the electromagnetic spectrum between the highest radio waves (microwaves) and the lowest frequencies of light (infrared). It is an area that has long been a sort of technological No Man's Land, since THz waves are difficult to generate and tend to be weakened by most materials. But Manijeh Razeghi is one electrical engineer who has ignored these limitations, seeking to overcome them instead.

Quantum Cascade Laser (QCL), a semiconductor laser first invented in the 1990s, operates in the infrared to terahertz range and mostly functions at super-cold temperatures with low output power, unsuited for practical applications. Razeghi built upon her previous achievements in semiconductor development, particularly the use of indium phosphide materials, to improve upon existing THz source designs, achieving the first wide-range high-power, room-temperature QCLs and transforming the device from a technological novelty to a practical, commercially viable product. Using Razeghi's QCL designs, the promise of terahertz technology could be fully realized at last.

IEEE Philadelphia Section

TEMPLE UNIVERSITY College of Engineering



WEDNESDAY APRIL 18TH, 2018

8:30 AM to 12:30 PM
Mitchell Auditorium
Bossone Research Center
3140 Market Street, Drexel University
Philadelphia, PA 19104

Program:

9:00 - 9:15 **Welcoming Remarks**
President John Fry, Drexel University

9:15 -9:30 **Introduction to THz Frequency Sources**
Afshin S. Daryoush, Drexel University

9:30 - 9:45 **Letters from Distinguished Guests and Laureates**
Martin Defour, Thales - Defense Missions System

9:45 - 10:15 **Building Blocks and Concepts for THz Remote Sensing and Communications**
Daniel Dolfi, Thales Research and Technology (TRT)-France

10:15 - 10:30 **Coffee Break**

10:30 - 11:00 **Progress on the High Power Semiconductor Lasers at CIOMP**
Cunzhu Tong, Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP)

11:00 - 11:30 **$Al_xGa_{1-x}N$/GaN Engineered Intersubband Devices**
Can Bayram, University of Illinois Urbana-Champaign

11:30 - 12:00 **Nanovation: Genesis of Material Scientists and Entrepreneurs By Manijeh Razeghi**
Ferechteh H. Teherani, Nanovation Company

12:00 - 12:30 **2018 Franklin Medalist: Laureate Lecture**
Manijeh Razeghi, Northwestern University

Registration: ***Free and open to the public***
www.drexel.edu/engineering/about/honors-awards/2018FranklinMedal

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THE FRANKLIN INSTITUTE *proudly presents* THE FRANKLIN INSTITUTE AWARDS

Four nearly two centuries, The Franklin Institute has honored pioneering achievements in science, engineering, and industry. The Franklin Institute Awards dates back to 1824 and is considered one of the most prestigious awards in science and engineering. This honor has been bestowed to likes of Nikola Tesla, Thomas Edison, Lord Rayleigh (John William Strutt), Max Planck, William H. Bragg, Albert Einstein, Sir Chandrasekhara Venkata Raman, Sergei A. Schelkunoff, John Bardeen, Ali Javan, Theodore H. Maiman, Arthur L. Schawlow, Zhores I. Alferov, Paul Baran, and Lotfi A. Zadeh. Notably, Drexel University has recently celebrated Nick Holonyak (2017 Franklin Medal), Kenichi Iga (Bower Award 2013), and Drexel University's own Paul Baran (Bower Award in 2001) to name just a few.