

Sharing session with Vg Prof Federico Capasso

School of Engineering and Applied Sciences, Harvard University

School of Physical and Mathematical Sciences, NTU

School of Electrical and Electronic Engineering, NTU

Venue: Hilbert Space (SPMS-PAP-02-02)

Host: Asst. Prof. Cesare Soci

Visiting Professor Federico Capasso will give a series of seminars to present his research activities. At the end of the seminars, he will welcome informal interaction sessions with members of our faculty and graduate students.

26 May 2014, 11am-12.30pm

Designing quantum fluctuations: Casimir forces, quantum levitation and the future of nanomachines

Attractive forces exist between any uncharged surfaces in vacuum due to quantum mechanical fluctuations (zero point energy). Known as Casimir-Lifshitz forces, they can be tailored by suitable choice of the materials and their shape and even turned into repulsive by interleaving a suitable liquid. Measurements of these exotic forces will be presented. These results have implications for future scaled-down MicroElectroMechanicalSystems (MEMS) opening the door to new actuators, nanoscale position sensors and frictionless bearings based on quantum levitation. The talk will conclude with a brief discussion of future exciting possibilities such as the vacuum torque and the “holy grail” of quantum electrodynamics, light generation by “shaking the vacuum”.

27 May 2014, 11am-12.30pm

Quantum cascade lasers: high performance light sources from the mid- to the far infrared and their applications

Quantum Cascade Lasers (QCLs) represent a radical departure from diode lasers in that they don't rely on the bandgap for light emission. This freedom from “bandgap slavery”, combined with the power of quantum design, and the attendant unipolar nature lead to unprecedented design flexibility and functionality. I will trace the path from invention to exciting advances in the applications of these revolutionary lasers which cover the mid- and far-IR (THz) spectrum and are broadly impacting sensing, spectroscopy, atmospheric chemistry and high power applications such as infrared countermeasures. I will also focus on recent developments in single mode high-power QCLs and in QCL array technology with single mode, high power, broadband tuning, as well as highly collimated high brightness devices. I will discuss applications to chemical sensing, such as trace gas analysis and stand-off detection) along with the ongoing commercialization of this technology. Progress in room temperature Terahertz QCL sources based on difference frequency generation will be reported.

Short Biography

Federico Capasso is the Robert Wallace Professor of Applied Physics at Harvard University, which he joined in 2003 after 27 years at Bell Labs where he was Member of Technical Staff, Department Head and Vice President for Physical Research. His research has focused on nanoscale science and technology encompassing a broad range of topics. He pioneered band-structure engineering of semiconductor nanostructures and devices, invented and first demonstrated the quantum cascade laser and investigated QED forces including the first measurement of a repulsive Casimir force. His most recent contributions are new plasmonic devices and flat optics based on metasurfaces. He is a member of the National Academy of Sciences, the National Academy of Engineering, the American Academy of Arts and Sciences. His awards include the King Faisal Prize, the IEEE Edison Medal, the SPIE Gold Medal, the American Physical Society Arthur Schawlow Prize in Laser Science, the Jan Czochralski Award for lifetime achievements in Materials Science, the IEEE Sarnoff Award in Electronics, the Materials Research Society Medal, the Wetherill Medal of the Franklin Institute, the Rank Prize in Optoelectronics, the Optical Society Wood Prize, the Berthold Leibinger Future Prize, the Julius Springer Prize in Applied Physics, the European Physical Society Quantum Electronics Prize.

Session jointly organized by School of Physical and Mathematical Sciences and School of Electrical and Electronic Engineering.

