

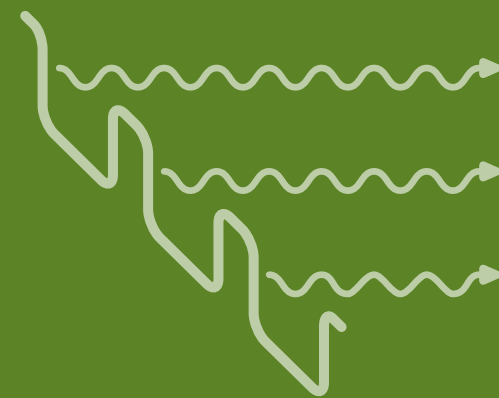
THE BIRCK NANOTECHNOLOGY CENTER WARMLY WELCOMES

Federico Capasso

PROFESSOR OF APPLIED PHYSICS, HARVARD UNIVERSITY

RECIPIENT OF THE IEEE EDISON MEDAL

New Frontiers in Optics and Photonics with Designer Electronic and Optical Materials



Wednesday
May 14

2 – 3^{pm}

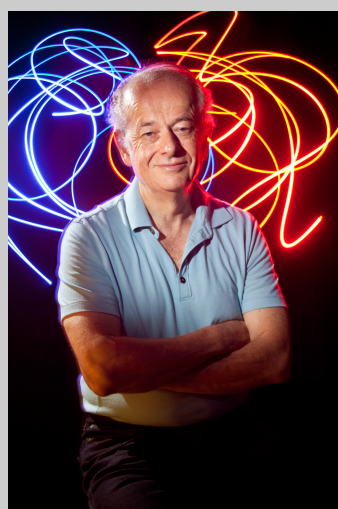
BURTON MORGAN
ROOM 121

THE EIGHTH EDITION OF THE Philip F. Bagwell Lecture

SERIES HELD IN FOND MEMORY OF PHILIP BAGWELL,
FORMER ASSOC. PROF. IN ELECTRICAL AND COMPUTER ENGINEERING,
TO CELEBRATE HIS SPIRIT OF DEEP THINKING ACROSS DISCIPLINES.

PREVIOUS HONOREES Wilfried Haensch • Zhores Alferov • Eugene Fitzgerald
Steve Hillenius • Jeff Hawkins • Albert Overhauser • Herb Kroemer

THE CONTROL OF ELECTRONS AND PHOTONS in artificially structured materials at the nanoscale by quantum and electromagnetic design has opened unique opportunities for major advances in science and technology. I will present a tutorial account of some these developments. From the design of the electronic resonances and their coupling to light in nanometer thick materials a new class of light sources (quantum cascade lasers) has emerged that now cover almost the entire infrared and far-infrared spectrum, leading to an explosive growth in applications. By structuring surfaces at the sub-wavelength with nanoscale optical resonators and nanometer thin layers, “metasurfaces” have emerged that have led to powerful generalizations of the laws of reflection and refraction, new thin film interferences and new ways to generate light beams and surface optical waves with “arbitrary” wavefronts. Applications of this new “flat optics” will be presented. Finally, I will show how quantum fluctuations at the nanoscale can be designed to control macroscopic quantum electrodynamical phenomena such as attractive and repulsive Casimir forces and their interaction with micro/nanomechanical structures.



FEDERICO CAPASSO is the Robert Wallace Professor of Applied Physics at Harvard University, which he joined in 2003 after a 27 years career at Bell Labs where he did research, became Bell Labs Fellow and held several management positions including Vice President for Physical Research. His research has spanned basic science and applications in the areas of electronics, photonics, nanoscale science and technology including plasmonics, metasurfaces and the Casimir effect. He pioneered bandstructure engineering of artificially structured materials and devices and invented the quantum cascade laser. He performed the first measurement of the repulsive Casimir force. He and his group recently discovered powerful generalizations of the laws of reflection and refraction applicable to metasurfaces and demonstrated that the latter can be used to design new planar optical components (flat optics). He is a member of the National Academy of Sciences, the National Academy of Engineering, and a fellow of the American Academy of Arts and Sciences. His awards include the King

Faisal International Prize for Science, the American Physical Society Arthur Schawlow Prize, the Wetherill Medal of the Franklin Institute, the IEEE Edison Medal, the SPIE Gold Medal, the European Physical Society Quantum Electronics Prize; the Berthold Leibinger Zukunftspreis (the future prize), the Julius Springer Prize for Applied Physics, the Jan Czochralski Award of the European Material Research Society for lifetime achievements in Materials Science; the IEEE D. Sarnoff Award in Electronics, the IEEE/LEOS Streifer Award, the Optical Society of America Robert Wood prize, the Rank Prize in Optoelectronics, the Material Research Society Medal, the Welker Medal, the Duddell Medal and Prize of the Institute of Physics (UK), the Newcomb Cleveland Prize of the American Association for the Advancement of Science, the “Vinci of Excellence” LMVH Prize and the New York Academy of Sciences Award.

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