

Dr. Luca Dal Negro, Boston University

## Predictive Design of Nanoscale Electromagnetic Fields for Optical Device Applications

**Abstract:** The development of rigorous and efficient computational techniques for the design of light-matter interactions in complex nanostructures and artificial optical materials (i.e., metamaterials) is key to current nanophotonics technologies. The control of *propagating* and *non-propagating* electromagnetic fields in *resonant* optical environments opens new and exciting venues to engineer optical interactions, energy concentration and nanoscale manipulation of optical fields for a number of optical device applications, including broadband linear and nonlinear nano-antennas, optical switchers, laser nano-cavities, and optical biosensors.

In this talk, within the general Green's function approach to vector multiple scattering of light, efficiently implemented within the rigorous framework of integral equations-based methods, Dr. Dal Negro will discuss some of our recent work on the design of sub-wavelength fields in metallic and metal-dielectric nanostructures with enhanced optical cross sections for light sources, sensors, and nonlinear optical elements compatible with the widespread silicon technology. The purpose of his talk is twofold: 1) to introduce the main ideas behind the most accurate computational approaches to complex nanophotonic structures; 2) to demonstrate the relevance of predictive design for the engineering of novel optical nanostructures.

**Bio:** Dr. Luca Dal Negro received both the Laurea in Physics, *summa cum laude*, in 1999 and the Ph.D. degree in Semiconductor Physics from the University of Trento, Italy, in 2003. After his Ph.D. in 2003 he joined MIT as a post-doctoral Research Associate. Since January 2006, he has been a faculty member in the Department of Electrical and Computer Engineering and in the Material Science Division at Boston University. He is currently a tenured Associate Professor and a faculty member of the Photonics Center at BU. Professor Dal Negro manages and conducts research projects on light scattering from complex media, nano-optics and plasmonics, silicon photonics, and computational electromagnetics. He received the 2009 National Science Foundation Career Award and has published more than 180 technical articles, with more than 4,900 citations. Professor Dal Negro has also been an invited speaker at numerous international conferences and symposia.