Georgia Electronic Design Center
Distinguished Lecture Series

Resonances for Spatially Distributed Emitters

FEATURING
Steven Johnson
Professor of Applied Mathematics and Physics
MIT

Tuesday, October 11, 2022
11:15 a.m. to 12:15 p.m. EDT
Location: Coda, The Atrium - 9th floor

Pizza & Soda Available Post Seminar

Abstract: It's well known that a resonant cavity can dramatically enhance light emission by a fluorescent particle, via the Purcell effect. A closely related enhancement occurs for ensembles of coherent or incoherent emitters, which arises in many circumstances: lasing, thermal emission, fluorescent media, Raman scattering in fluids, scattering by surface roughness, and even dark-matter axion haloscopes. However, such "distributed" emission problems favor quite different resonant geometries, in part because the role of corner singularities is upended by spatial averaging. Moreover, even though distributed-emission problems tend to be naturally translation invariant, the process of seeking an optimal emission-enhancing geometry leads to spontaneous symmetry breaking. Theoretically, new tools are becoming available to reveal the possible behaviors and upper bounds of light–matter interactions in complex nanostructured geometries. Computationally, the modeling of such systems naively involves an ensemble average of a large number of expensive electromagnetic simulations, but new trace-optimization algorithms now make it possible to perform large-scale "inverse design" of distributed emission over thousands of degrees of freedom.

"Light-matter interactions in complex nanostructured geometrics"

Biography: Steven G. Johnson is a Professor of Applied Mathematics and Physics at MIT. He works in the field of nanophotonics—electromagnetism in media structured on the wavelength scale, especially in the infrared and optical regimes—where he works on many aspects of the theory, design, and computational modeling of nanophotonic devices, both classical and quantum. He is co-author of over 200 papers and over 25 patents, including the second edition of the textbook Photonic Crystals: Molding the Flow of Light. In addition to traditional publications, he distributes several widely used free-software packages for scientific computation, including the MPB and Meep electromagnetic simulation tools and the FFTW fast Fourier transform library (for which he received the 1999 J. H. Wilkinson Prize for Numerical Software).

Hosts: Stephen E. Ralph & Nima Ghalichechian