

Fundamental Limits on Photonic Devices via Lagrange Duality: A Complement to Inverse Design

Speaker: **Alejandro Rodriguez, Princeton University**



Cornell University
School of Electrical and
Computer Engineering

Abstract :

Advances and application of inverse design techniques in electromagnetism are pushing photonic device performance to new limits, paving the way for new types of light-matter interactions. In this talk, I will describe a general framework, based on Lagrange duality, for computing physical bounds on nanophotonic devices. Complementing structural optimization or "inverse design", the approach exploits a hierarchy of energy-conservation constraints which provides systematic and geometry-agnostic control over the spatial extent of local violations of physics, and can also be used to obtain optimal nanostructures. We present representative examples, including bounds on metasurface scattering cross sections, thermal radiation, and field transformations.

Bio:

Alejandro Rodriguez is an Associate Professor of Electrical Engineering and the Director of the Program in Materials Science and Engineering at Princeton University. He received Bachelors and PhD degrees in Physics at MIT in 2006 and 2010, respectively, and was a Postdoctoral Fellow at Harvard University. His research centers around nanophotonics, the study of light in nanostructured media, where he has made contributions to the understanding of quantum and thermal fluctuations, nonlinear optics, numerical methods, and asymptotics. Alejandro was awarded the Presidential Early Career Award for Scientists and Engineers, the National Science Foundation Early CAREER Award, the Society of Hispanic Professional Engineers Young Investigator Award, and the Department of Energy Frederick A. Howes Award in Computational Science. When he is not playing with photons, he can be found in a superposition of dancing salsa, watching films, playing the piano, listening to Cuban music, and playing strategy games.

Virtual Talk

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