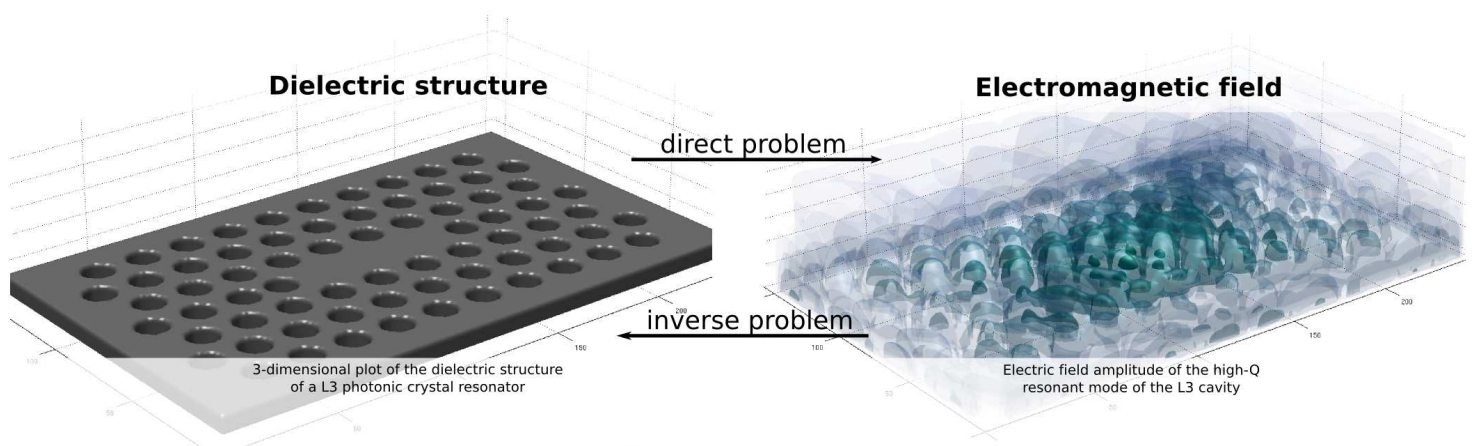


# Electromagnetic Inverse Design

Jesse Lu and Jelena Vuckovic

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We develop a method to solve the electromagnetic inverse design problem; that is, to find a dielectric structure that will produce a specified electromagnetic field. Such a method enables the design of non-intuitive, multi-objective photonic components such as small mode-volume or doubly-resonant cavities, broadband waveguide couplers and dispersion-tailored waveguides.

## Problem Challenge

The electromagnetic inverse design problem is challenging because

- realistic dielectric structures are typically binary, consisting of only two discrete dielectric materials, and
- there is no one-to-one correspondence between field profiles and dielectric structures, since certain field profiles are impossible to achieve.

## Current Progress

Currently, we have been able to produce two-dimensional proof-of-concept designs including

- line and “X” resonators,
- degenerate and non-degenerate doubly-resonant cavities, and
- a single to dual-beam waveguide coupler.



Figure 1: Magnetic field profile and two-dimensional dielectric structure of a small mode-volume resonator produced by our inverse design method.