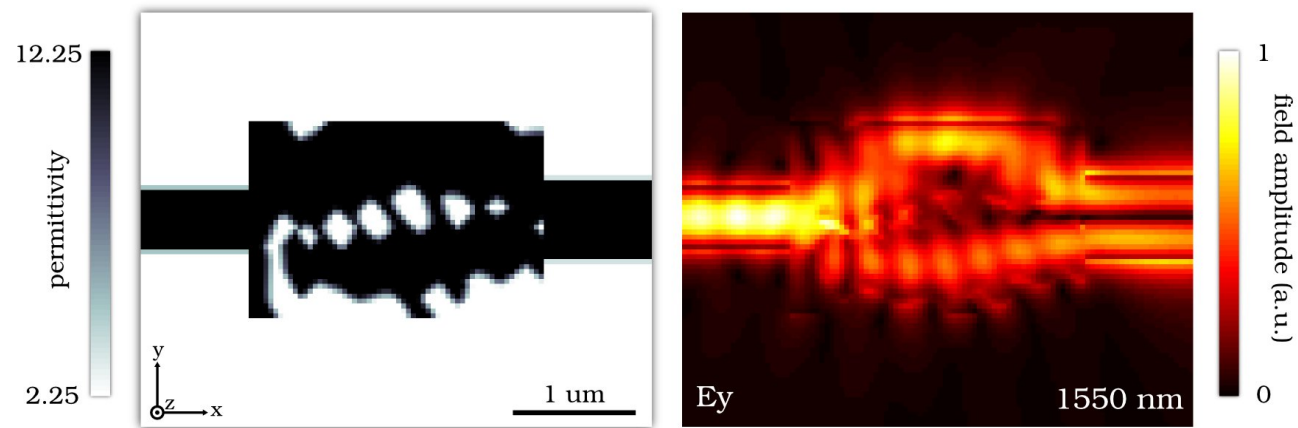


# Nanophotonic Computational Design

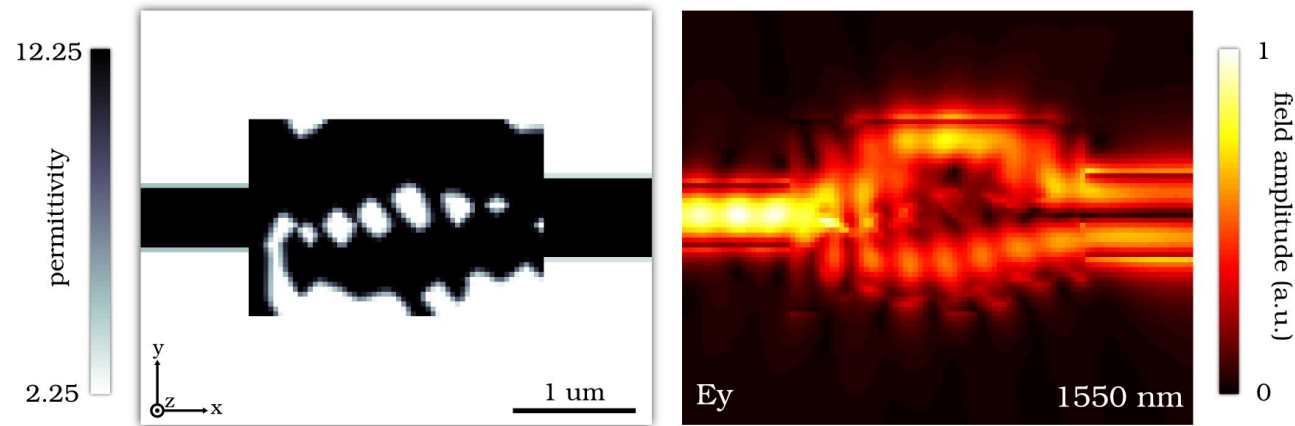
Jesse Lu

February 25, 2013

Goal: Show you how to design *any* linear nanophotonic device



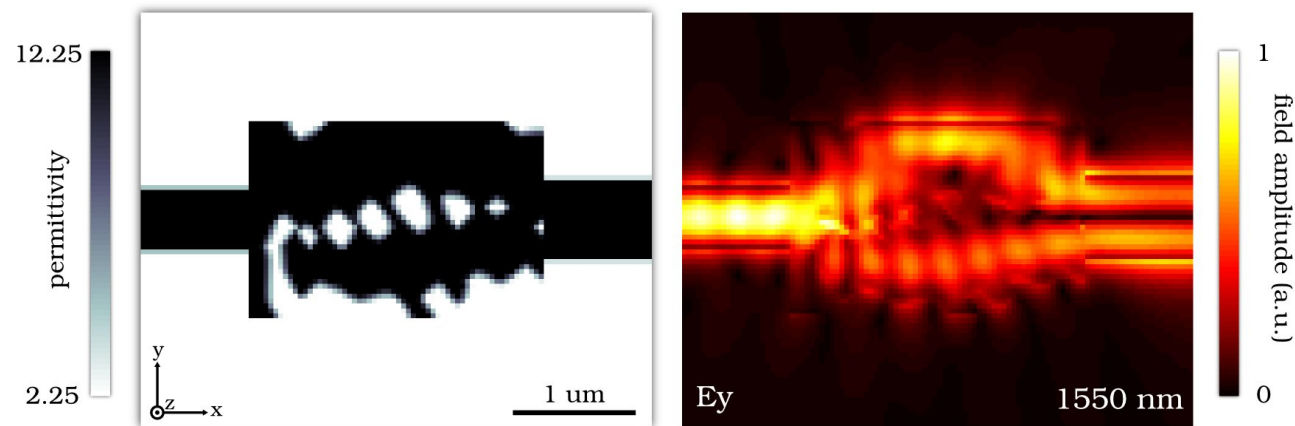
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- Physics Advisory:

CONTAINS INVOLVED MATHEMATICAL CONTENT

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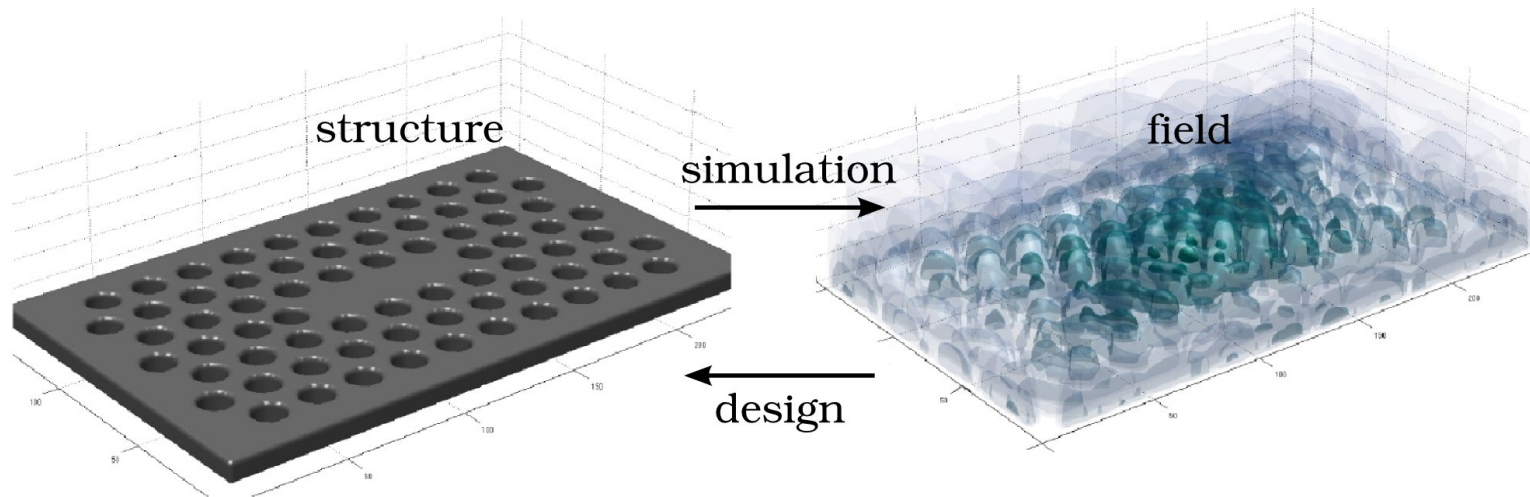
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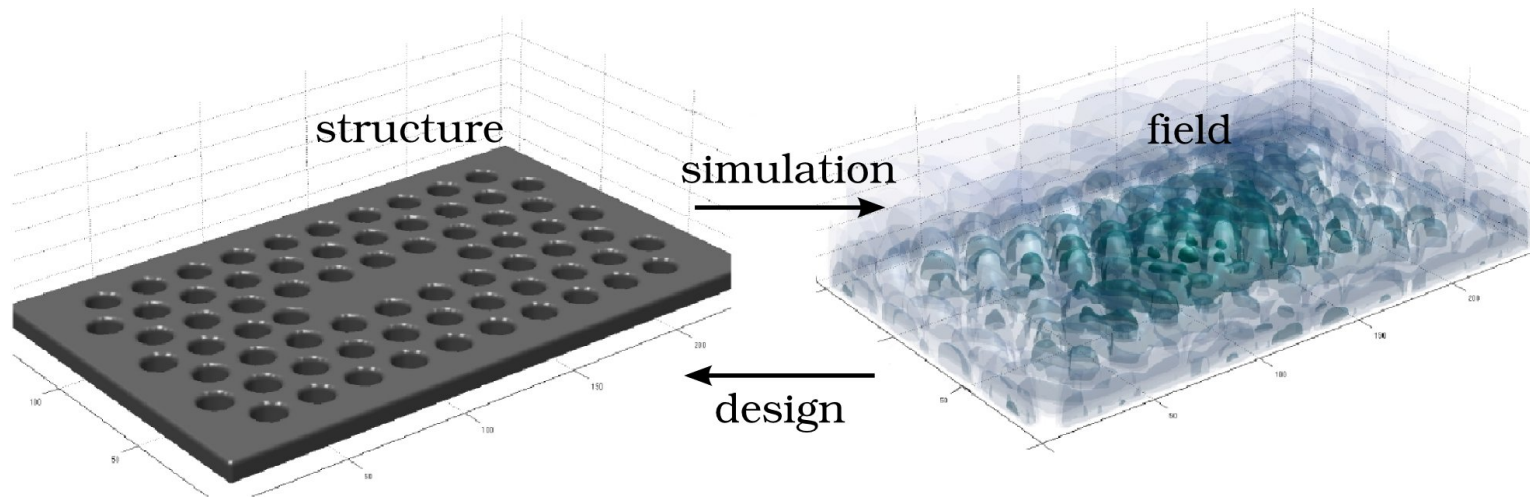
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CONTAINS INVOLVED NANOPHOTONIC CONTENT

# Given a field, can we find its structure?



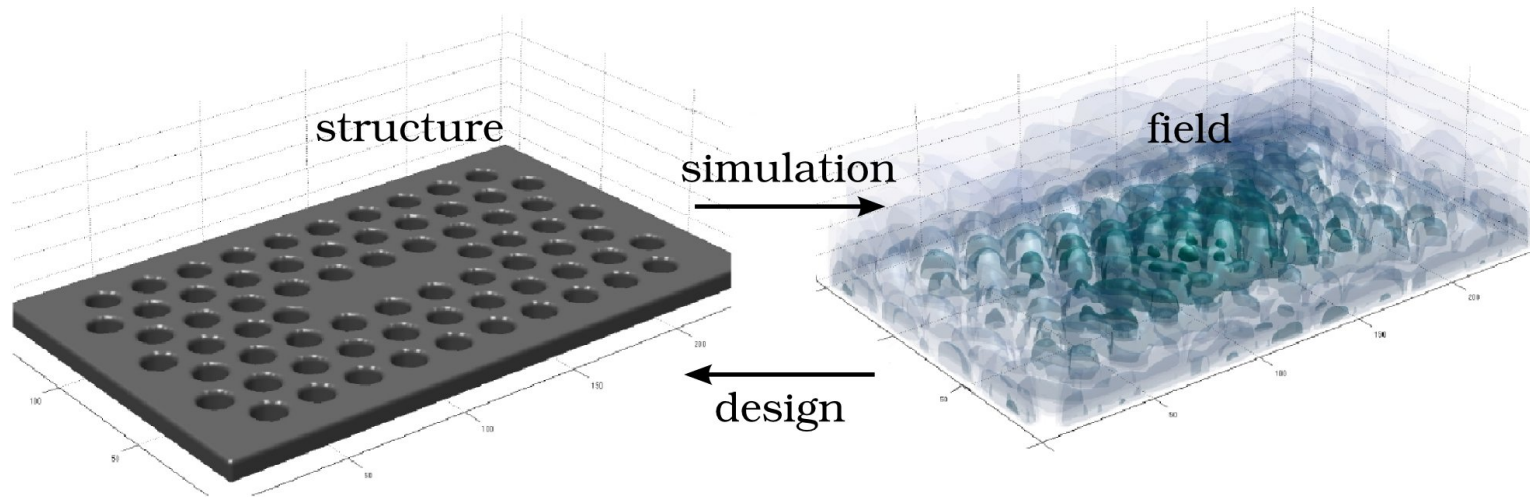
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- Equivalently, find  $\epsilon$  (structure) given  $E$  (field)

$$\nabla \times \mu_0^{-1} \nabla \times E - \omega^2 \epsilon E = -i\omega J$$

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- If possible, we can design *any* nanophotonic/optical component!

- Answer: Yes (trivial!)

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$$\nabla \times \mu_0^{-1} \nabla \times E - \omega^2 \epsilon E = -i\omega J$$

$$\omega^2 \epsilon E = \nabla \times \mu_0^{-1} \nabla \times E + i\omega J$$

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$$\epsilon = (\nabla \times \mu_0^{-1} \nabla \times E + i\omega J) / \omega^2 E$$