Optimization and Prediction of Spectral Response of Metasurfaces Using Artificial Intelligence

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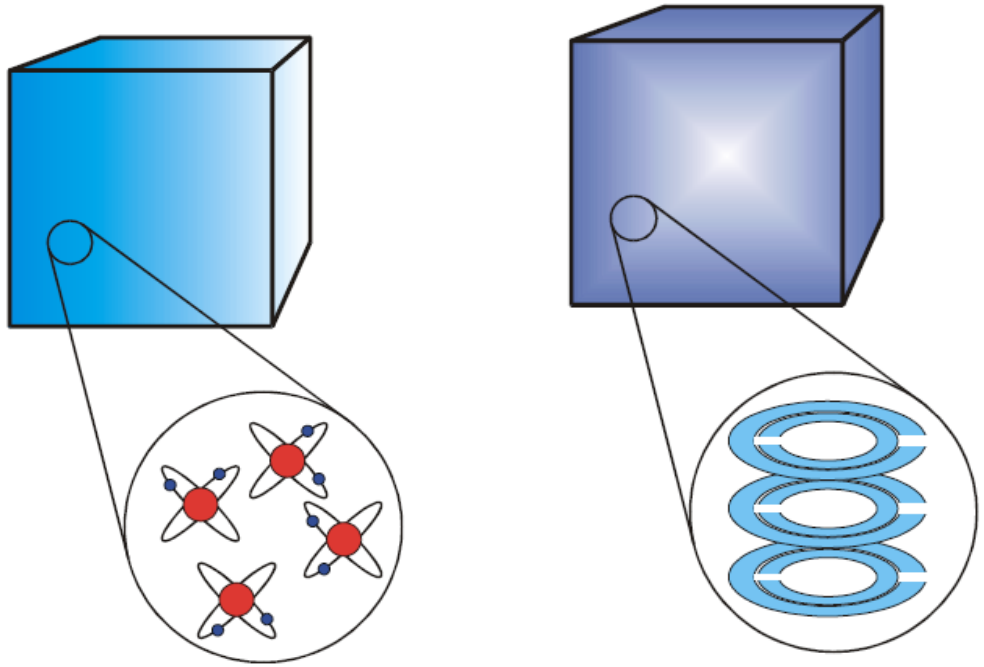
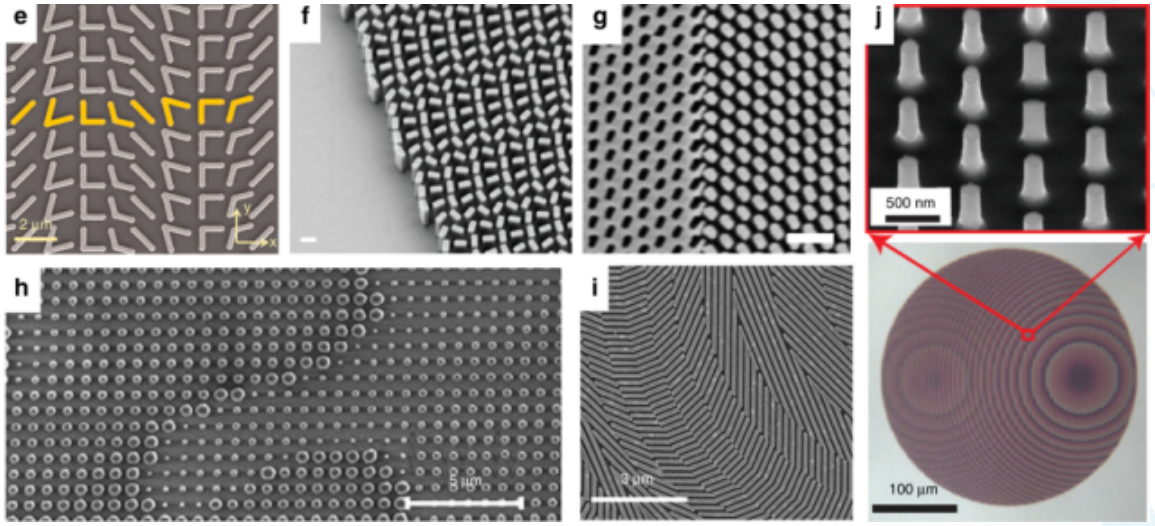
Metamaterials and Metasurfaces

Man-made “atoms” : Metamaterials



Metasurfaces

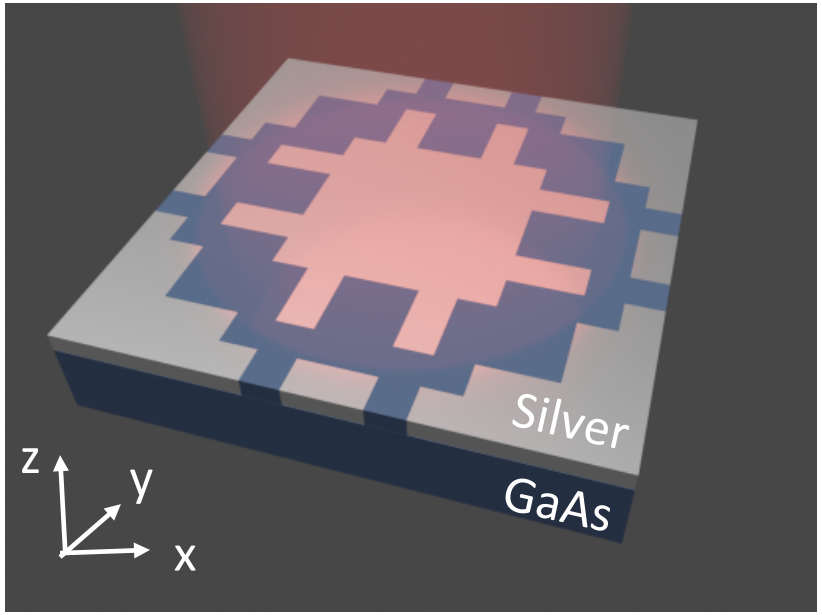


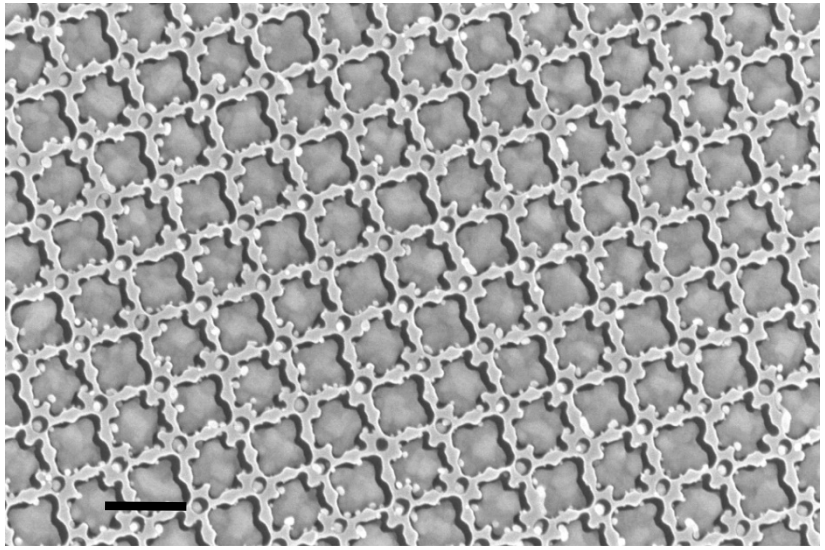
Ref. : Neshev & Aharonovich, Light : Science & Applications 7 (58), 2018.

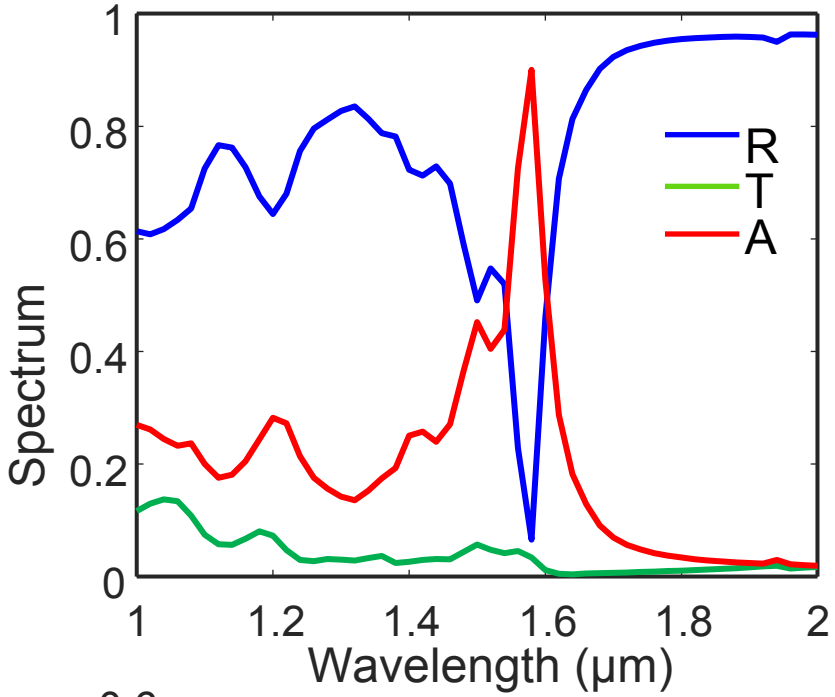
In metamaterials, optical properties are determined by the configuration and properties of the meta-atoms.

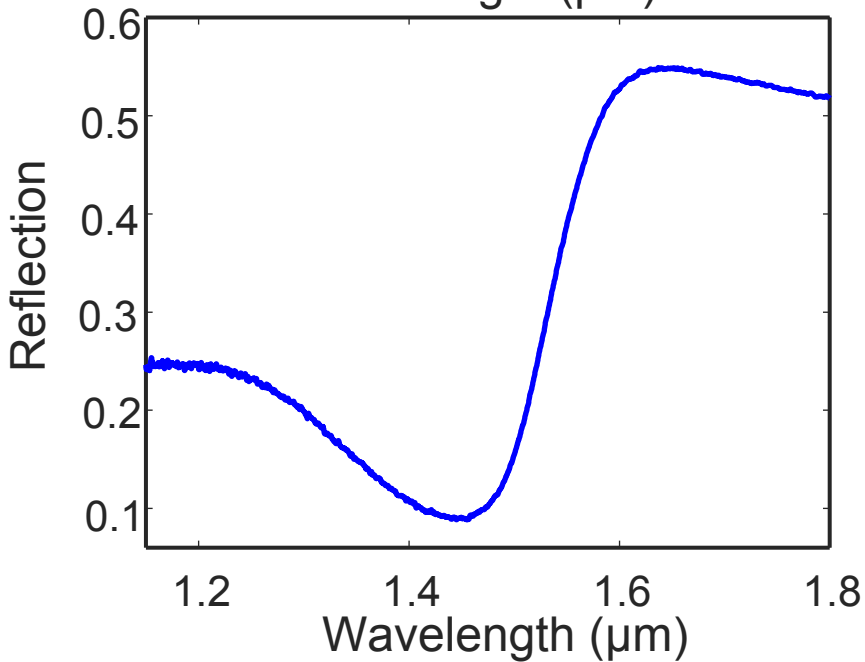
Metasurfaces are planar (2D) equivalents of metamaterials.

Optimization Using Genetic Algorithms

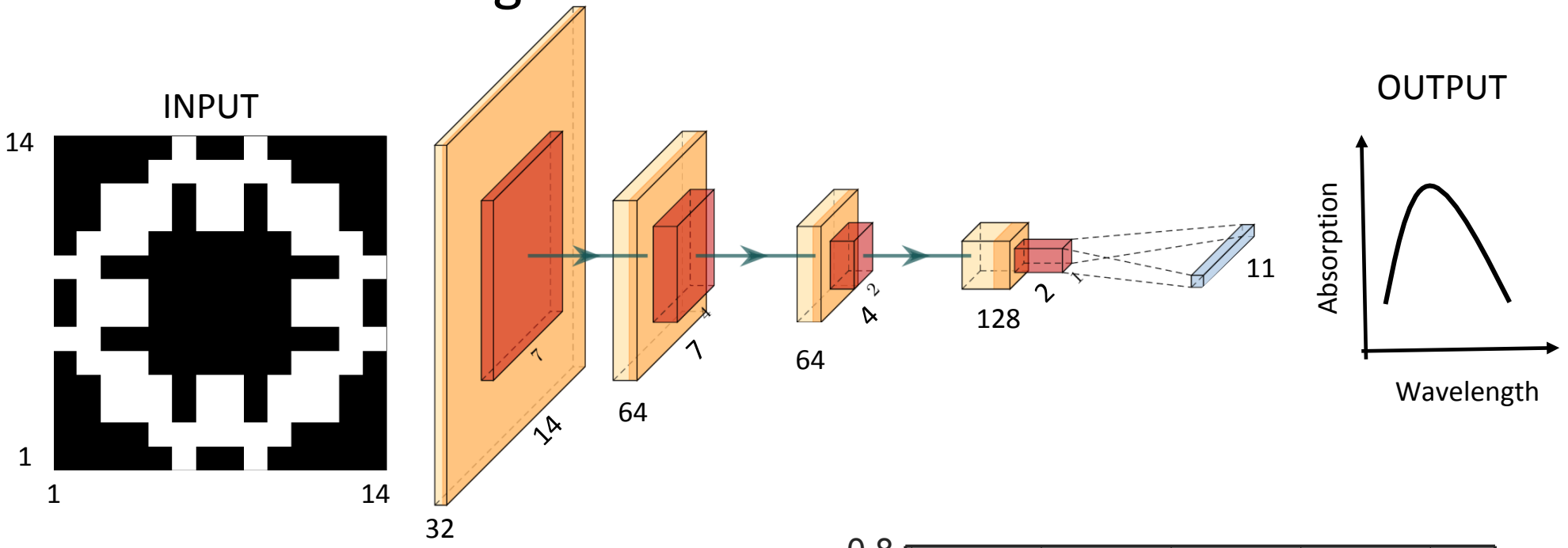


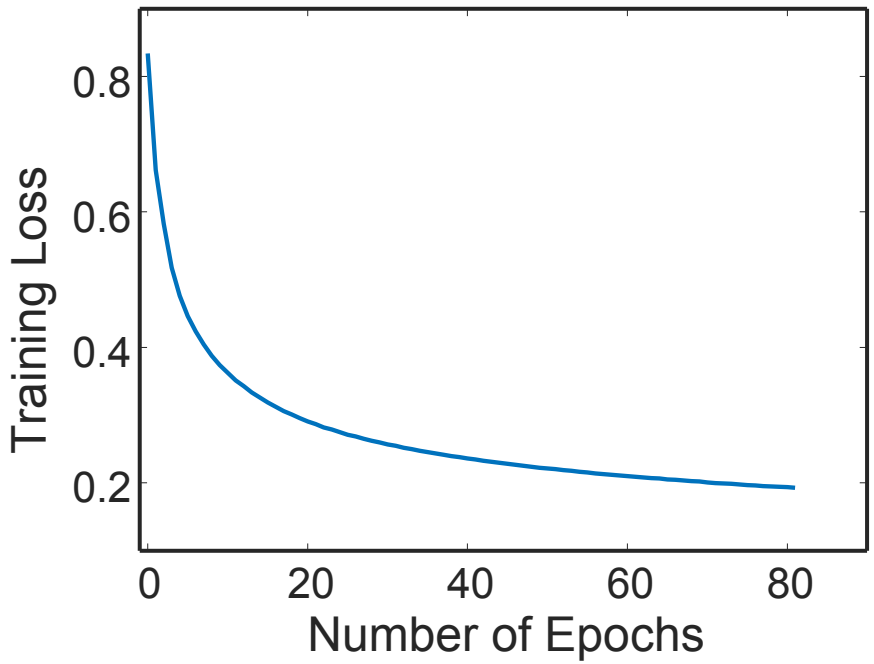


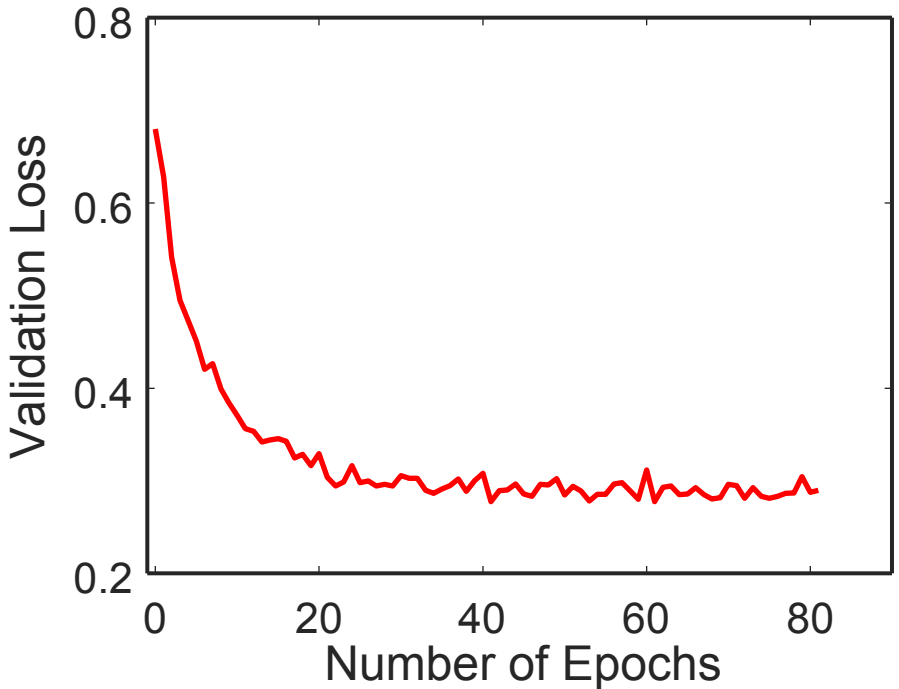




Prediction Using Convolutional Neural Networks







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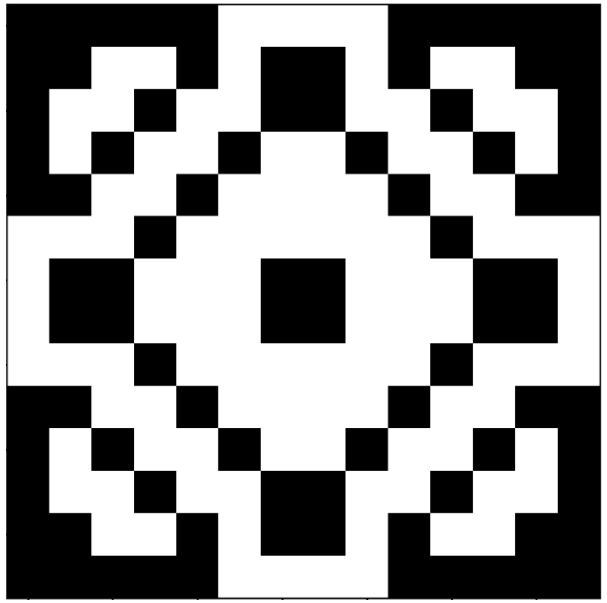

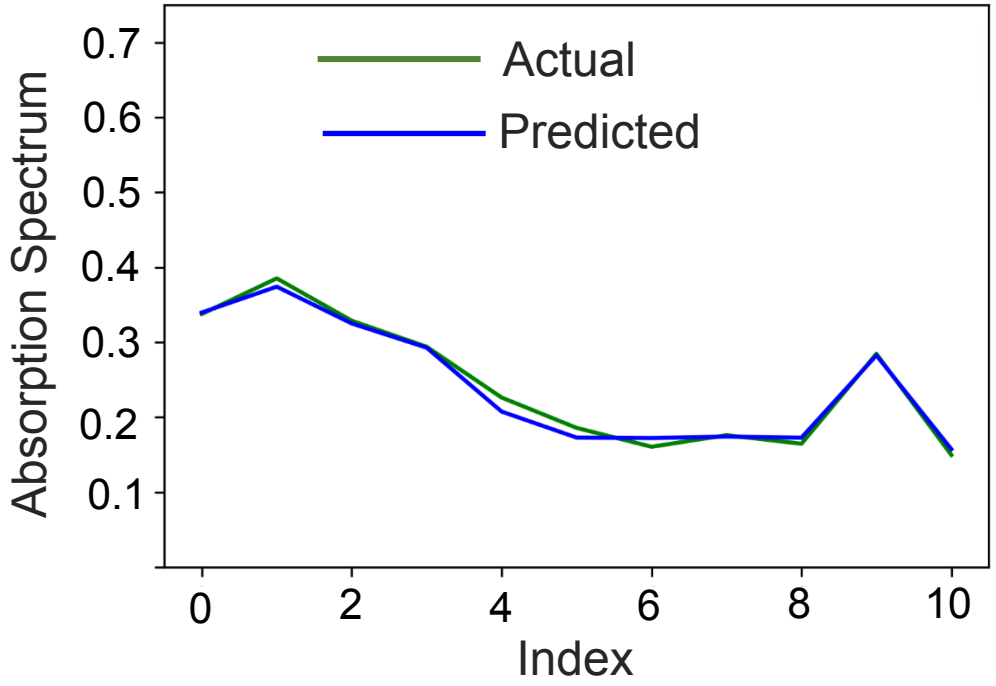

CNNs could accurately predict the absorption spectrum of metasurfaces not included in training data set.

Summary

- We used genetic algorithms (GAs) to optimize the absorption spectra of plasmonic metasurfaces.
  - The experimental results agree well with the GA optimization.

- Using a CNN, we were able to predict the spectra of metasurfaces not included in the training data set.

- The optimization of absorption using metasurfaces is our first step in designing high-efficiency hot electron detectors.