UNIVERSITY OF TARTU
Institute of Physics

Numerical analysis of light propagation in nanostructured black metal samples

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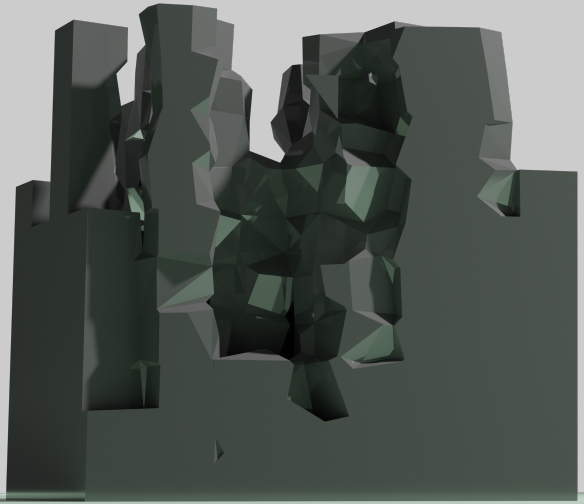
20.09.2025

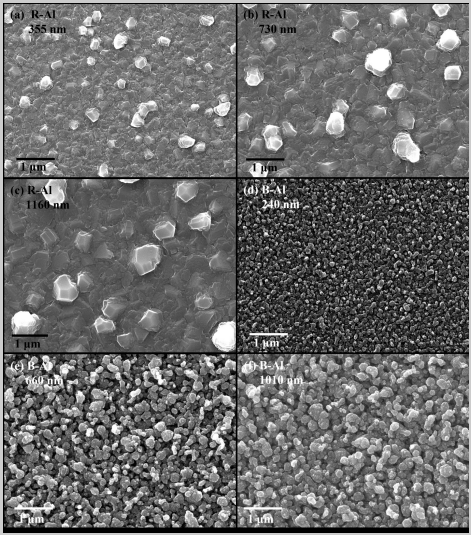
Overview

- Reflectivitiy of nanoporous aluminum films
  Langmuir **41**, 3832 (2025)
- Absorption in gold nanoparticles
  manuscript in preparation
- Resonances in gold nanoislands
  Nanoscale, **9**, 12014 (2017)

Nanoporous aluminum films (Black Aluminum)

Langmuir **41**, 3832 (2025)





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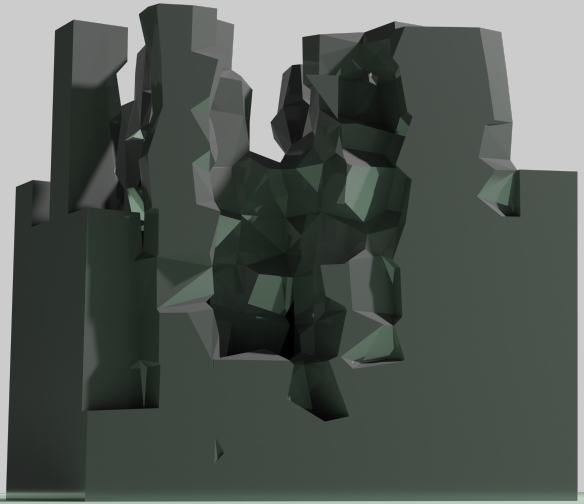

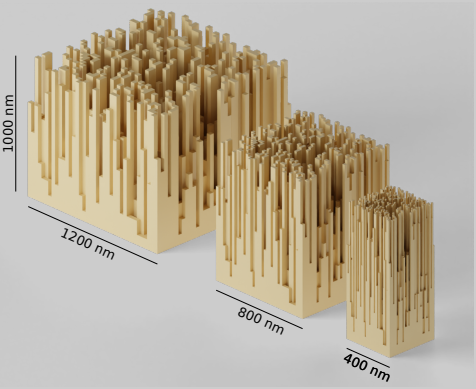

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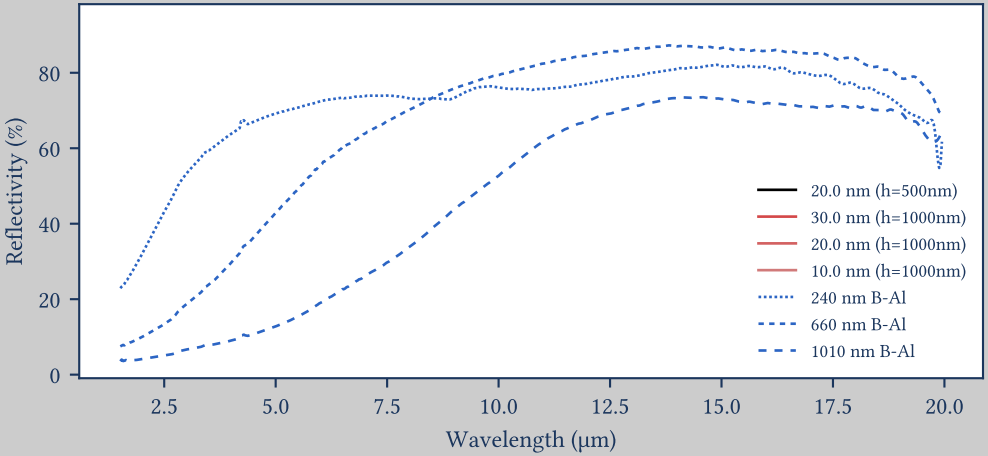

Nanoporous aluminum films (Black Aluminum)

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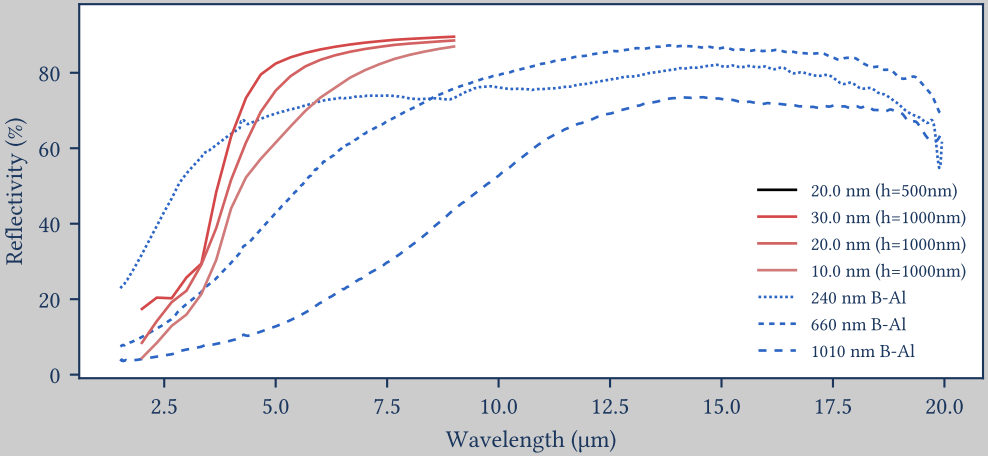

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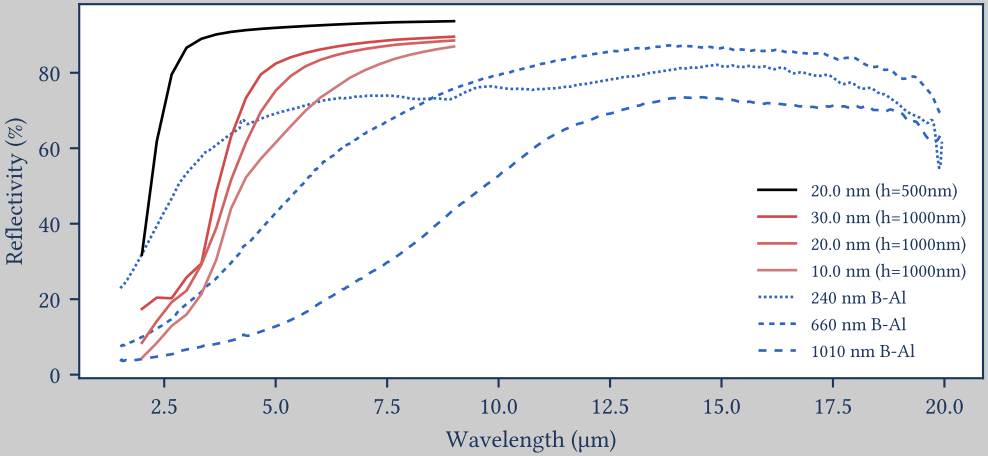
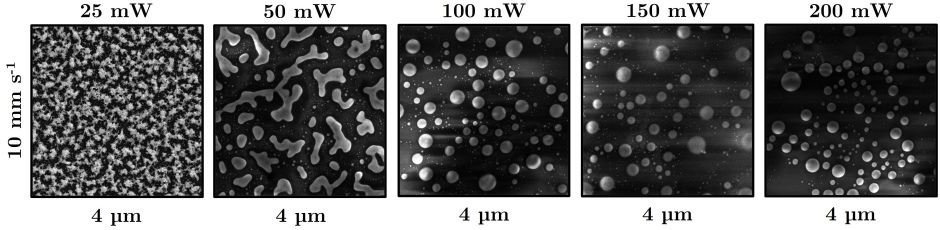
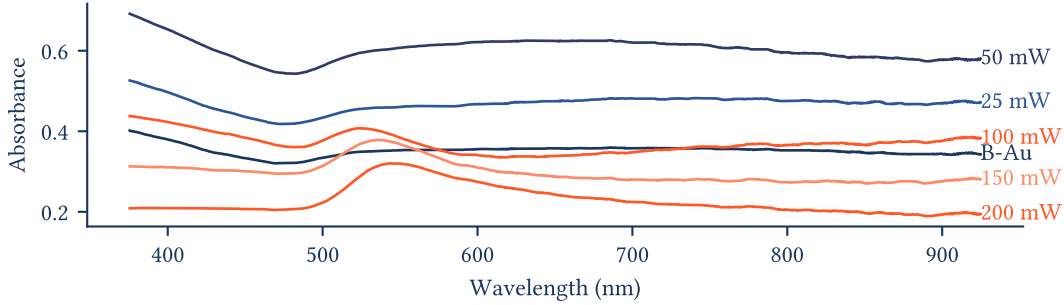


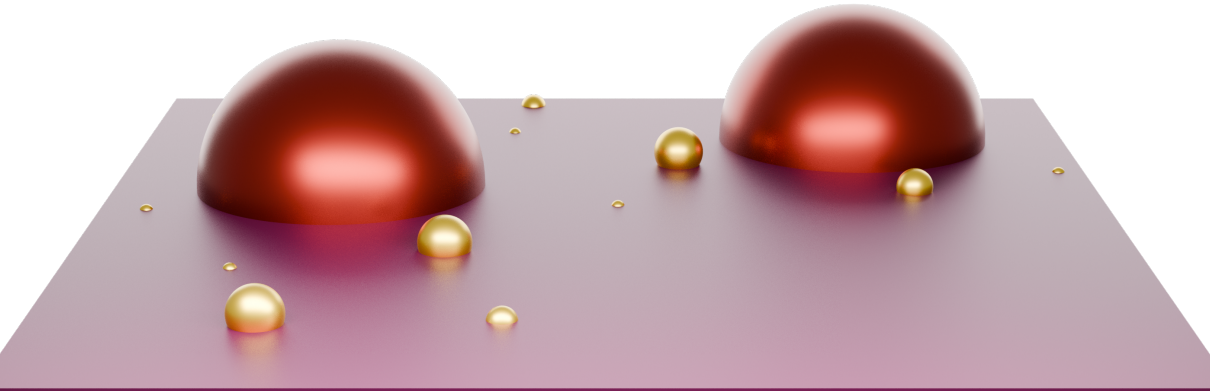
Nanoporous gold films + laser writing

manuscript in preparation

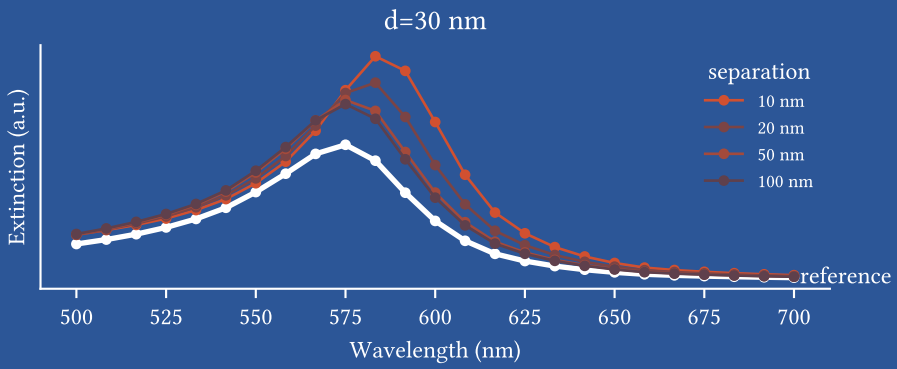




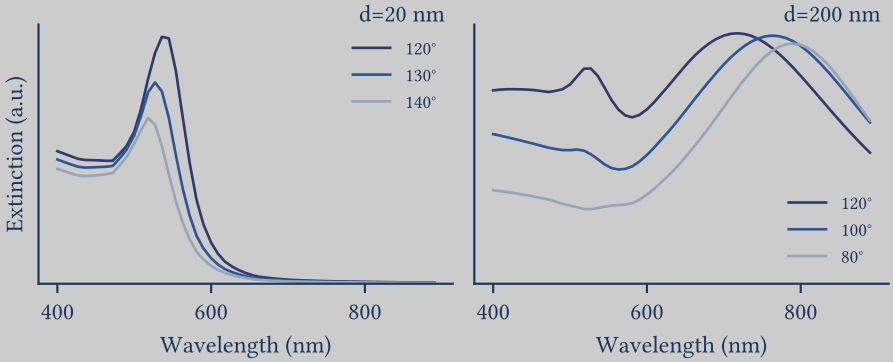
Simulation geometry



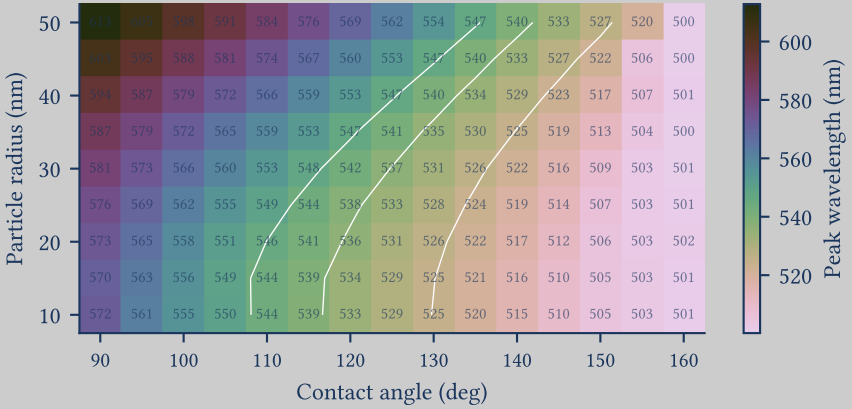
Interparticle coupling



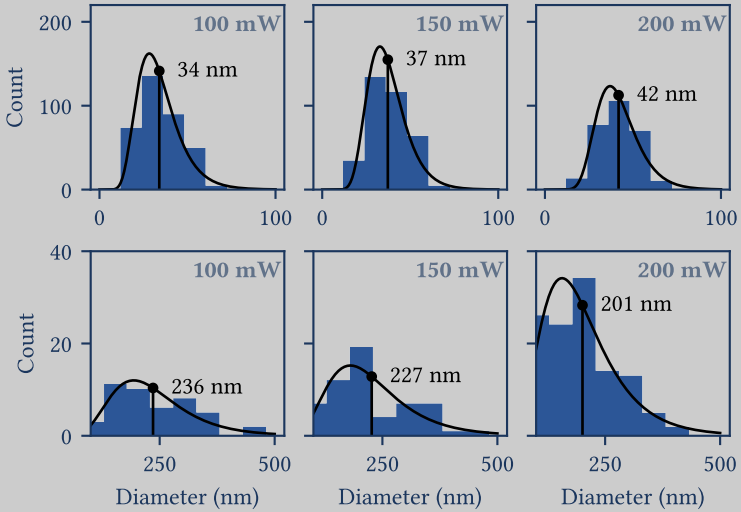
Calculated particle spectra



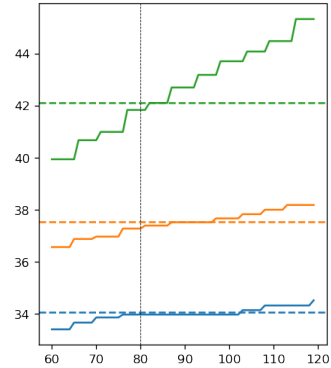
Calculated particle spectra

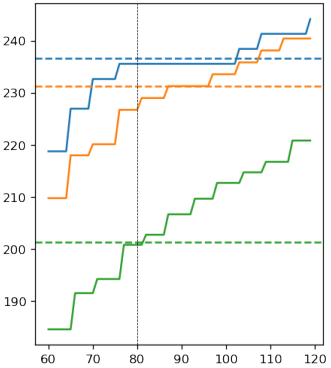


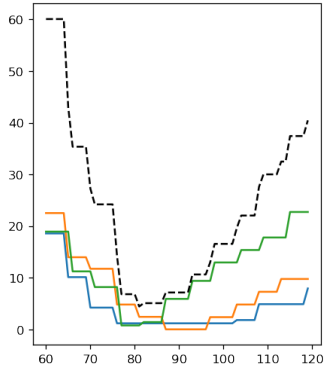
Measured particle size distribution



Particle size cutoff

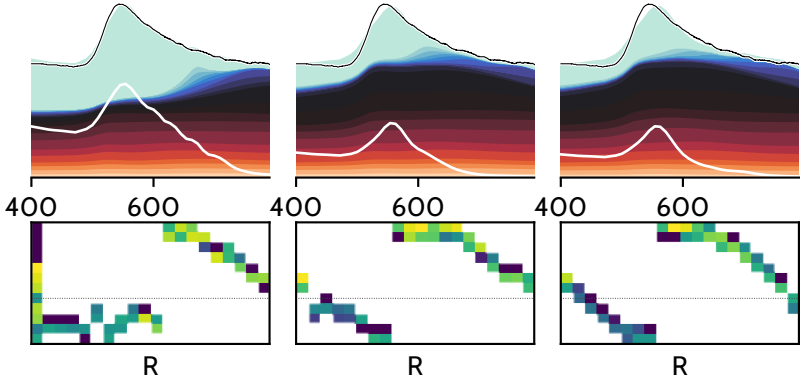




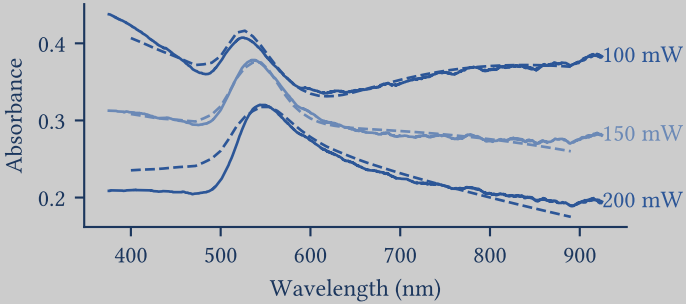


Obtaining contact angles

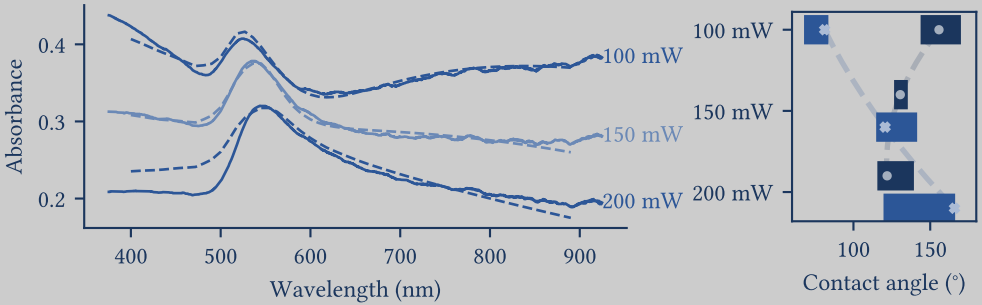
Least-squares fitting



Results


Absorbance
0.4
0.3
0.2
400
500
600
700
800
900
Wavelength (nm)
100 mW
150 mW
200 mW

Results


Absorbance
0.4
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400
500
600
700
800
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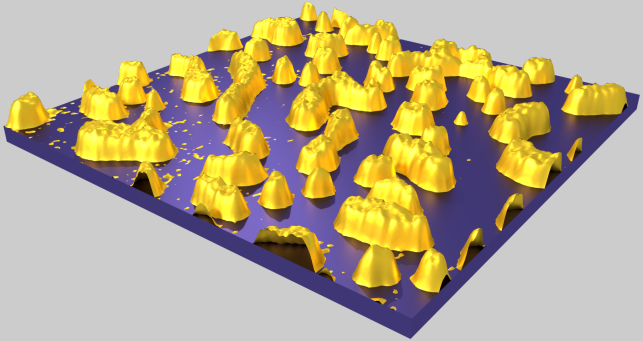
Wavelength (nm)
100 mW
150 mW
200 mW
100 mW
150 mW
200 mW
100
150
Contact angle (°)

Matching resonances of individual particles

Nanoscale, **9**, 12014 (2017)



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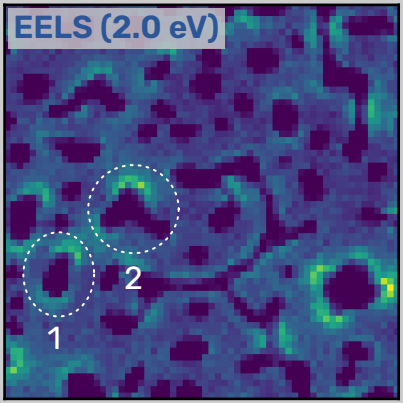

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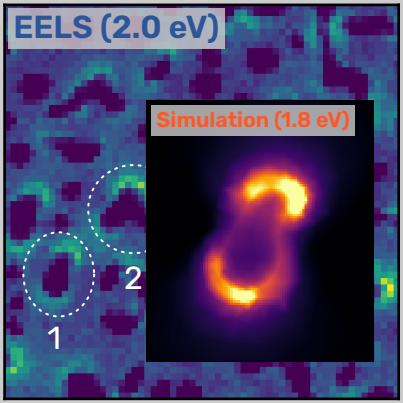
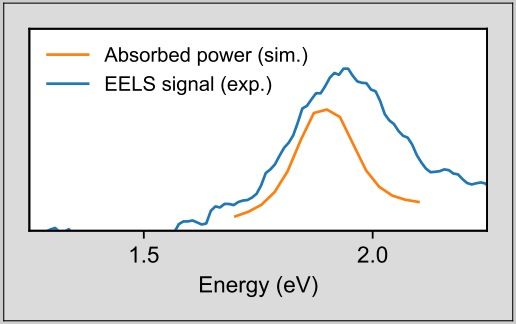
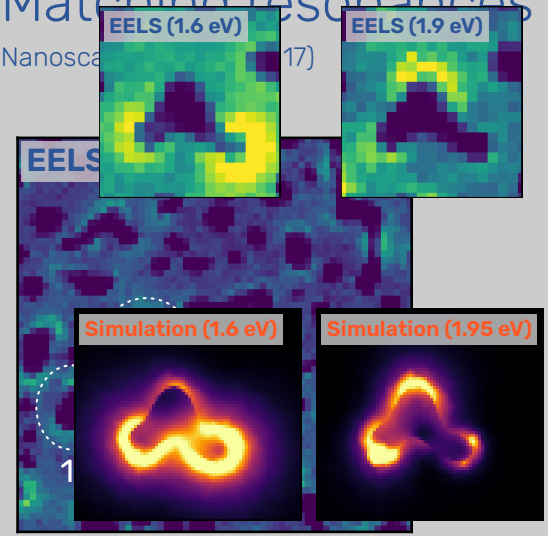
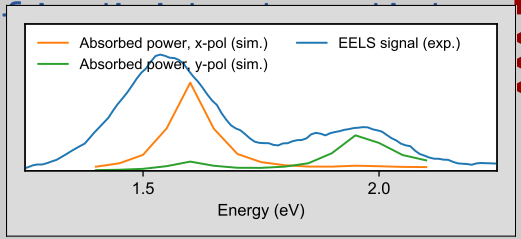




Matching resonances of

Nanosca 17)





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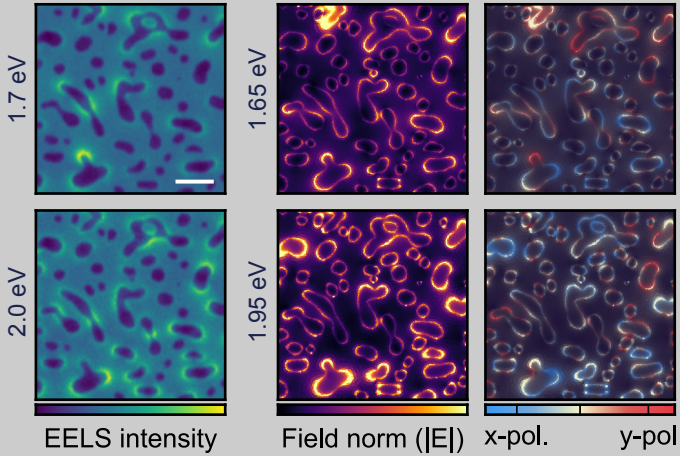

Summary

- COMSOL simulations of plasmonic particles (Al, Au)
- Augmenting experimental measurements with numerical analysis
  - B-Al: separate effect of sample size and roughness
  - B-Au: explore particle shape influence
  - Au nanoislands: verify polarization of plasmonic modes

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