

Experimental Chiral Plasmonics Using Quasi-Bound States in the Continuum

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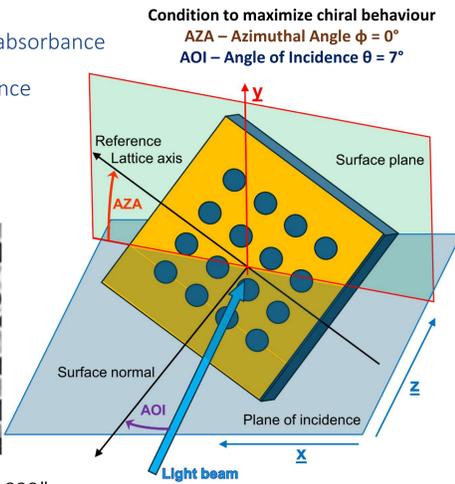
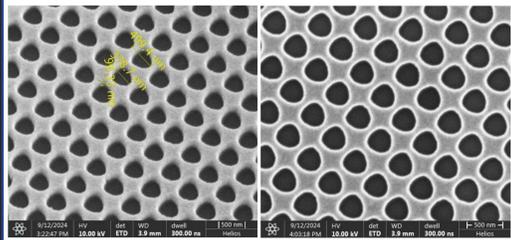
Definitions

This work reports the experimental characterization of the chiral optical response from a gold metasurface featuring asymmetric oval nanoholes, supporting both surface plasmon polariton (SPP) and quasi-Bound State in the Continuum (q-BIC) modes.

A_{left} - counterclockwise circularly polarized light absorbance

A_{right} - clockwise circularly polarized light absorbance

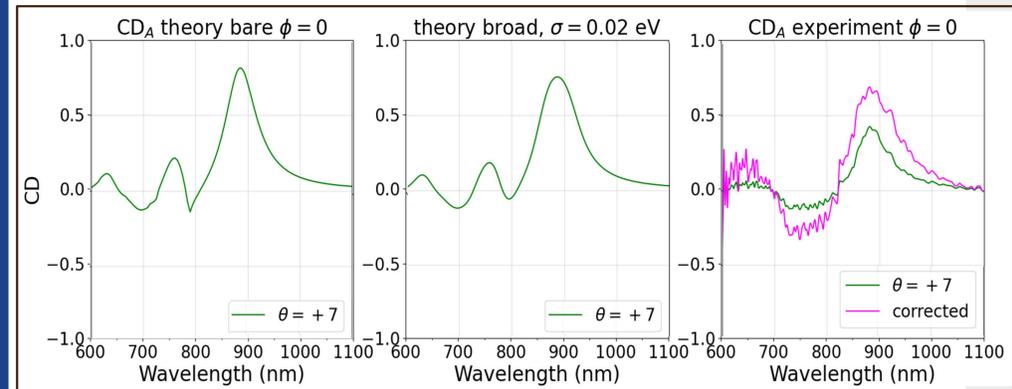
$$CD = \frac{A_{left} - A_{right}}{A_{left} + A_{right}}$$



Design based on "ACS Appl. Opt. Mater. 2024, 2, 825–833"

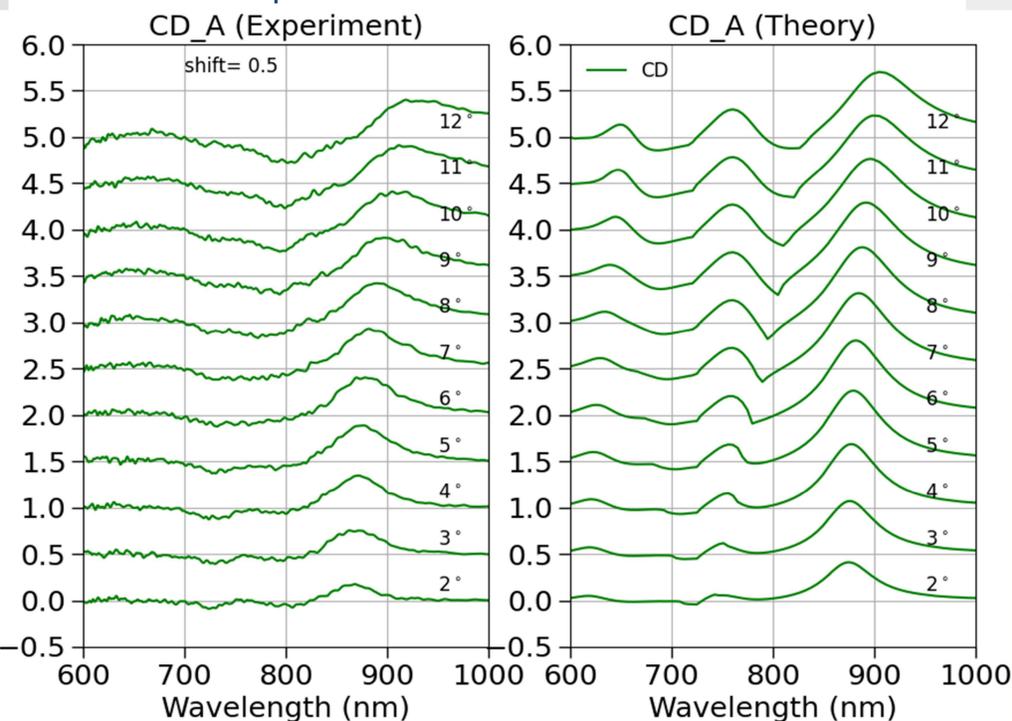
BICs are photonic states within the continuum spectrum that remain decoupled, theoretically offering infinite Q-factors. Symmetry breaking transforms these into q-BICs, maintaining narrow linewidths and high Q-factors while introducing chirality or topological properties. q-BICs are most often studied in dielectric systems, which are subject only to radiative loss. In this work we show that q-BICs with strong chiral properties appear also in metallic systems, despite the presence of nonradiative loss.

Circular Dichroism (CD) in Absorption

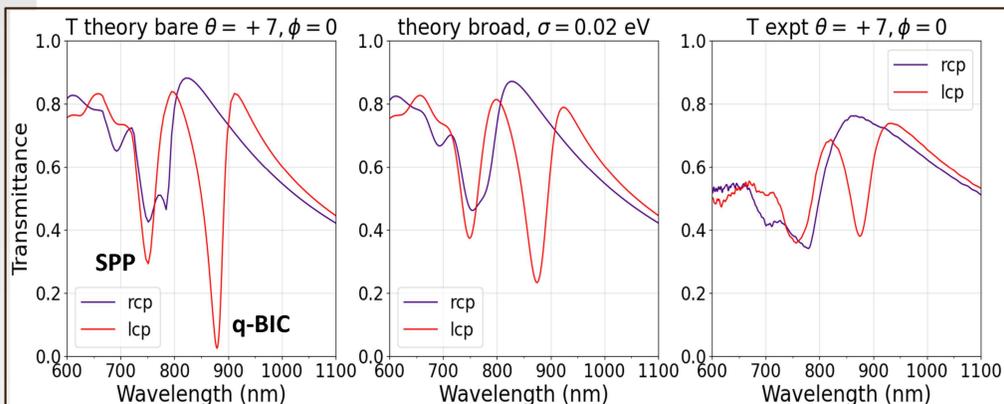


The BIC peak is strongly chiral, while the SPP peak is not.

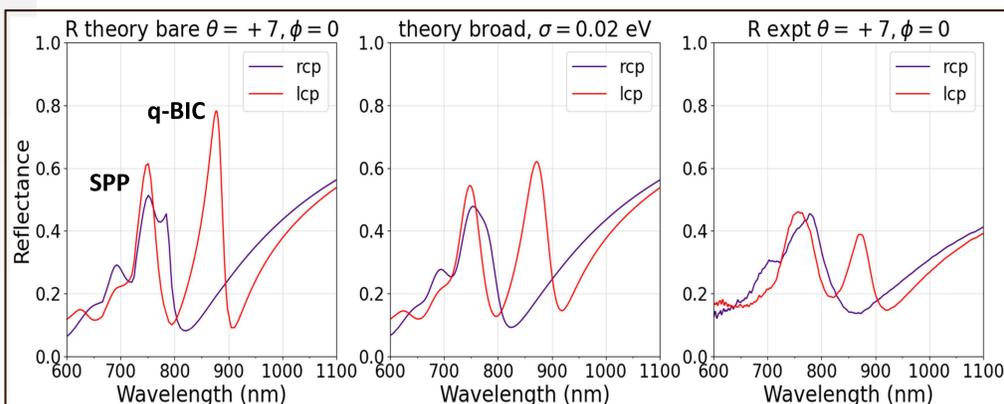
CD in Absorption from 2° to 12°



Transmittance

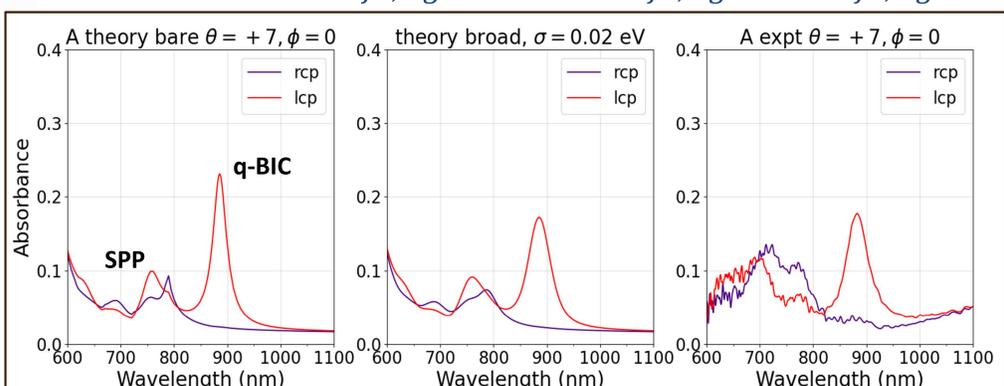


Reflectance

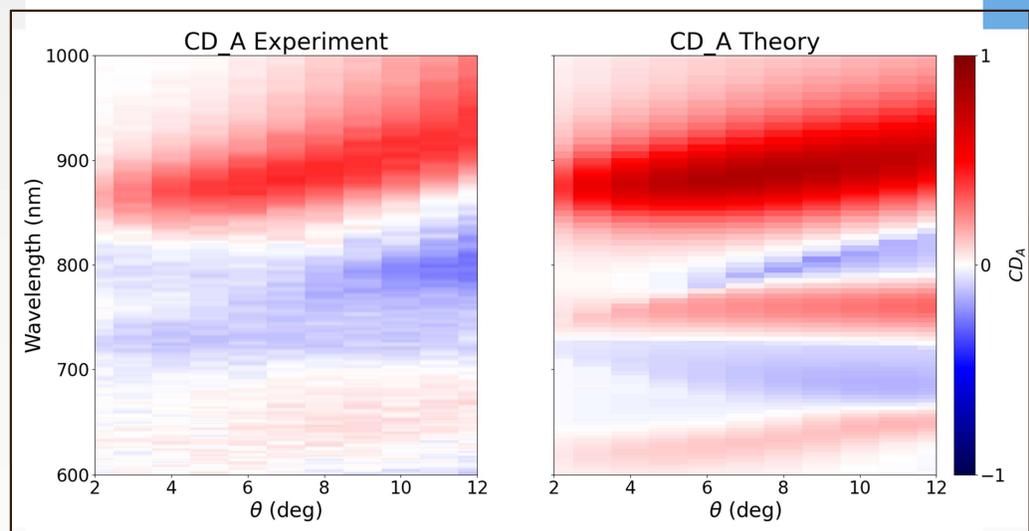


Both reflectance and transmittance show excellent agreement with theoretical predictions, demonstrating that these strongly coupled BICs, exhibit unambiguous chiral behaviour with a significant CD sign change.

Absorbance : $A_{left,right} = 1 - R_{left,right} - T_{left,right}$



Background noise (likely Rayleigh scattering) persists across all wavelengths, with interband transitions appearing below 700 nm. Subtracting the diffusion background significantly improves theoretical agreement.



Analysis reveals strong left circular polarization coupling (maximized at 7°) and a clear Fano line shape. The BIC mode shows significant chirality, directly contrasting the non-chiral SPP response.

Future Work

Measuring the topological properties of the q-BIC via Stokes parameters

Acknowledgments

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