Machine-Learning-Based Optimization of Chiral Photonic Metasurface: Evolution- and Neural-Network-Based Designs for Printing or Ablating

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Circularly polarized electromagnetic waves incident on a nanopatterned metasurface, such as produced in thin-film dielectrics or metallic sheets, can experience frequency-dependent filtering effects in reflection and/or transmission geometry. A chiral pattern in GaP optimized by a neural network shows an increased circular dichroism [1], which results in a stronger reflectivity of right circularly polarized waves and lower transmittivity of left circularly polarized waves compared to a simpler human-designed pattern (Fig. 1). Outcomes from the multi-epoch design optimization procedure – through an evolutionary algorithm and a deep-learning-style approach - are discussed for a frequency-range-neutral comparative consideration suitable for both (nano)printing or ablating of surface patterns.

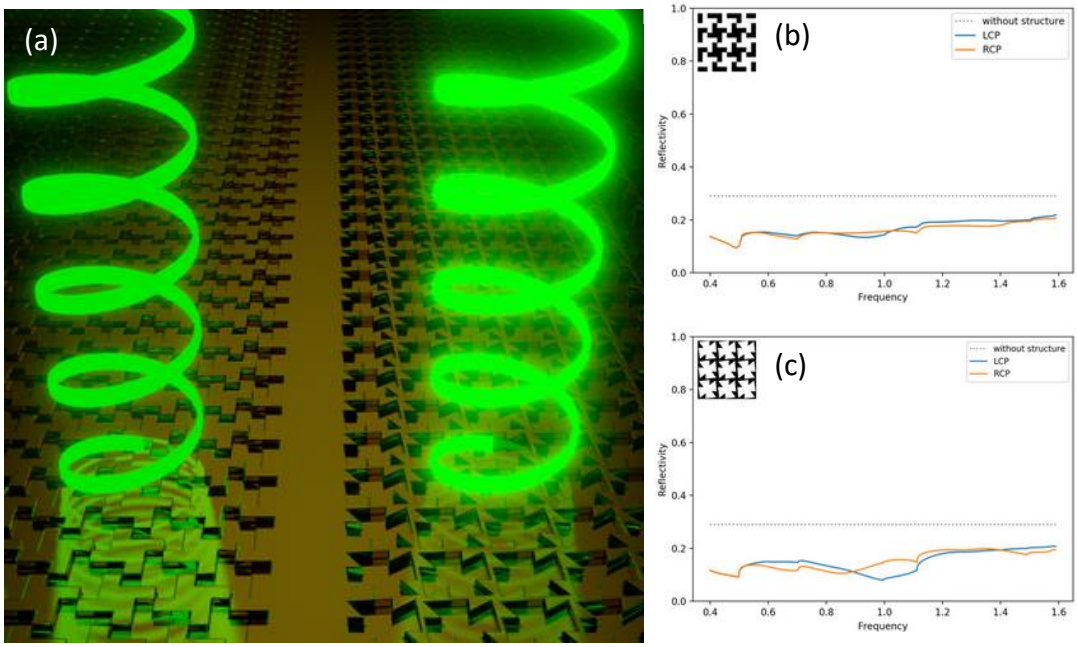

Figure: Artists' interpretation of two chiral photonic metasurfaces, © O. Mey and A. Rahimi-Iman, 2022 (a), and corresponding plots of simulated reflectivity over normalized frequency (b, c) for the two example structures (cf. insets), CC-BY-4.0 license, © The Authors, 2021 [1].

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References: [1] O. Mey and A. Rahimi-Iman; PSSRRL 202100571 (2021) https://doi.org/10.1002/pssr.202100571