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Epsilon-Near-Zero Metamaterial Geometry for Nonlinear Optical Generation ANNA SHELTON, MARIAMA DIAS, University of Richmond — Epsilon-near-zero (ENZ) thin films show promise in generating nonlinear optical phenomena, such as second and third harmonic generation, phase conjugation, and negative refraction, due to their ability to densely confine incident light energy in a thin film structure. However, ENZ materials on their own suffer from high coefficients of reflection. One method devised to increase coupling of incident light energy into ENZ thin films is the inclusion of metallic nanophotonic structures, allowing incident light to excite the localized surface plasmon polaritons (LSPP) of the metals and be more efficiently coupled into the ENZ thin film. In this work, we simulated four ENZ thin films, seven nanophotonic geometries, and three metals in Ansys Lumerical's FDTD to find an optimal combination of elements for maximizing energy density in the ENZ thin films. We found that optimal combinations resulted in surface energy density magnification of more than 300x the incident light energy density. This poses ENZ metamaterials as strong candidates for improving many fields of photonics, including solar cell technology and all-optical signal processing.

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