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Electromagnetic metamaterial platforms: Pioneering the interdisciplinary research

ABSTRACT

Periodic arrangements of artificially engineered structures with subwavelength scale dimensions are a promising frontier in interdisciplinary research involving physics, material science, engineering, biology, and chemistry. Such metamaterials in comparison to their bulk counterparts found in nature, are manufactured with original material designs which provide excellent flexibility, functionality, and tunability to efficiently enhance, control, and manipulate electromagnetic radiation. Various optical effects, ranging from optical nonlinearities to enhanced fluorescence and photoluminescence can be boosted by metamaterial platforms from various chemical compositions. Although metamaterials and their 2D planar equivalents, metasurfaces, can be used in a plethora of diverse emerging classical and quantum optical applications, their fabrication procedures often limit their use in industrial applications. In this talk, the manufacturing of three-dimensional hybrid metamaterial designs will be reported, and their optical responses will be discussed regarding size, geometry, and composition. The hypothesis-driven investigations combine results from theoretical simulations and experiments that cross-correlate chiral photonics, metamaterials, topological insulators, nonlinear Kerr effect, and plasmonics.



BIO

Dr. Kilic utilizes a systematic, theory-driven, application-oriented, experimental fabrication, characterization, and verification method as an approach for scientific research and discovery. He leverages advanced metamaterial platforms which have the unexplored potential to engineer extreme light-matter interaction at the nanoscale. Dr. Kilic received his B.Sc. degree in Physics (with honors and first rank in his class) from Yildiz Technical University, Istanbul-Turkey, and his M.Sc. degree in physics from Bogazici University, Istanbul-Turkey. He pursued his PhD in Electrical Engineering at the University of Nebraska-Lincoln (UNL) and graduated in 2021. He was a postdoctoral researcher working under the supervision of Professors Christos Argyropoulos, Eva Schubert, and Mathias Schubert at UNL. He has recently been appointed as Research Assistant Professor at the Electrical and Computer Engineering department at UNL. He has published over 15 technical papers in highly ranked journals and refereed conference proceedings, and over 50 other conference contributions. Dr. Kilic received multiple international awards and recognitions for his research studies, such as in 2019, he was the recipient of the Nobel Laureate John B. Fenn, Sr. Foundation Endowed Scholarship from the Society of Vacuum Coaters Foundation. In 2021, he was also selected as one of the postdoctoral fellows of the international networking event “Humboldt meets Leibniz: Emerging Topics in Optics and Photonics” which took place in Hannover, Germany under the slogan “Connecting Talents Across Generations”.

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