Controlled THz Generation by Nonlinear Metasurfaces

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Abstract

In the last couple of decades, there have been dramatic advances in the generation, manipulation, and detection capabilities of THz waves (0.1-10 THz). These advances forecast a variety of emerging desirable applications. However, despite the immense recent progress in THz technologies, there is still a substantial lack of simple methods to generate fully controlled THz waveforms. In my talk, I will present the recent advancements in the ability of nano-engineered plasmonic metasurfaces to generate broadband and highly controlled THz waves. I will elucidate the underlying physical mechanisms that make the THz emission from the metasurfaces comparable in strength to that emitted from orders of magnitude thicker nonlinear crystals, excited at the same conditions. I will also show that simple electromagnetic considerations allow to further enhance the THz radiation from the metasurfaces by more than an order of magnitude. In addition, I will demonstrate how to utilize the well-known Pancharatnam-Berry phase to obtain unprecedented spatio-temporal control over the amplitude, phase, and polarization of the emitted THz waves, opening the door for holographic THz emitters.

Short Biography

Prof. Ellenbogen is the Chair of The Department of Physical Electronics at Tel-Aviv University. He also heads the Laboratory for Nanoscale Electro-Optics. He holds a bachelor's degree in Physics and Computers, a Master's degree in Physics, and a PhD in Nonlinear Optics. He was a Fulbright Postdoctoral Fellow at the School of Engineering and Applied Sciences at Harvard University where he worked on nanoplasmonics and excitonics. In addition, he was a member of The Center for Excitonics in MIT. In 2012 he joined the Department of Physical Electronics at The Tel-Aviv University School of Electrical Engineering to establish The Laboratory for Nanoscale Electro Optics. Since then he received several career awards and competitive research grants for major research contributions to the field of linear and nonlinear metamaterials, including the Kadar Family Award for Outstanding Research, Schmidt Futures, Momentum fund, ERC-STG, and ERC-COG grants. His research interests include nanoscale light-matter interaction, nonlinear and ultrafast optics, and optical metamaterials.