

# THEODORE MAIMAN SEMINARS on physics 2019

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## Physics and applications of epsilon-near-zero materials

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11:30 h, Lecture Hall of Max Planck Institute of Quantum  
Optics

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In this talk, we describe some of the unusual optical properties of materials, known as epsilon-near-zero (ENZ) materials, for which the dielectric permittivity is very small. We describe some of the unusual geometrical optical properties of such materials and present theoretical predictions of how fundamental radiative properties are modified under such conditions. We also describe some of the nonlinear optical properties of these materials. Recent work has shown that optical materials can display an extremely large optical nonlinear response in their ENZ spectral region. We review this topic from the point of view of developing a conceptual understanding of why the nonlinear response is large under ENZ conditions and of exploring the implications of this work for applications in the field of photonics. In the work published in reference, we reported that indium tin oxide (ITO) has an ENZ wavelength of approximately 1240 nm. In this spectral region, the value of  $n_2$  is as much as 1000 times larger than its value in the visible spectral region. The unprecedentedly large value of  $n_2$  suggests that these materials will play a key role in the future development of applications in the field of photonics.