

Spectral reshaping of Photo-Luminescence with Metasurfaces

Koby Scheuer

School of EE, Department of Physical Electronics, Tel-Aviv University
<http://web.eng.tau.ac.il/~kobys/wp/>
E-mail: kobys@tauex.ac.il

Abstract

The properties of photo luminescence (PL) from direct bandgap semiconductor (SC) devices are determined by the type of the material and the epitaxial layer structure. However, the properties of the PL can be controlled by modifying the optical states available for the emitted photons. In the past several years, efforts have been made to develop methods for tailoring the PL from SC devices by coupling emitters (quantum wells and quantum dots) to metamaterials and metasurfaces. While the coupling of a quantum dot to nano-antenna or to a metamaterial is relatively well understood, the interaction of a quantum well is more complex. To date most studies in this field, rely on attempts to align the metamaterial/metasurface resonance to the peak of the PL emitted from the (un-patterned) SC material in order to enhance the emission. In this presentation, I will present a simple, semi-classical, model for describing the interaction of QW with metasurfaces, facilitating quantitative prediction of the modification in the PL intensity and spectral profile. The model predicts that the geometry of the metasurface exhibits substantial impact on the spectral enhancement and shape and that polarization effects play an important role in determining the modified emission. I will show the good agreement found between the theoretical prediction and our experimental results and discuss some of the potential applications.

Short Biography

Jacob Scheuer is the Bernard L. Schwartz Chair in Nano-Scale Information technology and a full professor at the school of Electrical Engineering, Tel-Aviv University. He received the B.Sc. degree (summa cum laude) in electrical engineering and in physics, and the Ph.D. degree in electrical engineering from the Technion-Israel Institute of Technology, Haifa, Israel, in 1993 and 2001, respectively. He was a Chief Designer with Lambda crossing-an optical component startup specializing in microring resonators for two years. Then, he joined the Center for the Physics of Information and the Department of Applied Physics, the California Institute of Technology, Pasadena, as a Research Associate. In 2006 he joined the School of Electrical Engineering, Tel-Aviv University. His main fields of research involve metasurfaces, plasmonics, integrated optics and telecommunications. Prof. Scheuer is the author or co-author of more than 220 scientific paper in peer-review journal, 4 book chapters, more than 140 papers in conference proceeding, and 12 patent applications. He is a Fellow of Optica (former Optical Society of America) and a fellow of the SPIE.

