"God made the bulk; Surfaces were invented by the devil."

Wolfgang Pauli

Università degli Studi di Brescia
Dipartimento di Ingegneria dell'Informazione, Sala Consiliare
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Optics at the NANOSCALE: An Attempt at a *Comprehensive* Analysis of *Superficial* Harmonic Generation

Dr Michael Scalora, US Army AMRDEC

We present a study of linear and nonlinear optical effects that occur when light interacts with metallic surfaces and generic structures with nanometer-scale features. Our model suggests that the nonlinear optical analysis of metals, conductive oxides, nano-antennas, meta-surfaces, etc. should be performed by including nonlocal effects (viscosity and pressure of free electrons); linear and nonlinear contributions of bound (inner-core) electrons to the dielectric constant; linear and nonlinear quantum tunneling currents if gaps between nanoparticles is on the nanometer and sub-nanometer scale; and conditions generally reflective of discontinuous free electron densities. We use a modified hydrodynamic model to evaluate harmonic generation from a gold mirror, where epsilon-near-zero conditions may be found and exploited, and from semiconductors like GaAs and GaP.

Short Bio

Dr Michael Scalora is a senior scientist at US Army AMRDEC, a component of RDECOM. His research is broad-based and has spanned a variety of subjects, from stimulated Raman scattering to the study of physical phenomena near the photonic band edge, from slow light, nonlinear frequency conversion, negative refraction and nonlinear optical at the nanoscale to the filamentation of Terawatt ultrashort light pulses in the atmosphere. He has published more than 250 peer reviewed articles, has authored a number of book chapters, overseen the work of a number of doctoral candidates; and holds 20 patents. He is a fellow of the OSA.