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Singularity-driven Second and Third Harmonic Generation in a ε-near-zero nanolayer

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(Submitted on 12 Jul 2011 (v1), last revised 7 Sep 2011 (this version, v2))

We show a new path to {\epsilon}~0 materials without resorting to metal-based metamaterial composites. A medium that can be modeled using Lorentz oscillators usually displays {\epsilon}=0 crossing points, e.g. {\epsilon}=0 at {\lambda}~7{\mu}m and 20{\mu}m for SiO2 and CaF2, respectively. We show that a Lorentz medium yields a singularity-driven enhancement of the electric field followed by dramatic lowering of thresholds for a plethora of nonlinear optical phenomena. We illustrate the remarkable enhancement of second and third harmonic generation in a layer of {\epsilon}~0 material 20nm thick, and discuss the role of nonlinear surface sources.

Subjects:	**Optics (physics.optics)**
Journal reference:	Physical Review A 84, 063826 (2011)
Cite as:	**arXiv:1107.2354 [physics.optics]**
	(or **arXiv:1107.2354v2 [physics.optics]** for this version)

Submission history

From: Antonella Vincenti [view email]
[v1] Tue, 12 Jul 2011 17:18:20 GMT (308kb)
[v2] Wed, 7 Sep 2011 17:37:07 GMT (495kb)

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