



Dr. Marco Liscidini

Postdoctoral Fellow
Department of Physics, University of Toronto
60 St. George street
Toronto, ON M5S 1A7 Canada
Phone (416)-9465858
liscidini@physcs.utoronto.ca



Abstract

Title: *Nonlinear optical properties of planar microcavities and 1D photonic crystals*

We present a theoretical study of second harmonic generation in one-dimensional photonic crystals and planar microcavities. This presentation will summarize the various mechanisms which lead to a high conversion efficiency in fully periodic photonic crystals or when a structural defect is introduced.

A possible route for increasing second harmonic generation is to embed the nonlinear source in a Fabry-Pérot cavity, which can be obtained by inserting a structural defect in a one-dimensional periodic system. In this case we observe an exponential scaling of second-harmonic signal with the number N of mirror periods, which is maximum when double resonance and phase matching conditions are simultaneously fulfilled.

In a one-dimensional periodic structure, a large enhancement in the second harmonic conversion efficiency can be obtained when resonant coupling of the pump and harmonic fields with photonic modes near the band-edges, as well as phase matching, are achieved. We demonstrate a conversion efficiency for frequency doubling which scales as the eighth power of the crystal length. This large scaling does not occur due to phase matching, and it can be explained in terms of field enhancement for the pump and harmonic frequencies at the band-edges, together with the concept of a self-adaptive coherence length. This result challenges a commonly held view regarding the necessity of phase matching for large efficiency scaling.

Biography

DR. LISCIDINI received the Ph.D. degree in physics from the University of Pavia in 2006 under the supervision of Prof. Lucio Claudio Andreani. His dissertation was on linear and nonlinear optical properties of planar microcavities and photonic crystal slabs. Since January he has been working as a postdoctoral fellow at the University of Toronto with Prof. John E. Sipe .

His research activity concerns the theory of linear and nonlinear optical properties of photonic crystal structures by means of numerical simulations. The main topics investigated involve the theoretical study of second-harmonic generation in doubly resonant microcavities and emission properties of photonic crystal slabs.