Abstract

Bistable Behavior of a Photonic Crystal Non-Linear Cavity

Jean Pol VIGNERON[¶] and Virginie LOUSSE

Laboratoire de Physique du Solide (LPS)
Facultés Universitaires Notre-Dame de la Paix
Rue de Bruxelles 61
B-5000 Namur
Belgium

jean-pol.vigneron@scf.fundp.ac.be

Received: Mon, 15 Apr 2002 11:07:03

A Fabry-Perot cavity can be closed with reflecting slabs made with different types of materials. An interesting situation occurs when the slabs are constructed from a photonic crystal in the non-propagating regime, i.e. with an incident frequency tuned to an evanescent mode. The situation is even more interesting when the cavity itself is filled with a non-linear Kerr medium, i.e. a material which changes its index of refraction with the transiting intensity. The response of this system to high-intensity incident waves falling normal to the interferometer is studied in detail. It is shown that (1) the photonic-crystal slabs are able to concentrate the energy density in the cavity so that non-linear effects are enhanced; (2) the index of refraction of the material which fills the cavity changes in a significant way as a function of the incident power; (3) in specific intensity ranges, the index of refraction in the cavity is multi-valued, leading to a bistable behaviour of the Fabry-Perot filter. The hysteresis cycle of the index of refraction, the transmission coefficient and reflection coefficient is described for a system using arsenic sulfide glass as a cavity-filling medium, and gallium arsenide - vacuum structure as photonic crystal slabs.

[¶]Presenter

Filename: Vigneron
Last document update: Wed Jul 10 08:15:31 MDT 2002