Applications of Photonic Crystals with Degenerate Spectral Band Edge

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BACKGROUND

In a vacuum, light propagates with a constant velocity, while in an optically transparent non-dispersive media, the speed of light propagation can be different. At optical frequencies, the refractive index of transparent materials usually does not exceed several units, and the speed of light propagation is of the same order of magnitude as the speed of light in vacuum.

The situation can change dramatically in strongly dispersive media. Although the phase velocity of light is still determined by the same mathematical expression, the speed of electromagnetic pulse propagation is now different and is determined by the group velocity which is one of the most important electromagnetic characteristics of the medium. With certain reservations, the group velocity coincides with the electromagnetic energy velocity and is usually referred to simply as the propagation speed of light in the medium.

Strong dispersion means that the group velocity strongly depends on the frequency. In the slow light case, the electromagnetic pulse propagates through the dispersive medium at a speed, regardless of the respective value of the phase velocity. In some cases, it can even turn virtually to zero, which implies that the electromagnetic wave at the respective frequency does not transfer the energy.

Slow and ultraslow light can have numerous and diverse practical applications. These phenomena can be associated with dramatic enhancement of nonlinear effects (higher harmonic generation, wave mixing, etc.), magnetic Faraday rotation, and many other important electromagnetic properties of the light-conducting medium. Such an enhancement can facilitate design of controllable optical delay lines, phase shifters, miniature and efficient optical amplifiers and lasers, etc. In addition, ultraslow light might allow nonlinear interactions down to a single photon level.

TECHNOLOGY DESCRIPTION

University researchers have developed a photonic crystal with specially designed geometry and composition capable of slowing down electromagnetic pulses, thereby enhancing the physical characteristics of non-linear and other active electromagnetic materials, as well as enhancing and reducing sizes of various electromagnetic devices.

APPLICATIONS

This invention could significantly benefit the design of ultrasensitive optical switches, quantum all-optical data storage and data processing devices. Ultraslow light can also be used for quantum communication and design of novel acousto-optical devices.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,538,211	09/17/2013	2005-400
United States Of America	Issued Patent	7,881,570	02/01/2011	2005-400

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OTHER INFORMATION

CATEGORIZED AS

- » **Materials & Chemicals**
  - » Other
- » **Sensors & Instrumentation**
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RELATED CASES

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