

# Cross-Polarized Wave Generation in a Nonlinear Hyperbolic Metamaterial

*Monday, 21 May 2018 18:00 (15 minutes)*

A generation of cross-polarized wave (XPW) in nonlinear hyperbolic metamaterials (NHMM), which are composed of periodic arrangement of gold (Au) and barium difluoride (BaF<sub>2</sub>) layers with subwavelength thickness for exhibiting anisotropy of permittivity and third-order nonlinearity, has been investigated numerically. This cubic nonlinear effect is described by degenerate four-wave mixing (DFWM) of three linearly polarized fields and one produced field, which has linear polarization in orthogonal direction. By managing the fill-factor value of the NHMM, the nearly phase-matched condition based on quasi-birefringent phase-matching (QBPM) technique are achieved implicitly. We found that the conversion efficiencies of XPW generation as a function of incident angle at various pumping intensities are maximized at optimal incident angle.

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**Session Classification:** A03: Optics and Photonics (Poster)

**Track Classification:** Optics, Non-linear optics, Laser Physics, Ultrafast Phenomena