SOLID HYDROGEN AS NONLINEAR OPTICAL MEDIUM

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Optical processes with quantum interference are opening various new possibilities beyond the limit of conventional optical processes. Typical examples would be ”lasing without population inversion” and ”resonantly enhanced nonlinear optics without resonant absorption”. The key physics of the processes is to establish a strongly-coupled dressed-state (typically, dark-state) as the eigen-state for Raman-driven three-level system. So far, it has been assumed that such processes can be realized only for low-density atomic systems. However, we show here that the ideal situation can be realized even in high-density solid medium using solid hydrogen. It is shown through the experiments of stimulated Raman scattering (SRS) that the strongly-coupled eigen-states are spontaneously evolved through the SRS process and in terms of the parametric anti-Stokes generation process the phase-matching is self-induced without stringent restriction of the medium. The present finding demonstrates its amazing potentiality of solid hydrogen as nonlinear optical medium, which may open a way to a new class of nonlinear-optics free from the restriction of the medium in wide wavelength range from infrared to vaccum-ultraviolet.