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All-Optical Modulation of Four Wave Mixing in a Rb-Filled Hollow-Core Photonic Band-Gap Fiber PABLO LONDERO, VIVEK VENKATARAMAN, AMAR BHAGWAT, AARON SLEPKOV, ALEXANDER GAETA, Cornell University — Hollow waveguides are capable of tightly confining vapors and light fields over large interaction lengths to generate exceptionally high nonlinearities that are highly sensitive to perturbations. We have previously shown that a Rb-filled hollow-core fiber can generate high optical depths resulting in four wave mixing (FWM) gains greater than 100 at microwatts of pump power. Here, we show that the introduction of a weak, resonant switching field perturbs the effective third-order susceptibility and produces a modulation of a weak probe undergoing FWM amplification on the D1 transition. Modulation is observed over the full FWM bandwidth of 100 MHz, which implies a system response time of 1.6 ns. We observe 3 dB attenuation of the output probe power with 650 nW of switching pump power. From these results, we extrapolate that switching occurs with 3600 photons and a switching energy density of 23 photons per atomic cross-section.

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