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Efficient Frequency Translation via Bragg Scattering in Rb-Filled Photonic Band-Gap Fibers[1] PRATHAMESH DONVALKAR, VIVEK VENKATARAMAN, STEPHANE CLEMMEN, KASTURI SAHA, ALEXANDER GAETA, School of Applied and Engineering Physics, Cornell University, NY-14853 — Bragg scattering via the nonlinear process of four-wave mixing is a promising approach to manipulate the frequency content of photonic quantum states. Here we report the first experimental demonstration of frequency translation from a signal to an idler wave at microwatt pump power levels in Rubidium vapor confined to hollow core photonic band gap fibers using Bragg scattering. Conversion at lower powers is facilitated by generating optical depths of around 100 in the fibers resulting in large nonlinear susceptibilities. We employ a four wave mixing scheme using the $5S_{1/2} \rightarrow 5D_{3/2}$ two-photon transition in ^{85}Rb. The continuous-wave pump beams are tuned to the D2 and D1 lines at 780 nm and 795 nm respectively. A weak signal beam tuned near the $5P_{3/2} \rightarrow 5D_{3/2}$ transition at 776 nm is translated to a wavelength of 761 nm, corresponding to the $5P_{1/2} \rightarrow 5D_{3/2}$ transition. Conversion of 12% for this 15-nm translation is achieved at pump powers as low as 40 μW, which is more than 3 orders of magnitude lower than previously reported for solid-state waveguides.

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Prathamesh Donvalkar
School of Applied and Engineering Physics, Cornell University, NY-14853

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