

Abstract Submitted  
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**Photon echo Measurement of Optical Decoherence in Er<sup>3+</sup>-doped Silicate Fiber**<sup>1</sup> ROGER M. MACFARLANE, YONGCHEN SUN, PETER B. SELLIN, RUFUS L. CONE, Physics Dept., Montana State University, Bozeman, MT 59717 — The dephasing time  $T_2$  ( $\Gamma_h = 1/\pi T_2$  is the homogeneous linewidth) of the  ${}^4I_{15/2} - {}^4I_{13/2}$  transition of Er<sup>3+</sup> in a silicate optical fiber was measured by two-pulse photon echoes vs. external magnetic field and temperature. A field of 2 T reduces the homogeneous linewidth by 1.8 MHz from its value of 3.2 MHz at zero field, an anomalously large reduction compared to that in oxide crystals with similar Er<sup>3+</sup> concentration. We propose that the dephasing is caused by two classes of low frequency tunneling modes: elastic “two-level-systems” (TLS) responsible for 1.4 MHz and coupled spin-elastic TLS modes for 1.8 MHz. The coupled modes acquire a magnetic character from an elastic Er<sup>3+</sup> spin-TLS interaction. The temperature dependence of the homogeneous linewidth is linear in the measured range of 1.4 to 4 K. Three-pulse photon echo decays measured from 0.5  $\mu$ s to 500  $\mu$ s and at a field of 5 T characterized spectral diffusion caused by the distribution of TLS tunneling rates. Our results suggest a potential for application of doped communication fibers in frequency selective optical processing, buffer memories and spatial-spectral holographic devices.

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