

1. **Research Title:** "Investigation of Guided Wave Nonlinear Processes for Infrared Frequency Conversion"
2. **Individual Sponsor:**  
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3. **Academic Area/Field and Education Level:** Physics, Electrical Engineering, Electro-Optics (MS or PhD level)
4. **Objectives:** Investigate the potential of nonlinear processes in guided wave structures, specifically waveguides and optical fibers. This includes Raman gain, parametric  $\chi^{(3)}$  processes like four wave mixing, and  $\chi^{(2)}$  OPO/OPA processes based on quasi-phasing (QPM). The goal is to develop innovative and versatile methods for generating output in the 2-5  $\mu\text{m}$  wavelength region and longer, using techniques that facilitate tuning and flexible pulse modulation. Coherent sources with these characteristics offer significant advantages for critical applications like infrared countermeasures, laser radar, and remote sensing.
5. **Description:** This project will explore, develop, and characterize guided wave structures and nonlinear processes for obtaining coherent output in the 2-5  $\mu\text{m}$  atmospheric transmission region. This technology enables us to take advantage of mature pump laser technology at shorter wavelengths, by converting it into the wavebands required by military applications. Approaches to be considered include four-wave mixing processes or Raman conversion in fibers or waveguides; and OPO/OPA processes in orientation-patterned semiconductor waveguides. Structures of interest include fluoride, chalcogenide, or other infrared-transmitting optical fibers; laser-inscribed waveguides; and waveguides fabricated in orientation-patterned semiconductors like gallium arsenide that exploit QPM.
6. **Research Classification/Restrictions:** This is a basic research project and is thus expected to be completely unclassified, although certain elements may be considered FOUO or subject to restriction under ITAR.
7. **Eligible Research Institutions:** Place an X in all that apply.  
 Universities (DAGSI)       AFIT (only)       USAFA