

## AIAD #11103

Research Opportunity (Both Faculty and Cadet)

### ORGANIZATION/PROJECT SPONSOR

Organization: U.S. Army Research Laboratory

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Location of Sponsoring Directorate or Division: Sensors and Electron Devices Directorate, Electro-Optics and Photonics Division, Adelphi, MD

### PROJECT

**Title:** Characterization of Solid-State High Energy Lasers

**Description:** This research program is focused on developing an understanding of the mechanisms that cause high energy solid-state lasers to operate at less than the theoretical limits for efficiency. There are a number of loss mechanisms in a laser cavity including upconversion. Cooperative upconversion in Er:YAG results in green luminescence when the material is pumped in the infrared. This process raises the threshold of Er:YAG lasers by reducing the energy in the cavity at the lasing wavelength. The rate of upconversion in Er:YAG has been measured at room temperature and at 80K, because lasers are being designed to work at both temperatures.  $Y_2O_3$ ,  $Sc_2O_3$ , and  $Lu_2O_3$  are other attractive host materials for which the upconversion process hasn't been quantified. Indirect evidence points to upconversion increasing at low temperature in Er:Y<sub>2</sub>O<sub>3</sub>, and decreasing at low temperature in Er:YAG. We would like to measure the upconversion rate in some other host materials, to compare with YAG, and to determine why the behavior is so different.

**ARL/Army Benefit:** The understanding of loss mechanisms in high energy lasers is critical to improving their optical and wall-plug efficiency. This in turn permits reductions in size, weight, and power requirements for their operation in the field for mobile Counter-Rockets, Artillery, and Mortars (C-RAM) applications.

**Background Required:** Background in optics, lasers, MATLAB, and LabWindows would be helpful, but not required.

**Security clearance required:** Secret/NAC for un-escorted access on post

**Capacity:** 1 per block

**Duration:** 3-9 weeks can be accommodated

**Block Preference:** All open