

**Opportunity Title:** High Power Solid-State Laser Science and Technologies

**Opportunity Reference Code:** ARL-C-SEDD-1346786070

**Organization** DEVCOM Army Research Laboratory

**Reference Code** ARL-C-SEDD-1346786070

**Description About the Research**

Research is being pursued on enabling technologies for high power solid-state lasers to meet the needs of the Army and the other armed services. These lasers are more rugged and compact than gas lasers, but are much harder to scale to sufficiently high powers while maintaining good beam quality. We are investigating technologies for power scalable gain media in Near- and Mid-IR along with advanced thermal management, and beam quality improvement. These include ceramic gain media, which are as good as single crystals in most regards, but are mechanically stronger, inherently engineerable, and can be scaled to larger sizes, if needed. We are pursuing the use of these materials and others at cryogenic temperatures, where key thermal and spectroscopic properties are much improved over those at room temperature. We are particularly interested in laser operation at wavelengths near 1.6 microns in Er-doped solids, since this wavelength range offers much improved eye safety, and where recent advances in diodes laser pumps offer the potential for greatly improved efficiency and reduced thermal distortion. Also of interest are so called 'low-phonon' laser materials which have high potential for efficient laser operation in the 3-5  $\mu\text{m}$  wavelength range. Other gain media of interest are fibers, which offer considerable beam quality and efficiency advantages, as well as better device integration, but require innovative designs to enable sufficient laser power scaling. We are also investigating special materials and laser architectures to promote heat removal from laser gain media and to further improve beam quality, beam correction and beam combining techniques based on stimulated light scattering (Brillouin and Raman).

Our laboratories have a range of laser and spectroscopic tools for these studies. These include numerous types of diode lasers and diode arrays, including fiber-coupled ones, for efficient pumping of bulk laser materials and fibers, and a range of laser cavity designs to test materials and thermal management approaches. We also have a host of state of the art spectrometers for absorption, emission and Raman spectroscopy, cryostats for both laser and spectroscopic studies as a function of temperature and a setup for measuring materials thermal conductivity in a wide range of temperatures.

**References**

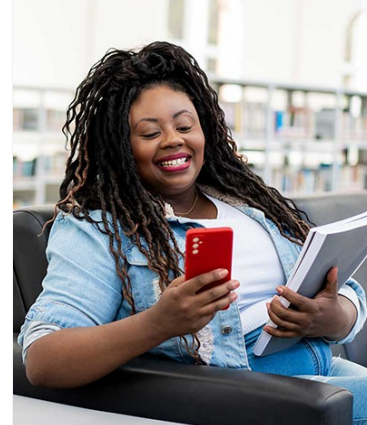
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**Keywords:** Laser materials, Solid-state laser, High power laser, Ceramics, Phase conjugation, Heat spreader, Eye safe, Fiber laser

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### **About SEDD**

The Sensors and Electron Devices Directorate (SEDD) is the Army's principal center for research and development in the exploration and exploitation of the electromagnetic spectrum, which includes radio frequency, microwave, millimeter-wave, infrared (IR), visible, and audio regions. SEDD is responsible for advances in laser sources, RF sources, IR sensors, signature detection and decoding, target imaging and its interpretation, fusion of data derived from several sensors, and electromagnetic protection.

In addition, SEDD is responsible for improving the technology base for electron devices and materials related to sensors and power devices. Research is conducted in related aspects of physics, electrical engineering, computer science, solid-state physics, chemical engineering, material sciences, and electrochemistry.

### **About ARL-RAP**

The [Army Research Laboratory Research Associateship Program](#) (ARL-RAP) is designed to significantly increase the involvement of creative and highly trained scientists and engineers from academia and industry in scientific and technical areas of interest and relevance to the Army. Scientists and Engineers at the CCDC Army Research Laboratory (ARL) help shape and execute the Army's program for meeting the challenge of developing technologies that will support Army forces in meeting future operational needs by pursuing scientific research and technological developments in diverse fields such as: applied mathematics, atmospheric characterization, simulation and human modeling, digital/optical signal processing, nanotechnology, material science and technology, multifunctional technology, combustion processes, propulsion and flight physics, communication and networking, and computational and information sciences.

### **A complete application includes:**

- **Curriculum Vitae or Resume**
- **Three References Forms**
  - An email with a link to the reference form will be available in Zintellect to the applicant upon completion of the on-line application. Please send this email to persons you have selected to complete a reference.
  - References should be from persons familiar with your educational and professional qualifications (include your thesis or dissertation

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advisor, if applicable)

- **Transcripts**

- Transcript verifying receipt of degree must be submitted with the application. Student/unofficial copy is acceptable

If selected by an advisor the participant will also be required to write a **research proposal** to submit to the ARL-RAP review panel for :

- Research topic should relate to a specific opportunity at ARL (see [Research Areas](#))
- The objective of the research topic should be clear and have a defined outcome
- Explain the direction you plan to pursue
- Include expected period for completing the study
- Include a brief background such as preparation and motivation for the research
- References of published efforts may be used to improve the proposal

A link to upload the proposal will be provided to the applicant once the advisor has made their selection.

**Questions about this opportunity?** Please email  
[ARLFellowship@orau.org](mailto:ARLFellowship@orau.org)

**Eligibility  
Requirements**

- **Degree:** Doctoral Degree.
- **Academic Level(s):** Any academic level.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** ([9](#) 👁)
  - **Engineering** ([15](#) 👁)
  - **Mathematics and Statistics** ([1](#) 👁)
  - **Physics** ([16](#) 👁)