REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHD-27-12

Assessing Material Performance Using Laser-Melt Dynamics and BRDF Characterization

PROJECT DESCRIPTION: High-energy laser systems are rapidly transitioning to the modern battlespace to deter and neutralize advanced threats. However, when these powerful beams strike a target, the intense energy doesn't just stop. It scatters, potentially creating collateral ocular hazards for friendly personnel. While standard reflections are predictable, high-energy strikes physically melt and deform the target in real time, creating a highly dynamic and unpredictable scatter profile.
For this project, we are looking for a driven participant to help solve this complex multiphysics challenge. As an ORISE participant, you will gain hands-on experience conducting high-energy material deformation experiments, analyzing dynamic Bidirectional Reflectance Distribution Function (BRDF) data, and running multiphysics engineering simulations to accurately model melt-pool and deformation physics. Your research will directly contribute to making next-generation laser engagements safer and more predictable. **Students from all disciplines and levels of experience are encouraged to apply, regardless of prior research experience.*

LEARNING OBJECTIVES: Under the guidance of a mentor, you will gain hands-on experience to complement your education and support your academic and professional goals. Along the way, you will engage in activities and research in several areas, including but not limited to:

1. Engage in advanced research and development (R&D) topics in laser-material deformation dynamics through participation in experimental data collection and contributions to multiphysics model development.
2. Advance applied research skills in a multidisciplinary environment that closely integrates experimental campaigns with computational engineering.

ACADEMIC LEVEL: Master's; Doctoral
DISCIPLINES NEEDED: Mechanical Engineering, Biomedical Engineering, Physics
RESEARCH LOCATION: JBSA Fort Sam Houston, Texas
RESEARCH MENTOR: Steven Cavazos, Ph.D.
Physics, University of Texas, San Antonio, 2024



Dr. Steven Jay Cavazos is a Research Physicist within the 711th Human Performance Wing, Optical Radiation Bioeffects Branch at Fort Sam Houston, TX. Leveraging his core expertise in computational multiphysics, his research focuses on bridging the gap between empirical data and predictive simulation to accurately model highly dynamic, time-dependent events. Dr. Cavazos currently directs a diverse portfolio of experimentally driven modeling initiatives. Furthermore, he serves as a formally appointed NATO representative, providing international subject matter expertise on laser safety and the mitigation of directed energy collateral effects.

The material was CLEARED on 19 Oct 2026; Case Number: AFRL-2026-1821
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