

# Department of Electrical and Computer Engineering



TEXAS TECH UNIVERSITY

Edward E. Whitacre Jr.  
College of Engineering

## Fall 2023 Seminar Series

**Seminar Title:** *Solid-State pulsed power research and development at the Lawrence Livermore National Laboratory*

**Time:** 2:00-2:50 PM, Friday, Nov 3, 2023

**Location:** Biology 101

### Speaker:

**Katherine Velas**

Lawrence Livermore National Laboratory

### Abstract:

The flexibility of solid-state pulsed power technology is highlighted by two applications in use and under development by the Lawrence Livermore National Laboratory (LLNL). In one application, linear induction cells driven by bipolar solid-state pulsed power have accelerated a kiloamp electron beam using active reset of the magnetic core material. Four 25 kV bipolar pulsers accelerated the Flash X-Ray (FXR) beam in double pulse mode, resetting the magnetic core between each pulse. The integration of the active reset system into a production facility enables continued development toward cinematographic radiography. In a second application, laser diodes are driven by a single pulsed driver that contains the energy storage, drive circuitry, and arbitrary waveform control necessary to tailor the optical output of an individual diode stack. The laser diodes are used to pump rep-rated petawatt laser systems that produce and study high energy density plasmas and materials found in extreme environments such as the interior of stars and fusion reactors, providing the fundamental understanding needed for applications ranging from astronomy to fusion energy. An introduction to LLNL and an overview of these two solid-state-pulsed-power technologies will be presented.

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### Speaker Bio:

Dr. Katherine Velas has B.S. in Applied Physics from Columbia University and Ph.D. in Aeronautics and Astronautics, Plasma Physics from the University of Washington. She has worked in magnetic confinement fusion, accelerator physics, high-energy density plasma physics, plasma propulsion, solid-state pulsed power, and rep-rated petawatt laser systems. She joined LLNL in 2018 as an applied physicist and pulsed power electrical engineer supporting research and development of solid-state pulsed power modulators driving linear induction accelerators for advanced radiography, and then becoming circuit simulations lead for ASD/Scorpius. Since 2022, Katherine has been leading the Power Conditioning electrical engineering team for the Advanced Photon Technologies Program within NIF & Photon Science where they are designing and building rep-rated Petawatt laser systems and researching next-generation laser architectures.



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