Nuclear Engineering and Radiological Sciences

Colloquium Winter 2017

Magnetically driven implosions for nuclear fusion, radiation source development, laboratory astrophysics, and high-pressure material properties

Ryan McBride, Ph.D.

Associate Professor of Nuclear Engineering and Radiological Sciences

University of Michigan

Magnetically driven implosions, utilizing large pulsed-power generators like the Z machine at Sandia National Laboratories and smaller generators like the Michigan Accelerator for Inductive Z-pinch Experiments (MAIZE), are an efficient means for assembling high-energy-density matter. High-energy-density matter is defined as matter at more than 1 million atmospheres of pressure (>1 Mbar). In many cases, we can compress and heat matter to more than 1 billion atmospheres of pressure (>1 Gbar) and more than 10 million °K (>1 keV). These are pressures relevant to the interior of stars and gas giant planets. We can also use these experimental systems to create matter at conditions similar to the conditions found in accretion discs surrounding black holes and in the photospheres of white dwarf stars. The properties and dynamics of matter in these regimes are still largely unexplored. In this talk, I will give an overview of how we use pulsed-power-driven techniques to generate this matter. I will also discuss several relevant applications, including inertial confinement fusion (ICF), radiation physics, radiation effects science, laboratory astrophysics, and material properties. Finally, I will discuss some of the research activities presently underway at Sandia National Laboratories as well as here at UM in the Plasma, Pulsed Power, and Microwave Laboratory.

In August of 2016, Ryan McBride joined the faculty of the University of Michigan as an associate professor in Nuclear Engineering & Radiological Sciences. His primary research interests are in nuclear fusion, radiation generation, pulsed-power technology, plasma diagnostics, and the dynamics of magnetically driven, cylindrically imploding systems. This research is conducted using the Michigan Accelerator for Inductive Z-pinch Experiments (MAIZE), which is a 1-MA pulsed-power machine residing in the Plasma, Pulsed-Power, and Microwave Laboratory at UM. Prior to joining UM, Professor McBride was with Sandia National Laboratories in Albuquerque, NM (from November 2008 to August 2016), where he held appointments as both a staff physicist and a department manager. At Sandia, Dr. McBride conducted research in nuclear fusion, radiation generation, and high-pressure material properties experiments using the Z pulsed-power facility (the world's most powerful pulsed-power device). Most recently, Dr. McBride's research has been focused on both theoretical and experimental studies of an exciting new concept called Magnetized Liner Inertial Fusion (MagLIF). MagLIF is one of the United States' three mainline approaches to studying controlled inertial confinement fusion in the laboratory. Dr. McBride received his PhD from Cornell University in 2009, where he studied magnetically driven implosions using the 1-MA COBRA pulsed-power facility.

MICHIGAN ENGINEERING
UNIVERSITY OF MICHIGAN

Friday,
March 17, 2017
4pm-5pm

White Auditorium, Cooley Building

Refreshments served at 3:45pm