CSU PHYSICS COLLOQUIUM

“Big Energy from Tiny Waves – Plasma Wakefield Accelerator Research at FACET-II”

Professor Michael Litos
University of Colorado Boulder
Monday October 4th at 4:00pm
120 Engineering (Hammond Auditorium)

Abstract

Plasma-based particle accelerators offer an opportunity to significantly reduce the size and cost of high-energy particle beams for applications ranging from ultrafast electron diffraction, to X-ray free electron lasers, to high-energy particle colliders. These applications in turn serve users in a variety of research fields by permitting access to ultrafast dynamics at atomic scales, or even fundamental particle interactions. Plasma wakefield accelerators (PWFAs) can sustain accelerating electric fields that are orders of magnitude greater than conventional metallic accelerating structures due in part to the fact that the plasma medium cannot itself be destroyed by the fields, in contrast to metallic structures. Researchers have shown that PWFAs can provide the promised large rates of acceleration to electron bunches, and the next great challenge for the field is to is to preserve the quality (i.e. emittance) of the accelerated bunches. This will be achieved by utilizing the plasma source itself to precisely focus the electron bunches into the PWFA, matching the natural divergence of the electron beam to the strong focusing force experienced in the plasma. Experiments planned at the currently-commissioning FACET-II facility at SLAC National Accelerator Laboratory aim to accomplish this alongside other tangential research goals utilizing relativistic particle beams and plasmas.

Biography

Mike earned his Ph.D. in experimental particle physics in 2010 from Boston University where he did experimental research in nucleon decay and neutrino oscillations as a member of the Super-Kamiokande and T2K collaborations. He earned 1/1337th of a Breakthrough Prize for his work in T2K. Mike switched fields to study plasma wakefield acceleration as a postdoc and later a staff scientist at SLAC National Accelerator Laboratory where he worked at the FACET facility from 2010-2016. There, he helped lead experiments that demonstrated the first high-energy, high-efficiency plasma wakefield accelerator, and was first author on the resulting paper that featured on the cover of Nature. Mike became an assistant professor at the University of Colorado Boulder in 2016 as a member of the Center for Integrated Plasma Studies, of which he is currently the associate director. His current research focuses on plasma source and diagnostic development in his campus laser lab, as well as larger scale collaborative research at SLAC. He is a leader and collaborator on a number of experiments planned for the FACET-II facility which is currently undergoing commissioning. In 2020 he received an NSF Early Career Award to support research into ion channel lasers at FACET-II.