



Wednesday
January 30, 2019
3:30 pm
Room 1005 EECS

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Laser Wakefield Driven X-ray Sources in Canada: A Brilliant Future for Agriculture and Global Food Security

There is need for stand-alone systems for screening plants and seeds at production sites. I will discuss development of high throughput X-ray phase contrast plant imaging and screening using LWFA-based X-ray sources (30 keV-80 keV). This effort is an initiative led by the Global Institute for Food Security at the U of Saskatchewan to establish the correlation between the phenotypic expression of a plant and its adaptation to biotic and abiotic environmental stress. Intense hard X-ray beams (5-50 μ J/shot at 40 keV) are generated by maintaining the laser beam ultra-relativistic self-guiding over long gas jet (cm). I will describe experiments with our new laser facility (up to 7 J in 18 fs at 2.5Hz) and discuss empirical scaling laws correlating the X-ray photon number to the laser and gas jet parameters. High throughput X-ray phase contrast imaging and 3D tomography were realized with average X-ray power (40 keV) of 10 μ W-50 μ W. We demonstrated seeing very small transparent objects embedded in inhomogeneous and anisotropic thick environment (including soil). Our scaling indicates that with a 1 PW laser a 40 keV X-ray beam with a 1 mJ per shot can be produced and that 1 Gray/shot dose could be achieved in a bio-system.

About the Speaker: Jean Claude Kieffer is Professor at INRS since 1990 and fellow of the Royal Society of Canada. He was Director of the INRS-EMT Center 2006 to 2011, and was the Canada Research Chair (Tier I) in ultrafast photonics from 2002 to 2016. He established in 2002 the Advanced Laser Light Source (ALLS) facility in Varennes (Qc), a Canadian National infrastructure. He is currently a member of the board of the Canadian Synchrotron and Science & Technology senior advisor for laser and optics for the President (M. Alain Rousset) of the Aquitaine Region Council (France). He is Vice President of the board of the Aquitaine technology transfer platform Alphanov (France). His research interests include plasma physics, ultrafast lasers, high intensity laser-matter interaction, particle acceleration and ultrafast x-ray sources and their societal applications. He manages the 600 TW short pulse laser (10J, 18fs) facility at INRS in Varennes. He is exploring the propagation of intense lasers in air for i) energy and wave guiding for homeland security and ii) remote environmental monitoring. He is also developing intense X-ray sources for Global Food Security.