



Colloquium

Harnessing Plasmas for Extreme Photonics and Quantum Optics

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Date: 2026/03/31 (Tue)

Venue: S4-625

Time: 14:00

Abstract :

Plasmas can endure laser intensities far beyond what conventional optical materials can withstand, making them an attractive medium for advancing high-intensity laser technologies and exploring novel applications in quantum optics. In this talk, I will discuss my recent research on plasma-based laser amplification, including Raman compression techniques designed to achieve next-generation laser intensities. Building on this foundation, I explore the use of dynamic plasmas for frequency upconversion, a promising approach for generating ultra-intense x-rays and studying collective effects in QED pair plasmas. In collaboration with SLAC's FACET team, we have identified cost-effective methods for investigating QED plasma phenomena, relying on the interaction of relativistic electron beams with laser drivers rather than requiring extraordinarily powerful lasers.

Beyond these classical applications, I will highlight emerging opportunities at the intersection of plasmas and quantum optics, where plasma-based processes show potential for producing quantum states of light, such as polarization-entangled photons and squeezed states, at intensities surpassing those achievable with traditional nonlinear crystals. By demonstrating plasma's remarkable capacity to transform light-matter interactions, this research opens exciting frontiers in quantum and laser physics, promising revolutionary approaches to manipulating light in a broad spectrum.