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Atomes et Molécules

Unité Mixte de Recherche 8523 CNRS – Université de Lille

## PhLAM RESEARCH SEMINAR SERIES

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## Pierre GLORIEUX Amphitheater, CERLA Building

# Fundamental Principles and Applications of Seeded Free-Electron Lasers

by


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In this seminar, we will review the principles and some key applications of externally seeded free-electron lasers (FELs), which deliver high-power, fully coherent, ultrafast pulses with variable polarization in the extreme ultraviolet (XUV) and soft X-ray ranges. Seeded FELs support a wide array of scientific experiments by enabling precise control over pulse characteristics. As an example, we will discuss the case of the FERMI FEL facility in Trieste, Italy, highlighting some of the advanced configurations developed there. These include setups for achieving shorter wavelengths, generating phase-locked pulses, and producing structured radiation with tunable orbital and spin angular momenta—capabilities essential for time-resolved studies across various research areas. The seminar will also address the benefits of fully coherent pulses, strategies for their generation and diagnosis, and the requirements for experiments using pulse shaping and coherent control. Additionally, we will consider future directions, including quantum coherence and the potential to generate FEL pulses with sub-Poissonian statistics.