Title: **Bright ultrafast X-ray generation from multi-stage hybrid wakefield accelerators**

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Abstract:

The objective of this doctoral thesis is to investigate, through theoretical, numerical, and experimental studies, the optimal configuration of density-tailored laser-plasma hybrid wakefield accelerators for the generation of bright ultrafast X-rays driven by relativistic electron beams produced in such accelerators. The doctoral student will:
1. prepare, perform, and analyze multi-dimensional particle-in-cell (PIC) simulations of advanced targets with tailored density profiles in order to improve electron beam properties, such as increasing the electron phase-space density, and thereby enhance the performance of the resulting X-ray beam;
2. develop analytical models describing the behavior observed in the PIC simulations;
3. prepare and carry out experiments using the petawatt-class laser systems at ELI Beamlines, as well as other laser systems abroad, to develop and commission advanced bright X-ray sources, and to verify the principles established through theoretical and numerical studies.
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