Generation of ultra-short light pulses with Accelerators

Project title:	Generation of ultra-short light pulses with Accelerators
PRISMAS Research Area:	Accelerator Science
Supervisor:	Francesca Curbis
Hosting University:	Lund University
Partners:	
Link to position:	Apply here

1. Project summary:

The project aims to generate, develop and study future concepts in the generation of ultra-short pulses in linac based sources. A number of different techniques have already been proposed, involving very strong electron pulse compression, Free Electron Laser (FEL) based techniques or a combination of compression and FEL schemes. The proposed project will start by exploring the capabilities in current accelerator and FEL systems. With focus on electron beam pulse compression and how the beam properties can be retained and requirements on suitable diagnostics. From this, new concepts for even shorter pulses, 100s of attoseconds, using FEL techniques will be studied and developed.

2. Keywords

Accelerator physics, Free Electron Lasers, attosecond pulses, beam diagnostics,

3. Project outline

- **State of the art:**

Several FEL facilties in the world are studying how to produce shorter pulses with different techniques. They want to address a user need to perform experiments with sub-femtosecond pulses and going into the limit of attosecond durations. The peculiar configuration of the bunch compressors at the MAX IV linac is of particular interest for new proposed facilities and might show that the FEL can reach better performances with this scheme.

- **Project objectives:**

In the first phase of the project, the MAX IV linac will be a crucial system to study very strong compression. The transverse deflecting cavity (TDC) diagnostics system, soon to be commissioned, will give capabilities to study the compressed electron bunches with high temporal resolution. The studies will be supported by simulations. The second phase of the project can preferably include measurements and studies of concepts at operating FEL facilities, such as FERMI@Elettra or FLASH at DESY. The methods developed here will both improve the operation capabilities at MAX IV, and advance the field of attosecond pulse generation.
Measurements at MAX IV can be carried out during accelerator beamtime, spread over the 4 years period. The PhD student will however benefit of being part of the accelerator development group at MAX IV giving insight in other accelerator research present at the laboratory.

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Link to PRISMAS overview: https://www.maxiv.lu.se/prismas/