



Contribution ID: 54

Type: **Invited Oral**

First SASE and Seeded FEL Lasing based on a beam driven wakefield accelerator

Monday, 7 November 2022 11:40 (30 minutes)

The breakthrough provided by plasma-based accelerators enabled unprecedented accelerating fields by boosting electron beams to GeV energies within few cm. This enables the realization of table-top accelerators able to drive a Free-Electron Laser (FEL), a formidable tool to investigate matter at sub-atomic level by generating X-UV coherent light pulses with fs and sub-fs durations.

So far, short wavelength FELs had to rely on the use of conventional large-size radio-frequency (RF) accelerators due to the limited accelerating fields provided by such a technology. Here we report the experimental evidence of a FEL driven by a compact plasma-based accelerator. The accelerated beams are characterized in the six-dimensional phase-space and have a quality comparable with state-of-the-art accelerators. This allowed the observation of amplified SASE radiation in the infrared range with typical pulse energy exponential growth, reaching tens of nJ over six consecutive undulators.

On the basis of these first amplification results starting from spontaneous emission (SASE), we upgraded the setup by seeding the amplifier with an external laser. Compared to SASE, the seeded FEL pulses are characterized by a higher pulse energy, two orders of magnitude larger (up to about 1 uJ) and an enhanced reproducibility (up to about 90%) resulting in a higher shot-to-shot stability.

Acknowledgments

Primary author: BIAGIONI, Angelo (INFN)

Co-authors: Dr ANANIA, Maria Pia (inf); Dr BELLAVEGLIA, Marco (inf); Prof. CHIADRONI, Enrica (Sapienza University of Rome); Prof. CIANCHI, Alessandro (Tor Vergat University of Rome); Dr COSTA, gemma (inf); Dr CRINCOLI, Lucio (inf); DELGIORNO, Martina (inf); Dr GALLETTI, Mario (Tor vergata University); Dr GIANNESI, Luca (inf); Dr ANNA, gribono (inf); VALERIO, lollo (inf); Prof. ANDREA, mostacci (inf); PELLEGRINI, donato (inf); Dr DI PIRRO, Giampiero (inf); Dr POMPILI, Riccardo (inf); Dr ROMEO, stefano (inf); Dr SHPAKOV, vladimir (inf); Dr VACCAREZZA, cristina (inf); Dr VILLA, fabio (inf); Prof. ARIE, zigler (3Hebrew University of Jerusalem); Dr FERRARIO, Massimo (inf)

Presenter: BIAGIONI, Angelo (INFN)

Session Classification: Plenary

Track Classification: Plenary Sessions: Invited Talks