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Carlo Maria Lazzarini

Research experience

My interests are ultrashort high-power lasers and laser pulse diagnostics, laser-driven electron acceleration, plasma diagnostics, high-resolution optical imaging, nanoparticle resonances, interaction of ultrashort laser with nano-structured targets. I am working at ELI Beamlines as Junior Researcher where I developed and I am responsible for the ALFA Beamline, an unique high repetition rate source of relativistic electrons driven by 1 kHz laser. I have also worked in different laser and optics laboratories and performed advanced training on ultrafast lasers and diagnostics. The main laser systems I have worked with are: Vulcan laser (RAL, UK), 10 TW Amplitude (IFPILM, Poland), L3-HAPLS (ELI), L1-Allegria (ELI), PALS laser (Prague,CZ), Astrella COHERENT laser (ELI), J-KAREN-P PW (QST, Japan), single-cycle kHz laser at University of Maryland (US), the BELLA PW laser at Berkeley (US) and the PW-class ALEPH laser at Colorado State University (US). I also have experience in Clean Room, nano-fabrication techniques and electronic imaging (SEM,TEM).

Education

- 2020-now Czech Tech University, Faculty of Nuclear Sciences and Physics Engineering. PhD program in "Quantum Technology" (expected in 2024).
- 2022 University of Maryland, US. Visiting Researcher in prof. Milchberg group, under the Czech Academy of Science mobility program.
- 2016 Imperial College London, UK. Visiting Researcher in prof. Giannini group.
- 2014 University of Pisa, Italy. Master Degree in Applied Physics.
- 2013 Scuola Normale Superiore, Pisa, Italy. Thesis work at NEST Laboratories.
- 2012 Ludwig-Maximilians-Universität, Munich. Erasmus exchange for one year.
- 2011 University of Pisa, Italy. Bachelor Degree in Physics.

Work experience

- 2015-now ELI-Beamlines, Czech Republic. Junior Researcher.
- 2018-2019 ELI-Beamlines, Czech Republic. Supervision of bachelor students.
- 2009 Italian Science Festival, Genova. Scientific tour guide.

Awards

- 2008 Italian Physical Society (SIF). Studentship winner based on test.

Trainings and Experiences

- 2018 IT-ELLI Training on "Focusing and Beam Propagation" at CLF,UK
- 2018 IT-ELLI Training on "Ultrafast Laser Pulses" at Szeged University, Hungary
- 2017 IT-ELLI Training on "Ultrashort Laser Metrology" at PYLA, Bordeaux, France
- 2013 PhD+ class on Technology Transfer by University of Pisa, Italy.



Main publications and patents

- 2024 **C.M.Lazzarini** et al. "Ultrarelativistic electron beams accelerated by a terawatt scalable kHz laser", accepted at Physics of Plasma. <https://doi.org/10.48550/arXiv.2302.11415>
- 2024 L. M. Railing, M. S. Le, **C. M. Lazzarini**, and H. M. Milchberg, "Loss-free shaping of few-cycle terawatt laser pulses", vol.49, 6, 1433-1436. <https://doi.org/10.1364/OL.516590>
- 2024 E.A. Vishnyakov et al., "Metrology for sub-Rayleigh-length target positioning in 10^{22} W/cm² laser-plasma experiments", accepted at High Power Laser Science and Engineering. doi:10.1017/hpl.2024.11
- 2021 P. Valenta, G.M. Grittani, **C.M. Lazzarini**, O. Klimo, and S.V. Bulanov, "On the electromagnetic-electron rings originating from the interaction of high-power short-pulse laser and underdense plasma", Physics of Plasmas, 28(12):122104.
- 2019 P. Valenta et al., "Polarity reversal of wakefields driven by ultrashort pulse laser", Phys. Rev. E 102, 053216.
- 2020 S. Lorenz et al., "Tomographic reconstruction algorithms for structured gas density profiles of the targets for laser wakefield acceleration", OSA, paper JM3A.33.
- 2019 O.G. Olkhovskaya et al., "Plasma channel formation in the knife-like focus of laser beam", J. of Appl. Phys. 86, 905860307.
- 2019 **C.M.Lazzarini** et al., "Electron acceleration at ELI-Beamlines: towards high-energy and high-repetition rate accelerators", Int. J. of Mod. Phys. A 34, 34, 1943010.
- 2019 S. Lorenz et al., "Characterization of supersonic and subsonic gas targets for laser wakefield electron acceleration experiments", Matter Radiat. Extremes 4, 015401.
- 2018 T.Levato et al., "HELL: High-Energy Electrons by Laser Light, a User-Oriented Experimental Platform at ELI Beamlines", Appl. Sci. 8(9).
- 2017 **C.M.Lazzarini** et al., "Linear ultrafast dynamics of plasmon and magnetic resonances in nanoparticles", Phys. Rev. B 96, 235407.
- 2017 **(patent WO2017211331A1)** "Device and method for high dose per pulse radiotherapy with real time imaging".
- 2012 M.Travagliati et al., "Interaction-free, automatic, on-chip fluid routing by surface acoustic waves" Lab Chip, 12, 2621-2624.

Main conferences and workshops

- 2023 SPIE Conference, Prague, Czech Republic. **Invited Talk** on "50 MeV electron beams from a scalable kHz laser".
- 2023 The Laser and Plasma Accelerator Workshop (LPAW23), Lagos, Portugal. Talk on "50 MeV electron beams from a scalable kHz laser".
- 2022 20th Advanced Accelerator Concepts Workshop (AAC2022), Long Island, US. Talk on "kHz Laser-Driven Electron Beams up to 50 MeV at ELI-Beamlines".
- 2020 ELI-Beamlines User Conference, Panel 10 "Laser Wakefield Acceleration in Near Critical Density Plasmas at High Repetition Rate". Organizer and Moderator.
- 2019 RIKEN research Lab, Tokyo, Japan. **Invited Seminar** on Experimental activity at ELI-Beamlines.
- 2019 Workshop on "Beam Acceleration in Crystals and Nanostructures", FermiLab, US. **Invited talk** on "Electron Acceleration at ELI-Beamlines: recent developments towards high-energy and high-repetition-rate accelerators".
- 2018 PLASMONICA 2018 workshop, Cetraro, Italy. Poster on "Ultrafast dynamics of plasmon and magnetic resonances in nanoparticles".
- 2017 HEDS Conference, Pacifico Yokohama, Japan. **Invited talk (on behalf)** on "High energy electron accelerator platform at ELI-Beamlines, ultrastable pointing investigations"
- 2016 HEPTech workshop organized by CERN, Romania. Participation.

Personal and technical skills

- Matlab, Mathematica, Zeemax, VirtualLab, Microsoft Project, Inventor (basic).
- Nano-processing in clean room, optical and electron microscopy.
- First aid lifeguard certificate (2007), "Società Italia Salvamento", Genova, Italy.
- Piano playing and "Teoria musicale e solfeggio" exam (music theory), Istituto Superiore di Studi Musicali "G.Lettimi", Rimini, Italy.