

# Europass Curriculum Vitae



## Personal information

Surname(s) / First name(s)

title

## Current position

## Languages

Mother tongue(s)

Self-assessment  
European level<sup>(\*)</sup>

English

French

## Main scientific interests

**Labate / Luca Umberto**

Dr. (PhD)

**Office:** Istituto Nazionale di Ottica, Consiglio Nazionale delle Ricerche (CNR),  
CNR Research Area, via Moruzzi 1 - 56124 Pisa, Italy

Senior researcher at Istituto Nazionale di Ottica, Consiglio Nazionale delle Ricerche (CNR), Pisa, Italy

## Italian

Understanding		Speaking		Writing
Listening	Reading	Spoken interaction	Spoken production	
C1 Proficient user	C2 Proficient user	C1 Proficient user	C2 Proficient user	C2 Proficient user
B1 Independent user	B2 Independent user	A1 Basic user	A1 Basic user	A1 Basic user

<sup>(\*)</sup> Common European Framework of Reference (CEF) level

- Optics of short and ultrashort lasers
- Laser-driven electron acceleration and X/ $\gamma$ -ray secondary sources
- Ultrashort and/or ultraintense laser-matter interaction
- Advanced optical/X-ray diagnostics of laser-plasmas
- Numerical simulations of (short/ultrashort) laser pulse generation and beam transport/focusing
- Laser-driven proton acceleration
- Experimental issues involved in the design, commissioning and operational management of small and medium scale laser facilities
- Medical applications of novel concept (laser-driven) electron accelerators
- Laser-matter interaction in Inertial Confinement Fusion relevant regimes (plasma instabilities, fast electron transport, etc.)
- Numerical simulations of laser-plasma interaction (using hydro and PIC codes) and particle transport/interaction (Monte Carlo GEANT4 code)

## Computer skills

**Operating systems:** Linux (preferred), MacOS, Windows

**Programming languages:** C/C++ (excellent), python (very good), LabView® (very good), Mathematica® programming (very good), bash/z shell scripting (good)

**Scientific libraries:** CUDA (parallel programming on GPUs), GEANT4, GSL - Gnu Scientific Library, FFTW (Fast Fourier Transform), python math/numerical libraries (matplotlib, numpy, scipy, simpy, etc.)

**Scientific software:** LabView®, Mathematica®, gnuplot, paraview, MIRO (simulation of optics and laser systems), gUPPE (simulation framework for femtosecond nonlinear optics), python/matplotlib,numpy/scipy

**Other software:** LaTeX, OpenOffice/LibreOffice, Microsoft Office

**Other:** Arduino programming, QT library (C++ graphics/GUI library), Boost Asio library (C++ library for network and low-level I/O programming), Apache (web server) configuration

## Teaching, awards and other scientific activities

▷ Referee for the following journals: *Applied Optics, Applied Physics B, Chinese Optics Letters, European Physical Journal Plus, Europhysics Letters, Journal of Physics B - At. Mol. Opt. Phys., Journal of Physics D - Applied Physics, High Power Laser Science and Engineering, Laser Part. Beams, New Journal of Physics, Nucl. Instrum. Meth. Phys. Res. A, Nucl. Instrum. Meth. Phys. Res. B, Nuclear Fusion, Optics Express, Optics Laser Technol., Phys. Rev. E, Phys. Rev. Lett., Plasma Phys. Controlled Fusion, Rev. Sci. Instrum., Scientific Reports*

▷ Lecturer for the course “Fisica degli acceleratori laser-plasma”, held at the Dept. of Physics of the Univ. of Pisa starting from the academic year 2019-2020

▷ Lectured for the course “Medical Imaging and Biosensors”, held at the Dept. of Engineering of the Univ. of Pisa starting from the academic year 2023-2024

▷ Since 2011 he is in charge of the laser systems hosted at the Intense Laser Irradiation Laboratory of the National Institute of Optics of the CNR (INO-CNR) (the laboratory features, among others, a 220TW TiSa system)

▷ Since 2019, member of the Editorial Board of the review “Quantum Beam Science”

▷ Elected member of the “Consiglio di Istituto” of the National Institute of Optics - CNR for the years 2017-2021

▷ Member of the Program Committee of the SPIE Conference “High Energy and Power Diode-Pumped Laser Technologies”, Prague (Czech Republic), 2025

▷ Member of the Program Committee of the SPIE Conference “High Power Laser”, held in Prague (Czech Republic) on April 19-22, 2021

▷ Member of the Program Committee of the SPIE Conference “High-power, high-energy and high-intensity laser technology”, held in Prague (Czech Republic) on April 1-4, 2019

- ▷ 2011: he received, as Principal Investigator, a funding of 540k€ (total project cost 747k€) from the Italian Ministry of Health through the call for projects “Giovani Ricercatori” (“Young Researchers”), for a project in the field of medical applications of laser-driven electron beams
- ▷ since 2016 he acts as reviewer for projects funded by the Italian National Institute of Nuclear Physics (INFN) (through the CSN5)
- ▷ Evaluator for a PhD thesis in the field of laser-driven particle acceleration, discussed in the academic year 2016-2017 at the University of Messina (Italy)
- ▷ Member of the Program Committee of the 4th EPS Conference on Plasma Physics, Espoo, Finland, 2013
- ▷ Supervisor of the PhD thesis work of the student Naveen C. Pathak (PhD program in Physics at the Department of Physics of the University of Pisa, final thesis title *Laser pulse propagation in plasmas and its implication of frequency upshift and electron acceleration*, discussed on June 2011)
- ▷ Since 2007 he has served several times as a member of the examining board for the assignment of research grants in the field of laser-plasma interaction by the Consiglio Nazionale delle Ricerche
- ▷ Since 2007 he is associated (“associazione scientifica”) with the Pisa Section of the Italian National Institute of Nuclear Physics (INFN)
- ▷ He was awarded for the 2nd best presentation in the Section “Biophysics and Medical Physics” at the 100th national congress of the Italian Society of Physics (SIF), held in 2014
- ▷ He acted as the scientific responsible for post-doc research grants assigned in the years 2013-2015 to dr. M. Cresci, dr. P. Koester, dr. T. Levato and dr. S. Pulignani, in the framework of the project “Giovani Ricercatori” funded by the Italian Ministry of Health, for research activities in the field of laser-driven electron acceleration.
- ▷ He acted as scientific responsible of 4 post-doc research grants assigned in the years 2013-2015 for research activities in the field of laser-driven electron acceleration
- ▷ He acted as scientific responsible for a post-doc research grant assigned since 01/11/2012 to 31/10/2014 for a scientific activity in the field of optics of ultrashort lasers
- ▷ “Outstanding referee” for the review *Rev. Sci. Instrum.* in the year 2010
- ▷ Responsible for the operational management of the 250TW laser system and responsible for the laser beam modelling, control, diagnostics and focusing in the Target Area of the “FLAME (Frascati Laser for Acceleration and Multidisciplinary Experiments)” laboratory, during its commissioning phase at the Laboratori Nazionali di Frascati in the framework of the INFN (Istituto Nazionale di Fisica Nucleare) strategic project “PLASMONX (Plasma Acceleration and Monochromatic X-ray generation)”
- ▷ Research fellow at the Institut für Optik und Quantenelektronik of the Friedrich-Schiller-Universität, Jena (Germany), from 01/12/2012 to 30/04/2013

## Responsibility of scientific projects

- ▷ Scientific Coordinator for the CNR for the PNRR IR project “EuAPS” (started in Dec 2022) (total funding for CNR: 6.6M€)
- ▷ Scientific coordinator of the INFN - Pisa unit for the INFN project “LPA2” (started in 2020)
- ▷ Scientific coordinator of the CNR - Pisa unit for the project “Preclinical Tool for Advanced Translational Research with Ultrashort X-ray Pulses” funded by the Italian Ministry of Research through the call MIUR PRIN2015 (project duration 2017-2020)
- ▷ Member of the Steering Committee, participation as “WP expert” to the WP4 (“Laser design and optimization”) and participation to the WP3 (“High gradient laser plasma acceleration bunches”) of the European project “EuPRAXIA”, aimed at producing a CDR for a laser-driven accelerator and FEL (funded in the framework of the H2020 program) 2016-2019
- ▷ Principal Investigator of the project *Study of radiobiological and radiotherapeutic effects of a novel laser driven electron accelerator*, funded by the Italian Ministry of Health in the call “Giovani Ricercatori 2009” (total budget k€ 747, total funding from the Ministry of Health k€ 540), project duration February 2012 - January 2016
- ▷ Scientific coordinator of the INFN - Pisa unit for the INFN project “SiCilia” (project duration 01/01/2016 - 31/12/2018)
- ▷ Work Package 5 (“Radiobiological Testing Facility”) leader within the INFN CNS5 experiment “L3IA - Line for Laser Light Ions Acceleration”, started in 2016
- ▷ Scientific Coordinator for the Italian participation to the Joint Research Activity “European Research Objectives on Lasers for Industry, Technology and Energy (EURO-LITE)” in the framework of the EC project “LASERLAB Europe” (June 2012 - November 2015, total funding allocated for Italy k€ 40)
- ▷ WP2 (“Laser-plasma diagnostic”) leader in the years 2014-2015 for the INFN project “PLASMAMED”
- ▷ Scientific coordinator of the project *AdOpRad - R&D of innovative wavefront sensors and adaptive optics for laser-driven radiological devices*, funded by the Tuscany Region (project duration 01/11/2012 - 31/10/2014)
- ▷ Scientific Coordinator for the Italian side of the Executive Program of Cooperation in the Field of Science and Technology between Italy and Japan on the *Study of laser pulse guiding conditions for laser-plasma acceleration* (years 2008 and 2009)

## Participation to conferences/seminars as invited speaker

- Invited seminar at INFN, Sezione di Pisa, 11 January 2022. Title: *Laser-driven particle acceleration: Perspectives for medical applications*
- Invited seminar at ELI-NP (Romania), 15 December 2021. Title: *VHEE applications of LWFA generated electrons*

## Peer-reviewed publications

### Selected publication

- Advanced Summer School on “Laser-Driven Sources of High Energy Particles and Radiation”, held in Capri, Italy on 9-16 July 2017. Lectures on *Ultra-fast, intense laser pulse diagnostics*
  - EXTATIC welcome week 2017, Trieste, Italy, 16-20 January 2017. Title of the talk: *Laser-driven electron acceleration and secondary X/ $\gamma$ -ray sources*
  - 3rd ELIMED workshop on Medical and multidisciplinary applications of laser-driven ion beams at ELI-Beamslines, Catania, Italy, 7-10 September 2016. Title of the talk: *Line for Laser-driven Light Ions Acceleration (L3IA) at ILIL and related TNSA studies*
  - International Conference on High Energy Density Sciences 2015, Yokohama, Japan, 22-24 April 2015. Title of the talk: *A small-scale laser-driven electron accelerator for radiobiology experiments at ILIL-CNR*
  - FisMat2015, Palermo, Italy, September 28 - October 2, 2015. Title of the talk: *Role of laser polarization on stable injection of laser-plasma acceleration at high dose for radiobiology applications*
  - SPIE Optics+Optoelectronics 2013 Conference, Prague, Czech Republic, April 15-18, 2013. Title of the talk: *Small-scale laser based electron accelerators for biology and medicine: a comparative study of the biological effectiveness*
  - 17th International Conference on Atomic Processes in Plasmas, 19-22 July 2011, Belfast (UK). Title of the talk: *X-ray spectroscopy and charged particles with small-scale lasers*
  - 4th International Conference on Superstrong Fields in Plasmas, Varenna, Italy, September 3-9, 2010. Title of the talk: *PLASMONX project: the FLAME laser and the test experiment at LNF-INFN*
- ▷ H-index: 26 (WoS database as of 2024), 30 (google scholar database as of 2024)
- ▷ Author of more than 160 peer-reviewed publications and 40 conference proceedings, book chapters, etc.
- M. Salvadori, F. Brandi, L. Labate *et al.*, *Quantitative elemental analysis of a specimen in air via external beam laser-driven particle-induced x-ray emission with a compact proton source*, Phys. Rev. Appl. **21**, 064020 (2024) (corresponding author)
  - L.A. Gizzi, L. Labate *et al.*, *Overview and specifications of laser and target areas at the Intense Laser Irradiation Laboratory*, High Power Laser Sci. Eng **9**, e10 (2021) (corresponding author)
  - L.A. Gizzi, E. Boella, L. Labate *et al.*, *Enhanced laser-driven proton acceleration via improved fast electron heating in a controlled pre-plasma*, Sci. Rep. **11**, 13728 (2021) (corresponding author)
  - L. Labate *et al.*, *Toward an effective use of laser-driven very high energy electrons for radiotherapy: Feasibility assessment of multi-field and intensity modulation irradiation schemes*, Sci. Rep. **10**, 17307 (2020)

- D. Panetta, L. Labate *et al.*, *Numerical simulation of novel concept 4D cardiac microtomography for small rodents based on all-optical Thomson scattering X-ray source*, Sci. Rep. **9**, 8439 (2019) (corresponding author)
- L. Labate, G. Vantaggiato, L. A. Gizzi, *Intra-cycle depolarization of ultraintense laser pulses focused by off-axis parabolic mirrors*, High Power Laser Sci. Eng. **6**, e32 (2018)
- M. G. Andreassi, ..., L. Labate, *Radiobiological Effectiveness of Ultrashort Laser-Driven Electron Bunches: Micronucleus Frequency, Telomere Shortening and Cell Viability*, Rad. Res. **186**, 245 (2016)
- L. Labate *et al.*, *LESM: a laser-driven sub-MeV electron source delivering ultra-high dose rate on thin biological samples*, J. Phys. D - Appl. Phys. **49**, 275401 (2016)
- N. Booth, ..., L. Labate *et al.*, *Laboratory measurements of resistivity in warm dense plasmas relevant to the microphysics of brown dwarf*, Nature Commun. **6**, 8742 (2015)
- P. Ferrara, ... L. Labate *et al.*, *3-D numerical simulation of Yb:YAG active slabs with longitudinal doping gradient for thermal load effects assessment*, Optics Express **22**, 5375 (2014) (corresponding author)
- T. Ceccotti, ..., L. Labate *et al.*, *Evidence of resonant surface-wave excitation in the relativistic regime through measurements of proton acceleration from grating targets*, Phys. Rev. Lett. **111**, 185001 (2013)

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Pisa (Italy), 15 april 2025

Luca U. Labate