PROJECT COORDINATOR & BENEFICIARY OF MEDEA

POLITECNICO DI MILANO

MILANO

ITALY

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Useful Links
www.medea-horizon2020.eu
www.polimi.it
www.fisi.polimi.it
www.turismo.milano.it
www.italia.it
www.linkedin.com/grp/home?gid=8277773

POLITECNICO
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MEDEA
Molecular Electron Dynamics investigated by Intense Fields and Attosecond Pulses

This project has received funding from the European Union's **Horizon 2020** research and innovation programme under the Marie Skłodowska-Curie grant agreement No 641789.

Home institution

Politecnico di Milano is a state scientific-technological university established in 1863 which trains engineers, architects and industrial designers. Education is at bachelor, master's, and PhD level. Currently more than 1,200 professors and researchers work at University and 40,000 students study in 7 different campuses. Polimi is one of the leading Italian research centres characterized by the combination of theoretical bases of excellence and first-rate research infrastructures providing the possibility of wide variety of experimental research. Polimi is organized in 12 Departments including all main areas of engineering, architecture and industrial design.

The Department of Physics has a long expertise in surface physics and laser technology.

Politecnico di Milano provides a coordinated environment for PhD level training through its PhD School, that coordinates 18 active PhD Programmes (http://www.polimi.it/phd). The PhD programmes at the Politecnico di Milano generally last 3 years and each programme has an English track. There are currently 1100 ESRs, 30% of which are international candidates. The PhD School. The Politecnico di Milano PhD School offers a number of educational activities aimed at providing researchers and ESRs with opportunities of multi-disciplinary and cross-cultural experiences. About 30 general and interdoctoral courses are offered each year, and each programme organizes PhD level courses and training activities and seminars. General training programmes include courses on Scientific, Technical and Public Communication; Quantitative Analysis of Very-Large Systems; Project Management; Nurturing Design Sciences with Humanistic Knowledge; Research Management.

Technology transfer activities and patenting are supported by a specific service (TTO) and several opportunities are offered to ESRs for developing spin-offs, with a Business Incubator and specialized training. Career development activities are also provided by the Career Service.

Politecnico follows the National procedures for accreditation of PhD programmes, according to the accreditation criteria established by the Ministry.

The PhD School has adopted the European Principles for Innovative Doctoral Training. The Physics Department currenly hosts five experimental laboratories working with XUV pulses generated by HHG.

Group leader

Name: Giuseppe Sansone
Nationality: Italian
Date of birth: 23 April 1977

Short CV:

2000: graduated in Physics, University Federico II Naples, Italy

2004: PhD in physics, Politecnico Milan, Italy

2009-2011: Visiting Scientist at the Max Planck Institute for Nuclear Physics in Heidelberg, Germany

Current position: Associate professor of Physics Politecnico Milan, Italy and Scientific Advisor of Extreme Light Infrastructure (ELI-ALPS) Szeged, Hungary.

After the first three years of my studies in Physics in Naples, I applied for an Erasmus fellowship and I had the opportunity to complete my master at the Friedrich Schiller University in Jena. The stay, which initially was supposed to last only six months, turned out to be much longer and I spent in Jena more than one a half year. Despite the initial strong difficulties with the language, I finally managed to let me understand (in some way...) and to complete my master thesis on the characterization of ultrashort femtosecond laser pulses. I enjoyed a lot that experience and I had the opportunity to work with state-of-the-art laser systems and to enjoy an incredible scientific freedom.

After this step and a long internal struggle, I decided to accept a PhD position in Milan at the Technical University (Politecnico) joining the ultrafast group led by Sandro De Silvestri. At that time we were still in the first phase of attosecond pulse generation and just only a few months after my start in Milan, the first experimental works on the attosecond structure of XUV radiation were published. We were among the first groups to stabilize the CEP of amplified pulses and this achievement opened up the way for a series of beautiful experiments with long and short femtosecond pulses that finally converged in the main topic of my PhD thesis.

After the completion of the PhD I remained the Politecnico as assistant professor and the subsequent four years were characterized by exciting experiments performed in large international collaborations. Together with Eric Constant and Eric Mevel from the University of Bordeaux, we demonstrated for the first time the generation of XUV continua and isolated attosecond pulses using the polarization gating technique envisaged by Paul Corkum more than 10 years before. These experiments led to (at that time) the shortest pulse ever produced (just 130 as)! Using these pulses, I was then involved in a very large (and also very long) European collaboration involving several research groups active in attosecond science. The main result of that collaboration was the first demonstration of attosecond dynamics in molecules, a price that took us almost a three-year long experimental campaign to be achieved!

I then decided that it was time to visit a new laboratory and to gain different expertise and, thanks to an Alexander von Humboldt fellowship, I joined the Max Planck Institute for Nuclear Physics in Heidelberg under the supervision of Joachim Ullrich and Robert Moshammer. Together with the very pleasant atmosphere of Heidelberg, I enjoyed a wonderful working situation during the two years I spent in Germany. I had the opportunity to build up and a test a Reaction Microscope and I was amazed by the complexity and high-technology involved in the construction of this machine. You can easily imagine my fear when, during the transportation of the Reaction Microscope to the laboratories at the Politecnico, I realized that one of the belt securing it to the bottom of the van went loose! For fortune nothing dramatically happened and, once arrived in Milan, the system immediately worked perfectly.

In the meanwhile, I received a large national grant to start my own attosecond laboratory at Politecnico. I took us a few years to setup everything but we finally managed to integrate the Reaction Microscope and to measure the first coincidence data.

In the meanwhile, frustrated by the poor efficiency of high-order-harmonic generation (a feeling that I guess many scientists of the network will share with me) I applied for a beamtime at the new Free Electron Laser in Italy FERMI. The scientific goal of the project was the investigation of a two-XUV--photon excitation mechanism of neon dimers, a process that I would not be not able to perform in my laboraoty. It was a very wise decision because, since then, we have been involved in several experiments at the Low-density-matter end station at FERMI. Every time the performances and the success of the experimental campaigns have increased constantly, like the friendly and nice atmosphere of the team and our colleagues in Trieste.

In the last years. I accepted a new challenge when I decided to work as Division Head of the Secondary Sources at the Extreme Light Infrastructure Attosecond Light Pulse Source (ELI-ALPS). It is really exciting to be part of the development of one of the largest laser facilities worldwide and it is really rewarding to see how an ambitious project turns out in something real.

So at the moment I am sharing my time between Milano and Szeged, with some short deviations to Trieste always looking for new and exciting experiments

Offered training

Research Training Modules (RTMs)

A. Second order autocorrelator (see next pages for details)

B. Alignment of a hollow fiber compressor (see next pages for details)

C. Development of a f-2f interferometer (see next pages for details)

Scientific Courses of the Physics Department

Photon migration and wave diffusion in random media content: *Understanding of the physics of light absorption and scattering in diffusive media. Use of the mathematical tools to study light absorption and scattering*	Alessandro Torricelli
Advanced optical microscopy and applications**	Andrea Bassi
Advanced optical microscopy and applications**	Giuseppe Chirico
Photonics I - *1° sem content: The course is intended to provide students with the fundamentals to understand the emission and the detection of optical radiation. The physical principles of light matter interaction and their applications in the most important photonic devices with be extensively treated.*	Mauro Nisoli, Gianluca Valentini
Photonics II - *1° sem content: To provide the basic knowledge necessary for the understanding of the ultrashort light pulse generation mechanisms, their propagation in linear and nonlinear media, their characterization techniques. To give examples of application of ultrashort pulses to the study of dynamical processes in physics, chemistry and biology.*	Giulio Cerullo, Antonio Pifferi
Micro and Nano optics - *2° sem content: Aim of the course is the study of the theoretical foundations and of the main applications of Integrated Optics, Microoptics and Nanooptics.*	Giuseppe Della Valle, Marco Marangoni
Advanced optics and lasers - *1° sem content: The course aims to provide students with a deeper insight of wave optics (interference and diffraction of light) and the basic concepts of laser physics and laser engineering. The principles of operation of the laser device, both in continuous wave operation and in specific pulsed regimes, are presented, and the main characteristics of laser radiation are discussed. Subsequently, a few significant types of laser are illustrated, in terms of principle of operation, main characteristics and performance, and applications to science and technology.*	Paolo Laporta

Transferable skills Modules (TSMs)

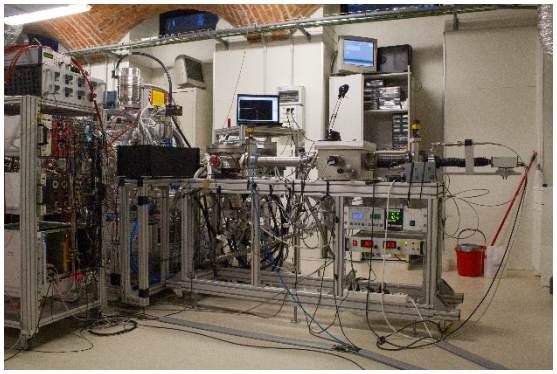
Photons and Bits: at the roots of the information age
Quantitative analysis of very-large systems: metrics, models, techniques, methodologies and tools
Electromagnetic radiation
Physical methods for Cultural Heritage
Functional Analysis and Partial Differential Equations
Management of design and innovation project – *2° sem content: Projects are the managerial tool that enable innovation. Until some years ago only companies operating in few specific sectors (e.g. aerospace and defense, civil engineering) needed a full set of tools and methodologies to manage projects. This course focuses on some key aspects of managing complex projects. Special attention will be devoted to uncertainty and risk management in design projects, to agile project management (e.g. SCRUM), to quantitative operating control and to the economic and financial aspects of projects. Moreover, organizational and behavioral topics will be presented through models and methodologies aimed at increasing competences in negotiation and team management.*
Leadership and Innovation – *2° sem content: Understand their role as leaders in society and business - ncrease their self-awareness, and focus their motivation and vision about their development as leaders -understand the role of leaders in managing and guiding interpersonal processes understand a changing socio-economic context and the challenges of sustainability, capture the opportunities, identify possible innovative directions for them and their organization - understand the dynamics of innovation processes within and across organizations - understand the dynamics of creativity and change in organizations, from the collaboration in small settings (team building, teamworking), to collaborative innovation in complex networks*
Methods and tools for systematic innovation – Innovation and intellectual property
Course of Italian language and culture

Others Information about offert of PhD Scool of Politecnico di Milano at this link:

http://www.dottorato.polimi.it/en/phd-programmes/active-phd-programmes/

For all courses recognition of credits must be discussed with the supervisor

A. Second order autocorrelator



Objective

The goal of the RTM is the construction and implementation of a second-order autocorrelator for the temporal characterization of femtosecond laser pulses. The reliable and repeatable measurement of the temporal characteristics of ultrashort pulses is a prerequisite for the realization of attosecond experiments.

Equipment

The ESRs will be provided with all optical components for the design and implementation of the autocorrelator including:

Optical mounts	Broadband mirrors	He-Ne for alignment	Manual translation stage
Alignment irises	Beam splitters	Glass wedges	Acquisition software
Beam attenuators	Nonlinear crystals	Glass plates	Piezoeletric stage and controller
Photodiodes	Visible spectromer	Personal protection devices	Desktop PC

Implementation

- The training will have a series of intermediate milestones and objectives:
- Introduction to the different methods of temporal characterization of ultrashort optical pulses: pros and cons.
- Design of the autocorrelator
- Determination of the temporal and spatial overlap of the two beams in the interferometer
- Measurement and optimization of the second harmonic signal
- Measurement of the interferometric autocorrelation trace
- Measurement of the intensity autocorrelation trace
- Measurement of the spectrally resolved intensity autocorrelation trace: introduction to the freq.-resolved optical gating
- Full-reconstruction of the temporal structure of the femtosecond pulse
- Effect of phase dispersion on the temporal structure

Duration

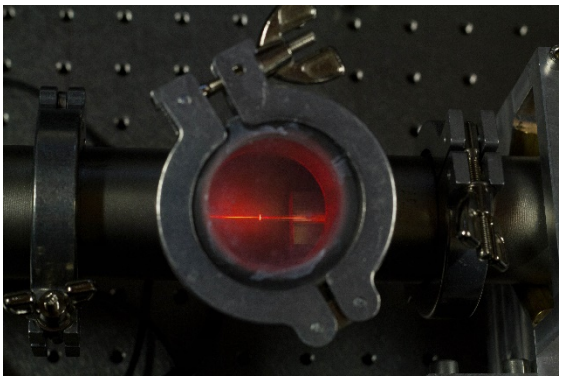
For the complete experiments a period of four weeks is planned. During this time the ESR will be involved mostly in the preparation of the experimental apparatus and in the data acquisition. The completion of the RTM will require a part of data analysis. For the experimental part, the ESR will be provided with a fraction of a 25-fs long pulse with energy of typically few □J.

The period for the participation to the RTMs should be agreed upon with the tutors

RTM at a glance

Title	*Host institution*	*Objective*	*Duration/ Period*	*Tutors*
Second order autocorrelator	**POLIMI**	Characterization of ultrashort femtosecond pulses *experimental activity*	4 weeks / to be discussed	Maurizio Reduzzi mauriziobattista.reduzzi@polimi.it Giuseppe Sansone giuseppe.sansone@polimi.it

B. Alignment of a hollow fiber compressor



Objective

The goal of the RTM is the design and implementation of a hollow-fiber compressor for the spectral broadening of femtosecond pulses. The generation of isolated attosecond pulses strongly depends on few-cycle visible-infrared pulses that can be generated using such a setup.

Equipment

The ESRs will be provided with all optical components for the design and implementation of the autocorrelator including:

Optical mounts	Broadband plane and focusing mirrors	He-Ne for alignment
Alignment irises	Beam splitters	Desktop PC
Beam attenuators	Hollow fiber capillary	Personal protection devices
Translation stages	Vacuum tubes	Manual translation stage
Input and output vacuum windows	Mounting blocks for vacuum tubes	Acquisition software
V-groove	Vacuum pump	Glass plates
Noble gases	Pressure gauge	CCD camera
Photodiodes	Visible spectrometer	Powermeter

Implementation

- The training will have a series of intermediate milestones and objectives::
- Introduction to the waveguided propagation in a capillary
- Setup of the vacuum tube and pressure measurement
- Design of the optical setup for coupling into the capillary
- Measurement of the focal spot size (He-Ne)
- Alignment of the capillary and optimization of power throughput and profile mode (He-Ne)
- Measurement of the beam divergence (He-Ne)
- Measurement of the focal spot size (Ti-Sapphire)
- Alignment of the capillary and optimization of power throughput and profile mode (Ti-Sapphire)
- Measurement of the beam divergence (Ti-Sapphire)
- Measurement of the spectral broadening for different pressure and different gases

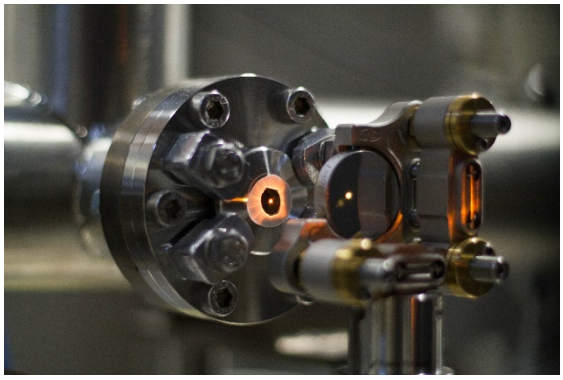
Duration

For the complete experiments a period of six weeks is planned. During this time the ESR will be involved mostly in the preparation of the experimental apparatus and in the data acquisition. In the first part of the RTM the ESR will work with a He-Ne for the first alignment of the hollow fiber compressor. In the second part of the RTM a 25-fs long pulse with energy of typically few hundreds of [illegible] will be used. The completion of the RTM will require a part of data analysis.

RTM at a glance

Title	*Host institution*	*Objective*	*Duration/ Period*	*Tutors*
Alignment of a hollow fiber compressor	**POLIMI**	Design and implementation of a hollow fiber compressor experimental activity	6 weeks /to be discussed	Matteo Negro matteo.negro@polimi.it Davide Facciala davide.facciala@polimi.it

C. Development of a f-2f interferometer



Objective

The goal of the RTM is the construction and implementation of a nonlinear interferometer for the measurement of the carrier-envelope-phase (CEP) fluctuations of a femtosecond amplified laser system. The reliable and repeatable generation of isolated attosecond pulses relies on the characterization and control of the CEP drift of high-intensity ultrashort few-cycle pulses.

Equipment

The ESRs will be provided with all optical components for the design and implementation of the autocorrelator including:

Optical mounts	Broadband plane and focusing mirrors
Alignment irises	Sapphire plates
Beam attenuators	Nonlinear crystals
Manual translation stage	Visible spectromer
Acquisition software	Desktop PC
He-Ne for alignment	Glass plates
Personal protection devices	

Implementation

The training will have a series of intermediate milestones and objectives:

- Introduction to CEP fluctuations and stabilization schemes: pros and cons.
- Design of the interferometer
- Generation of white light continuum
- Generation of second harmonics from the white light continuum
- Measurement of the spectral interference fringes with and without CEP stabilization on the oscillator
- Stabilization of the CEP drift
- Measurement of the residual in-loop CEP drift

Duration

For the complete experiments a period of four weeks is planned. During this time the ESR will be involved mostly in the preparation of the experimental apparatus and in the data acquisition. The completion of the RTM will require a part of data analysis. For the experimental part, the ESR will be provided with a fraction of a 25-fs long pulse with energy of typically few □J.

The period for the participation to the RTMs should be agreed upon with the tutors.

RTM at a glance

Title	*Host institution*	*Objective*	*Duration/ Period*	*Tutors*
Development of a f-2f interferometer	**POLIMI**	Measurement of the carrier-envelope phase fluctuations of a laser system experimental activity	4 weeks /to be discussed	Paolo Carpeggiani paoloantonio.carpeggiani@polimi.it Andrea Trabattoni andrea.trabattoni@polimi.it Giuseppe Sansone giuseppe.sansone@polimi.it

About the life in Milano

The Comune di Milano offers a special website expecially dedicated to tourism and cultural events in the city, where you can also download a complete tourist guide to the city (available in different languages) and several iPhone Apps to enjoy the city, its culture and its leisure:

www.turismo.milano.it

You can also ask for information to one of the two Tourist Offices in the city:

Piazza Castello, 1 - Tel. 02 7740.4343

Opened from Monday to Friday from 9.00 AM to 6.00 PM - Saturdays: from 9.00 AM to 1.30 PM and from 2.00 to 6.00 PM - Sundays: from 9.00 AM to 1.30 PM and from 2.00 to 5.00 PM

Milano Centrale railway station (next to platform 21) - Tel. 02 7740.4318-4319

Opened from Monday to Friday from 9.00 AM to 5.00 PM - Saturdays and Sundays: from 9.00 to 12.30 AM

Welcome activities at the home institution

First, you need to register on our website and request a new login.

You can do this by navigating to www.polimi.it/servizionline and go to 'online services', then request to create an account as a 'new user'. By doing this you will be assigned you own Personal Login and you will have access to the pages dedicated to users.

For others information about life in Italy and Milan, please contact Stefania Mosca by mail who will be happy to help you!