BENEFICIARY OF MEDEA

FOUNDATION FOR RESEARCH & TECNOLOGY-HELLAS

HERAKLION

GREECE

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Useful Links
www.medea-horizon2020.eu
www.forth.gr
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www.visitgreece.gr/en/main_cities/heraklion
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FORTH
Institute of Electronic Structure and Laser

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

The Foundation for Research and Technology-Hellas (FORTH), established in 1983, is one of the largest research centers in Greece with well-organized facilities, highly qualified personnel and a reputation as a top-level research foundation worldwide. FORTH reports to the General Secretariat for Research and Technology of the Hellenic Ministry of Education, Research and Religious Affairs. The Foundation, with headquarters in Heraklion, includes six Research Institutes in different parts of the country:

In Heraklion

Institute of Electronic Structure and Laser (IESL)

Institute of Molecular Biology and Biotechnology (IMBB)

Institute of Computer Science (ICS)

Institute of Applied and Computational Mathematics (IACM)

In Rethymnon

Institute for Mediterranean Studies (IMS)

In Patras

The Institute of Chemical Engineering Sciences (ICE-HT)

Also, in Ioannina operates the Department of Biomedical Research under the Institute of Molecular Biology and Biotechnology (IMBB).

FORTH's activities are complemented by Crete University Press (CUP), the Skinakas Observatory, the Science and Technology Park of Crete (STEP-C) and PRAXI/HELP- FORWARD Network. The research and technological directions of FORTH focus on areas of major scientific, social, and economic interest, such as: Microelectronics, Lasers, Materials, Molecular Biology and Genetics, Biotechnology, Computer Sciences, Bioinformatics, Robotics, Telecommunications, Computational Mathematics, Chemical Engineering, Human and Social Sciences, Cultural Studies.

IESL is a well-established internationally-recognized Research Institute, with personnel of ~200 members. IESL possesses research infrastructures of international standards and unique within Greece (lasers, micro/nano-electronics, polymers & soft matter, astrophysics). The Institute has achieved excellence in several research areas and has laid the grounds for a competitive presence in others.

IESL in collaboration with the Univ. of Crete and other national and international Universities is training post-graduate and PhD students. A large number of PhD dissertations of Physics, Chemistry, Material Science, Biomedical departments are implemented at IESL. Training activities include series of seminars and the organization of schools.

In IESL operates currently the attosecond S&T experimental laboratory conducting research in generating, characterizing and exploiting of energetic short pulse duration XUV radiation.

Group leader

Name: Charalambidis Dimitris
Nationality: Hellenic
Date of birth: 29 September 1952

Short CV:

1975: graduated in Physics, University of Athens, Greece

1978: Physikdiplom, Univ. of Freiburg, FRG

1979-1982: Teaching and military Service

1987: PhD in Physics, Univ. of Freiburg, FRG

Current positions: Full Professor of Physics Univ. of Crete, Greece, Affiliated Faculty member at FORTH-IESL and Scientific Chief Advisor of Extreme Light Infrastructure (ELI-ALPS) Szeged, Hungary.

After finishing my studies in Athens I decided to continue towards post-graduate studies in Germany. My Greek degree has not been accepted as equivalent to the German Diploma and thus I did additional studies at the Univ. of Freiburg, at that time FRG, that led to obtaining the German Diploma in Physics.

Returning to Greece I had to serve in the Navy for close to two years and for some period I was teaching Physics, Math and Chemistry to schoolchildren.

In 1983 I returned to Germany and started my PhD in the Albert Ludwigs Universität, Freiburg i.Br. My PhD was on Beam Foil Spectroscopy performed at the 7MV Van der Graaf accelerator of the University. During my PhD I measured lifetimes, fluorescence yields and decay rates of metastable states of Li, Be and B like ions of C,N,O and Ne, as well as Zeeman quantum beats applying x-ray and electron spectroscopy, using already at that time position sensitive detectors. It was during this period that I got fascinated working in the lab, setting up demanding experiments, solving problems, being creative, focused and dedicated, taking important initiatives and finally being successful.

After the completion of the PhD I was recruited at FORTH IESL as a post-doctoral fellow, where half a year later I got a researcher position. During this period, at FORTH-IESL, a highly dynamic and rapidly developing laser laboratory was established and operating, attracting significant funds from competitive EU projects. In this optimal environment of large research opportunities, I switched my research activities from accelerator atomic physics to laser based atomic and molecular physics, coherent phenomena, multiphoton processes, non-linear optics and later to strong field interactions in atoms and molecules and ultrafast dynamics. Meanwhile I was elected Assistant Professor, then Associate and in 2003 Full Professor in the Physics Department of the University of Crete, while remaining till today affiliated faculty member at FORTH-IESL, where I always had me research laboratories.

In Crete, I have learned to appreciate and serve quality in research, to choose and work in timely forefront areas, to establish and lead a successful research team, to be competitive internationally, to present and promote our research in international events, to organize such events, to participate and contribute to international research evaluation and management panels and to participate in a number of EU funded projects with a total IESL budget ~9 MEuro. In the framework of these European projects a number of active fruitful collaborations have been developed. MPQ, Univ. of Burgundy, LENS, LOA, AMOLF, Univ. Aut. de Madrid, Univ. of Dublin, Imperial College, Politecnico di Milano, KFKI in Europe, LLNL and Oak Ridge in the US are institutions, with which common experiments and projects have been pursued or are ongoing. Most important in the same framework a large number of young researches from abroad and Greece have been trained over the years in our laboratory, quite a few of which are now faculty members at different places worldwide. Highlights of my research in Crete include the demonstration of Laser Induced Continuum Structure in different systems and coupling schemes, development of quantitative methods in Multi-Photon Ionization processes and Coherent Control. Since the advent of experimental attosecond science I have contributed to the field focusing in the generation of energetic attosecond pulses and their exploitation in non-linear processes in the XUV spectral regime. The first direct observation of attosecond bunching; the generation of energetic coherent XUV super–continua for the synthesis of intense isolated attosecond pulses; the implementation of the first XUV-pump-XUV-probe experiments at the boundary between femto- and attosecond scales are examples of the work produced by our attosecond S&T laboratory in the last decate.

Since 2008 I actively participate in the preparation and implementation of the European Research Infrastructure "Extreme Light Infrastructure (ELI)". Already during the formation of the concept of the ELI project I have co-introduced the idea of the inclusion of attosecond research as a main component of the project. Later on I have contributed at different capacities to the implementation of the ELI-Attosecond Light Pulse Source (ELI-ALPS) project, in which currently I serve as chief scientific advisor.

Thanks to the MEDEA network I recently started activites in producing or acting in video clips, toolkits and other PR activities.

More detailed, occasionally updated, information about me can be found in
http://www.iesl.forth.gr/downloads/people/cv/107.pdf

Offered training

Research Training Modules (RTMs)

A. Non-linear XUV autocorrelator for attosecond pulse measurements
B. Polarization gating of many cycle laser pulses (see next pages for details)

Scientific Courses of the Physics Department

Quantum Electronics I: *Laser theory and technology*	Dimitris Charalambidis
High peak power short pulse duration lasers*: Fs pulse generation, amplification, characterization*	Dimitris Charalambidis
Photonic Materials: *optical fibers, photonic crystals, metamterials, THz photonics*	Stelios Tzortzakis
Quantum Electronics II: *Non-linear optics*	Kostas Kalpouzos
Optics I:I *Wave optics, wave front sensing*	Dimitris Papazoglou
Quantum Optics – Quantum Information - *Theoretical foundations and main applications of Quantum Optics and Quantum Information*	Peter Lambropoulos George Nikolopoulos
Applied Quantum Mechanics: *Special chapters of Quantum Mechanics related to Photonic applications and Micro-, Nano-electronics*	Nikos Flytzanis

Transferable skills Modules (TSMs)

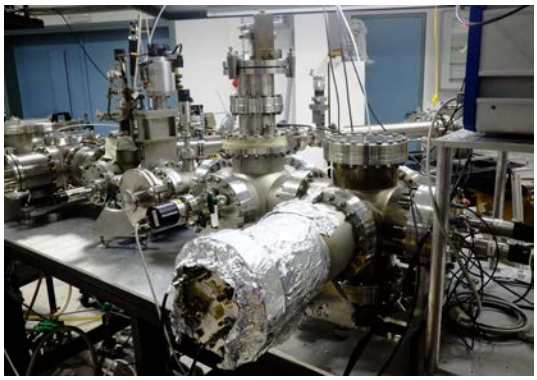
Language course given at the Univ. of Crete
Seminars of Laser safety
Laser based physical methods for Cultural Heritage
Series of lectures given by the Onassis public benefit Foundation: ***The Onassis Science Lectures*** *are organized on a yearly basis in the month of July. The purpose of the lectures - which are jointly organized by the Alexandros Onassis Foundation and FORTH - is the enrichment of young talented scientists and students via lecture series of the highest level. The main speakers of these lectures are recipients of the Nobel Prize or of equivalent scientific stature. The Chairman of the Organizing Committee is John Papamastorakis, Professor Emeritus of the Department of Physics of the University of Crete. The lectures are given in the English language by international highly reputed scientific personalities. The lectures cover subjects, which are at the forefront of the current research activities in the areas of Physics, Chemistry, Biology, Mathematics and Computer Science. There are up to three lecture series per year planned, covering different scientific areas. The lectures are held in the facilities of the Foundation for Research and Technology-Hellas (FORTH) in Heraklion Crete.* *More information is available in the Onassis Science Lectures website.*

Further Information about the graduate studies programs of the Physics Department of the Univ. of Crete are given in:

https://www.physics.uoc.gr/en/content/graduates

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

A. Non-linear XUV autocorrelator for attosecond pulse measurements



Objective

The goal of the RTM is the acquaintance with and the operation of different modes of a second-order XUV autocorrelator for measurement of the duration of attosecond laser pulses. A reliable measurement of the duration of attosecond pulses is necessary for the implementation of ultrafast dynamics studies.

Equipment

The ESRs will be provided with an operational non-linear XUV autocorrelator and an operational attosecond beamline for the operation of the autocorrelator. The equipment includes:

Laser beam from a 400mJ, 18 fs,10Hz Ti:Sa System	Polarization gating shaped laser pulses	Loose geometry laser focusing mirror set up	Digital Oscilloscope, PC with automation, acquisition software
Irises	Beam stops	Si-plate beam separator	Personal protection devices
Vacuum line	Gas jets	Metal filters	Ion mass spectrometer
Electron spectrometer	Ion Microscope	Attosecond delay line	Split XUV optical elements

Implementation

The training will include several sequential steps:

- Introduction to the different measurement methods of XUV pulse duration. Pros and Cons
- Introduction to 2nd order autocorrelation based optical fs pulse characterization techniques
- Creating and measuring vacuum in the different vacuum beamline parts
- Generation of HHG in a pulsed gas jet with an annular laser beam
- Measurement of XUV spectra using different filters and photoelectron spectroscopy in single photon ionization
- Separation of XUV-IR beams
- Procedure and establishment of optimal spatiotemporal overlap of the two XUV beam parts
- Measurement of XUV ionization mass spectra from a second gas jet spectra
- Measurement of 2nd order autocorrelation traces of APT for different laser focus-gas jet positioning
- Recording of 2nd order AC traces of an XUV continuum generated by polarization gating
- Measurement of spatially resolved atom ionization
- Subject to time availability, comparative measurements between 2nd order AC and RABITT traces

Duration

For the complete experiments a period of four weeks is planned. During this time, after a short introduction to the techniques to be used, the ESR will be involved mostly in the preparation of the experiment and in the data acquisition. The completion of the RTM will require a part of data analysis. 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*
Non-linear XUV autoccorelator for asec pulse measurements	**FORTH**	attosecond pulse duration measurement *experimental activity*	4 weeks / to be discussed	Paris Tzallas ptzallas@iesl.forth.gr Dimitris Charalambidis chara@iesl.forth.gr

B. Polarization gating of many cycle laser pulses

Objective

The goal of the RTM is the acquaintance with the intricacies of polarization gating of many cycle laser pulses and the operation of the relevant interferometric polarization gating and the collinear many cycle polarization gating devices. Polarization gating of many cycle high peak power laser pulses is a condition for the generation of energetic coherent XUV continua and eventually energetic isolated attosecond pulses.

Equipment

The ESRs will be provided with an operational interferometric polarization gating set up and a novel version of a collinear wave-plate polarization gating device appropriate for the shaping of many cycle laser pulses. The equipment includes:

Laser beam from a 3mJ, 35 fs,10Hz Ti:Sa System	Interferometric Pol. Gating device (IPG)	Tight laser focusing optical elements	Digital Oscilloscope, PC with automation, acquisition software
Irises	Beam stops	Vacuum line	Personal protection devices
Gas jets	Metal filters	XUV spectrometer	Collinear many cycle pol gating (CMC-PG) device

Implementation

The training will include several sequential steps:

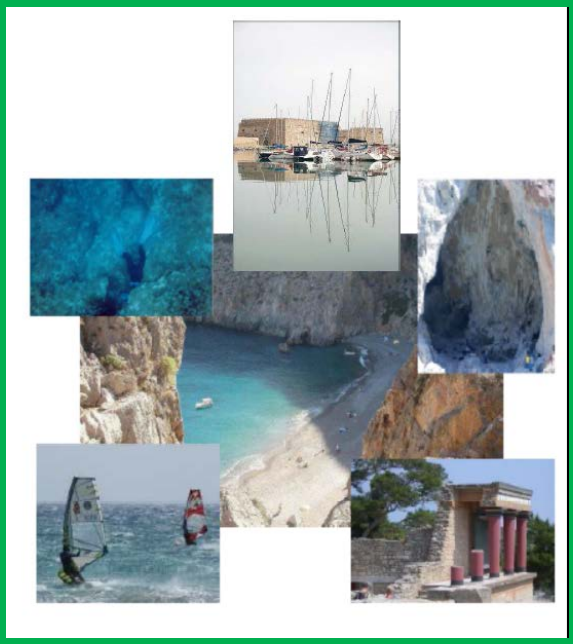
- Introduction to the different polarization gating techniques. Advances and limitations
- Introduction to the IPG technique
- Alignment of the IPG device
- Generation of XUV radiation with and without IPG and measurement of the XUV spectra
- Optimization of the generation of XUV continua
- Introduction to the CMC-PG technique
- Optimization of the CMC-PG device parameters
- Measurement of XUV spectra with and without CMC-PG
- Comparison of single shot and averaged spectra. The role of CEP

Duration

For the complete experiments a period of four weeks is planned. During this time, after a short introduction to the techniques to be used, the ESR will be involved mostly in the setting up of the devices and in the data acquisition. he 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*
Polarization Gating of many cycle laser pulses	**FORTH**	Generation of energetic coherent XUV continua *experimental activity*	4 weeks / to be discussed	Paris Tzallas ptzallas@iesl.forth.gr Emmanuil Skantzakis skanman@iesl.forth.gr



A special website dedicated to tourism for all cities and prefectures of Greece, including Heraklion and Crete, where information can be found about culture, touring, leisure, activities, maps and more can be visited in the following link:

www.visitgreece.gr/en

An excellent alternative is the web site of the Region of Crete:

http://www.incrediblecrete.gr/

You can also ask for information at the Heraklion Tourism Directorate of the Island of Crete:
Xanthoudidou 1
71202, Heraklion
Tel. +302810228225

Welcome activities at the home institution

All formalities needed when arriving will be arranged with the guidance by the secretary of the institute Magda Kokolaki magda@iesl.forth.gr, +302810391315, who will be happy to assist you.

Laboratory information can be given by Dr. Paris Tzallas ptzallas@iesl.forth.gr , +302810391127.