



EARLY STAGE RESEARCHER

Potamianos Dionysios

PROJECT: *Attosecond Electron Dynamics in Molecules on Surfaces*

Host institution: Max-Planck-Institut für Quantenoptik

Supervisors: Dr. R. Kienberger, Dr. T. Metzger, Dr. P. Tzallas

Start date: May, 01 2016

General info: Investigation of the electron delocalization processes in molecules and molecular systems on surfaces. Ultrafast dynamics will be explored in ultrathin films with well-characterized layer deposition and molecules such as metalloporphyrins, fullerenes and peptides adsorbed on thin silica films.

Attosecond pulses at ultraviolet (UV) frequencies will be used to generate coherent electronic dynamics in the valence shell of the molecules. Their subsequent dynamics will be traced by the use of attosecond transient absorption or photoelectron spectroscopy using an attosecond XUV probe.

CURRICULUM VITAE

EDUCATION

2016-today Ph.D. in “Attosecond electron dynamics on molecules” at the Max-Planck-Institute for Quantum Optics and TUM, Garching, Germany. Scholarship funded by the European Union’s Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 641789. Supervisor: Prof. R. Kienberger

2013-2016 Master in “Photonics” at the University of Patras (Greece), Department of Physics, GPA: 8.8/10. Scholarship co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF)-Research Funding Program: Thales. Investing in knowledge society through the European Social Fund, Research Project PHOTOPOLIS at the University of Patras.

Master Thesis: Investigation of the nonlinear optical properties of some Au decorated Nanodiamonds, and some graphenes linked with polymers under ns, ps and fs laser excitation. Supervisor: Prof. S. Couris

2008-2013 Diploma in Physics at the University of Patras, GPA: 6.62/10

Diploma Thesis: Experimental investigation of the nonlinear optical properties of dithiolenes based on Pt, Supervisor: Prof. S. Couris

2005-2008 Senior High School
Grade: 18.8/20

SKILLS

- Development of optical setups
- Experimental techniques: Attosecond Streaking Spectroscopy, Z-scan, Optical Kerr Effect (OKE), White light generation, Laser Ablation
- Use and maintenance of various laser systems: Q-switched, mode-locked, femtosecond, picosecond, nanosecond, multipass amplifier, parametric amplifier.
- Other techniques: UV-Vis-NIR spectroscopy, Atomic Force Microscopy (AFM), Dynamic Light Scattering (DLS), Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Profilometer

PUBLICATIONS

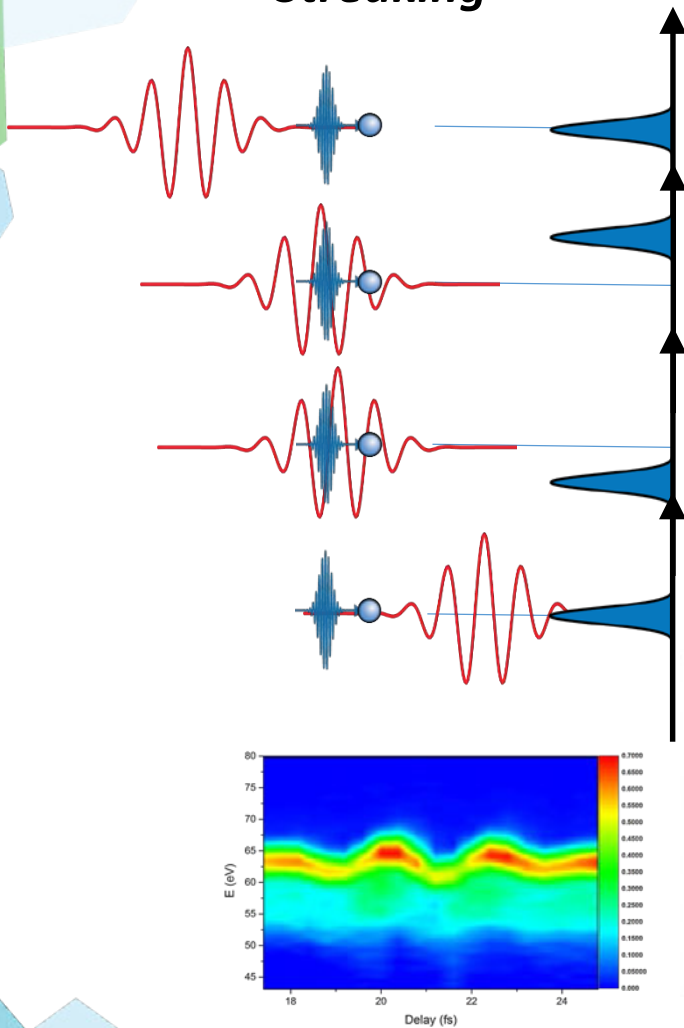
“Ultrafast third order nonlinearities of several organic solvents”, K. Iliopoulos, **D. Potamianos**, E. Kakkava, P. Aloukos, I. Orfanos, S. Couris; Opt. Express **23**(19), 24171-24176 (2015).

“Non-linear optical response of gold-decorated nanodiamond hybrids”, **D. Potamianos**, I. Papadakis, E. Kakkava, S. Couris, A.B. Bourlinos, G. Trivizas, R. Zboril; J. Phys Chem C, **119** (43), pp 24614–24620 (2015).

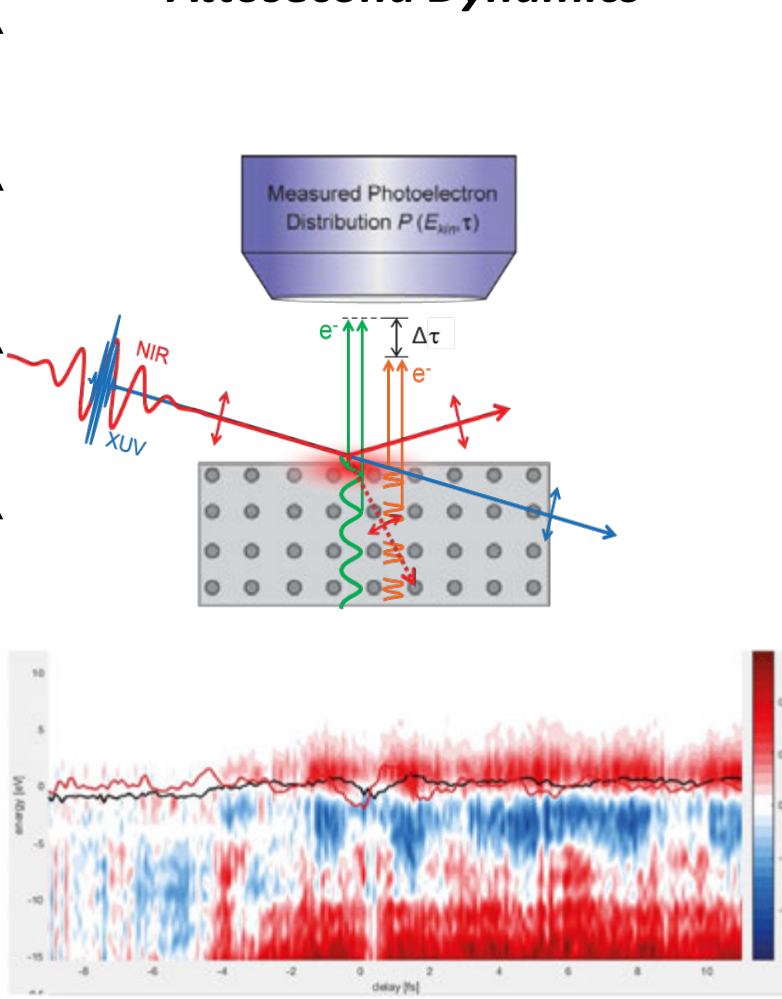
“Third-order Nonlinear Optical Properties of Some Novel BODIPYs”, **D. Potamianos**, P. Giannakopoulou, A. Kaloudi-Chantzea, G. Pistolis, S. Couris, 16th International Conference on Transparent Optical Networks, ICTON, (2014).

SCIENTIFIC SCOPE OF THE PROJECT

Streaking



Attosecond Dynamics



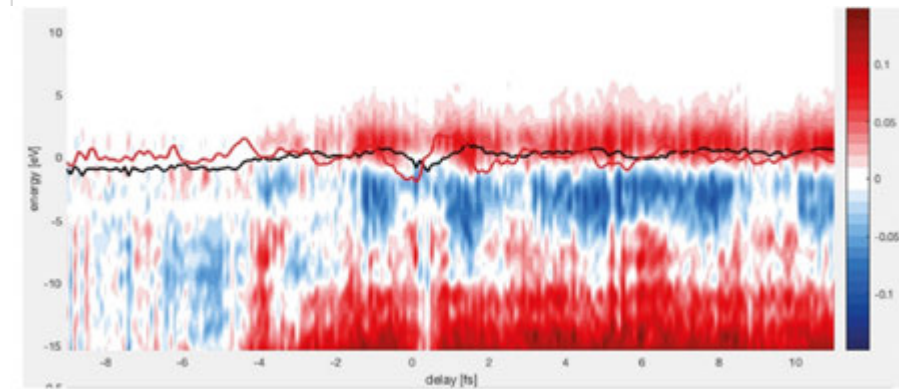
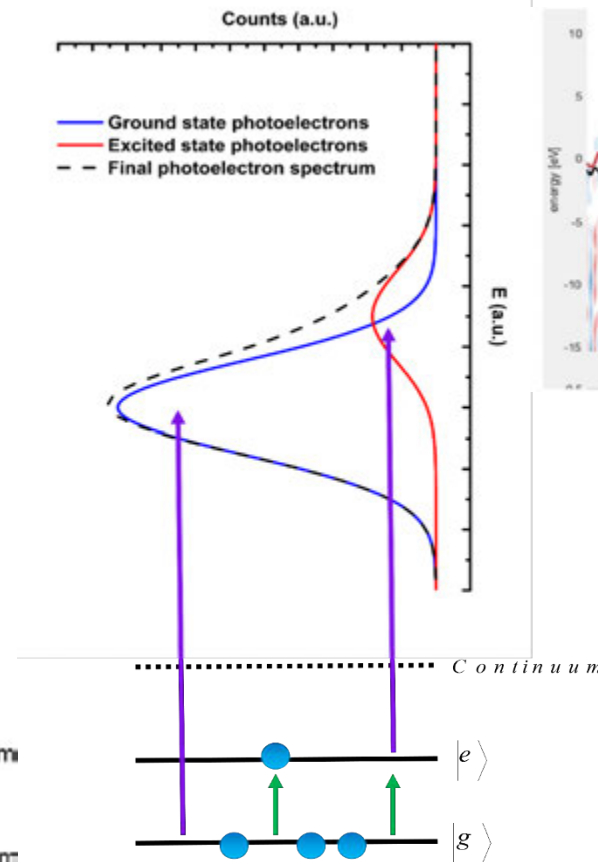
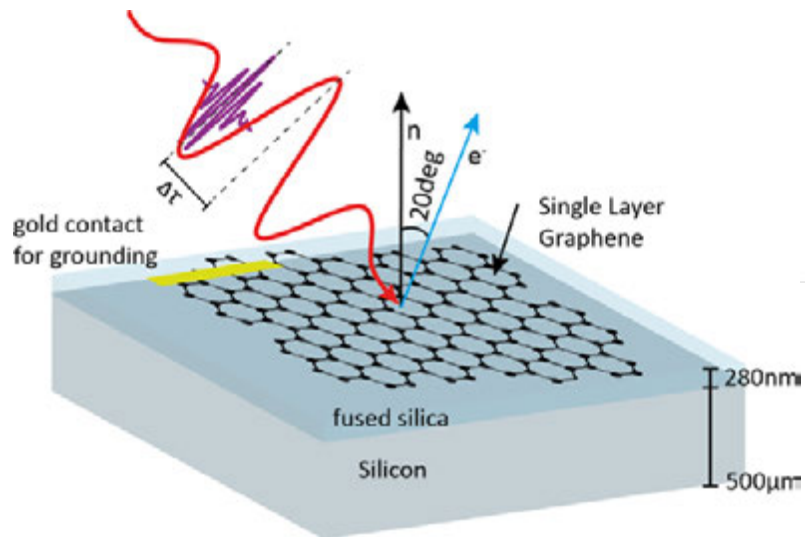
Results

- Generalize attosecond streaking spectroscopy to record the attosecond electron dynamics.
- Insight in the inner workings of molecular systems.
- Possible application of the measured systems in detection systems, laser technology, photovoltaic cells, etc.

SCIENTIFIC ACTIVITIES AND GOALS IN PROGRESS

Attosecond Electron Dynamics on Graphene***Benchmark system for recording electron dynamics with attosecond streaking:***

- Well studied theoretically.
- Experimentally studied electron dynamics in few-fs time scale.

**Upcoming tasks:**

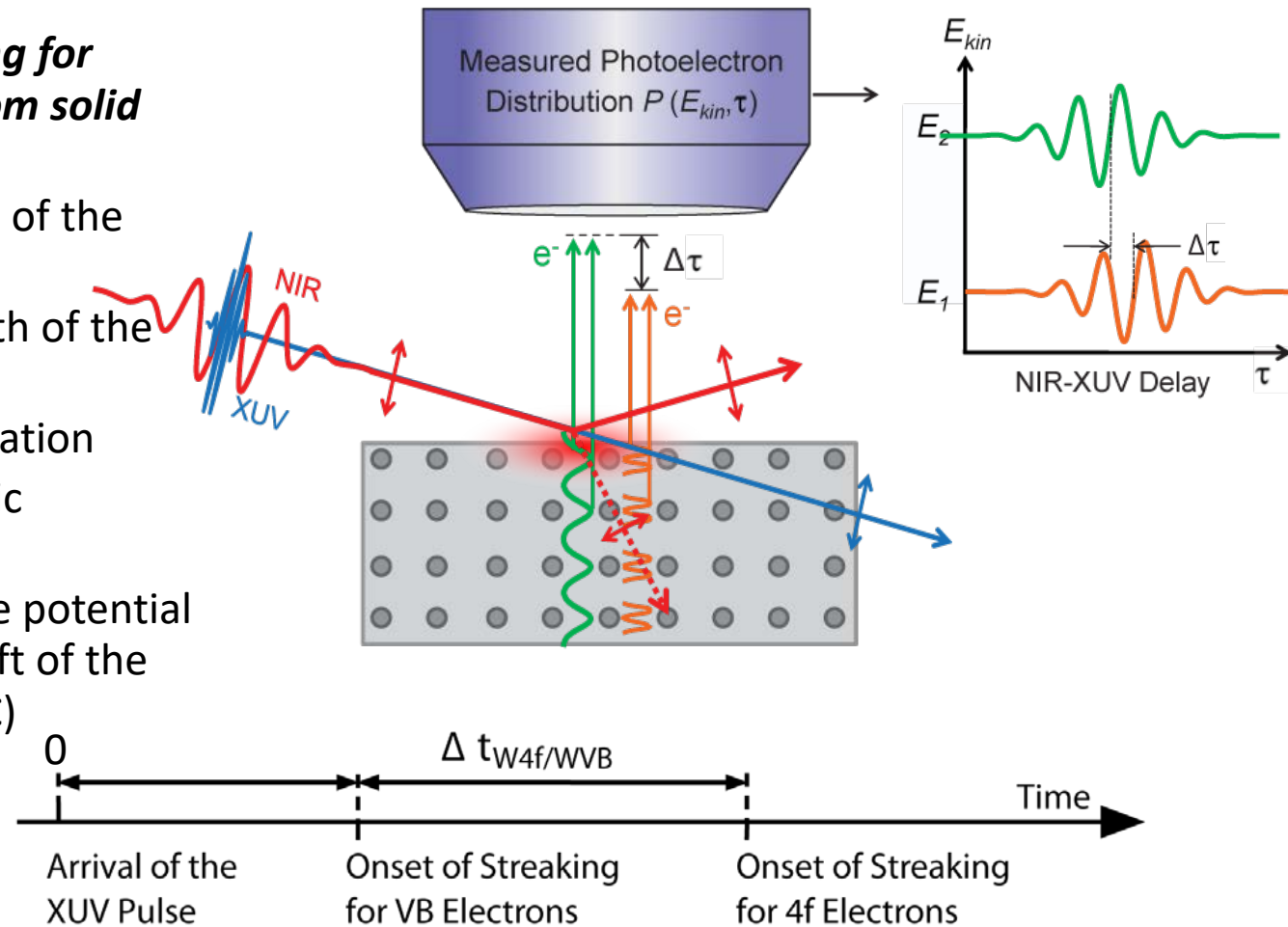
- Study monocrystalline graphene sample.
- Implement hemispherical detector for k-space resolution.
- Improve experimental and analysis methods.

SCIENTIFIC ACTIVITIES AND GOALS IN PROGRESS

Attosecond Streaking Chronoscopy of Tungsten

The onset of streaking for electrons emitted from solid state depends on

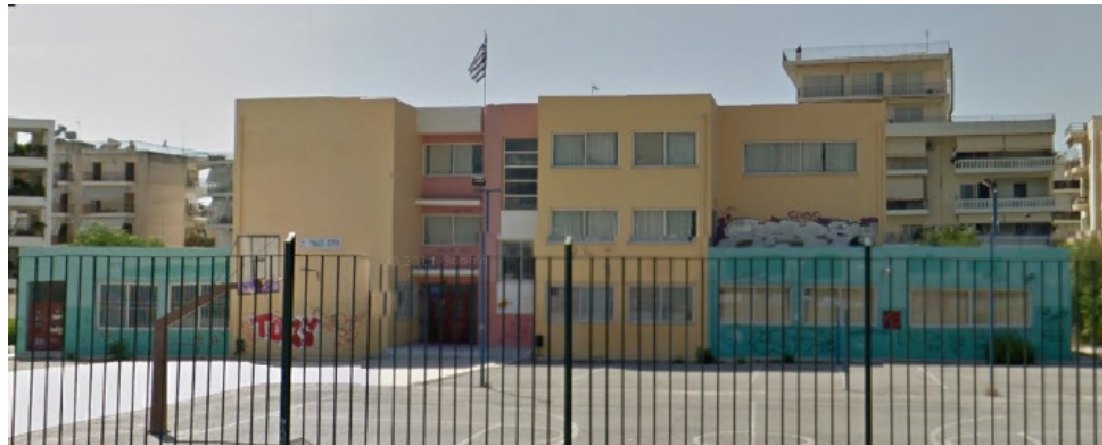
- Penetration depth of the NIR field
- Mean escape depth of the electrons
- Velocity of propagation
- Elastic and inelastic scattering
- Lattice and surface potential induced phase shift of the electron (EWS,CLC)



SECONDMENTS, OUTREACH ACTIVITIES AND SOFT SKILLS TRAINING

Ongoing secondment at TRUMPF

Planned secondments	Start (month)	Duration (months)	Objectives/ Content of the training
TRUMPF	27	4*	Design and operation of a high-power pump laser for OPCPA based on thin-disk technology. The goal parameters of the pump laser are 200 mJ at 5 kHz repetition rate.
FORTH	33	1	Interferometric polarization gating (RTM)
FEMTO	35	1*	CEP-stabilisation noises in high power amplifiers. How to perform market analysis (TSM), R&D in industry (TSM), CEP stabilization of oscillators and amplifiers (RTM)

Planning Outreach activity at 21° Gymnasium of Patras, Greece

High Energy, High Power Few Cycle OPCPA prototype laser system. High-power pump source, based on regenerative thin-disc amplifier. Repetition rate 6 kHz

CAREER DEVELOPMENT PLAN AND FUTURE ACTIVITIES

Research Skills and techniques acquired:

1. Training in laser alignment
2. Training in high power laser systems
3. Training in XUV attosecond pulse generation techniques
4. Training in operation of Ultra High Vacuum systems
5. Training on surface treatments and sample preparation methods
6. Training in photoelectron spectroscopy techniques
7. Training in attosecond streaking spectroscopy

Transferable skills (including communication skills)/ entrepreneurial skills:

- Special training session on Photonics Explorer Kit (17/10/2016 IESL-FORTH, Heraklion, Greece)

Other professional training (course work, teaching activity):

- Lab tour for High school students within the MPQ photon lab training
- Project Management Seminar at TUM
- German language Courses at TUM
- Working students