

Virtual workshop

Quantum Battle in Attoscience –

An Example of Science

Communication

Dejan Milošević

**Faculty of Science, University of Sarajevo
& Academy of Sciences and Arts of
Bosnia and Herzegovina**

Connect 2020, Neum, August 27, 2020

Outline

- COVID-19 pandemic, WHO, March 11
- Anton Zeilinger, Sarajevo lecture March 11
- COST actions
- Xi'an, Beijing, Wuhan, Dresden, Lyon
- ANUBiH
- Quantum Battle in Attoscience – July 1-3

**ACADEMY OF SCIENCES AND ARTS OF
BOSNIA AND HERZEGOVINA**

invites you to a lecture by Academician Anton Zeilinger
President of the Austrian Academy of Sciences

**QUANTUM PUZZLES:
FROM FOUNDATIONS TO APPLICATIONS**

The lecture will be held on Wednesday, 11th March, 2020 at 12:00
in the amphitheater of the Faculty of Science, University of
Sarajevo, Zmaja od Bosne 33-35



Quantum Puzzles:
From Quantum Foundations to Quantum
Information and Quantum Communication



Colloquium
Sarajevo
11 March 2020









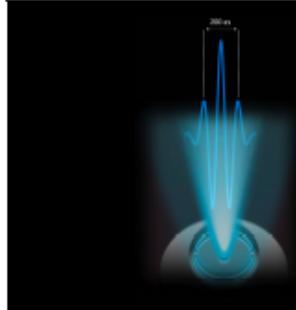
COST Action - AttoChem

- The European Cooperation in Science and Technology (COST) is a funding organisation for the creation of research networks, called COST Actions. These networks offer an open space for collaboration among scientists across Europe (and beyond) and thereby give impetus to research advancements and innovation.
- COST is bottom up, this means that researchers can create a network – based on their own research interests and ideas – by submitting a proposal to the COST Open Call. The proposal can be in any science field. Actions are highly interdisciplinary and open ...

CA18222 - Attosecond Chemistry

AttoChem Action is an **interdisciplinary network supported by COST**, whose main objective is to design new strategies for the control of charge migration in molecules by directly acting on the attosecond time scale. This ability will be used to selectively break and form chemical bonds, thus opening new avenues for the control of chemical reactions. **The AttoChem network will coordinate experimental and theoretical efforts to exploit the large potential of attosecond techniques in chemistry** and will also act as a liaison with the relevant stakeholders to bridge the gap to industrial applications.

Work Package 1



New attosecond techniques for the control of electron dynamics in molecules.

WG1 leader - Caterina Vozzi

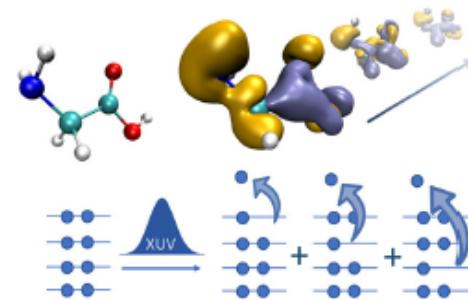
caterina.vozzi@polimi.it

Work Package 2

Computational tools for the description of attosecond electron and nuclear dynamics.

WG2 leader - Ladislau Nagy

lnagy@phys.ubbcluj.ro



Work Package 3



Attosecond imaging and control of charge migration and chemical reactivity.

WG 3 - Franck Lepine

franck.lepine@univ-lyon1.fr

COST Action researchers win ERC Advanced Grants

- Anne L'HUILLIER (Lund University), for a project entitled *Quantum Physics with Attosecond Pulses (QPAP)*. With the grant from ERC, Anne and colleagues plan to use laser technology to create ultra-short light pulses to study the motion of electrons within atoms and molecules.
- Fernando MARTÍN (Autonomous University of Madrid), for a project entitled: *Imaging, Decoherence, and AttoSecond probing of ionization-induced charge migration in molecules (IDEAS)*. Its objective is to understand, and eventually predict, the first stages of charge migration processes in complex molecules, occurring in the time range of attoseconds.
- Jonathan TENNYSON (University College London), for a project entitled: *Precision spectroscopic data for studies of exoplanets and other hot atmospheres (ExoMolHD)*. The project aims to provide data to enable astronomers to analyse the atmosphere of planets orbiting other stars, to better understand their composition.

The projects are among the 82 projects in the Physical Sciences and Engineering domain. **The sum of the three grants are bringing more than 7 million euros to carry out research.** For further information and details on these projects, follow this [link](#).

Dear MC member,

We would be delighted, if you could participate at the 1st Action Workshop (to be held in Cluj, Romania, from March 18 to 20) and the MC meeting of the ATTOCHEM COST action.

See you in Cluj!

Best regards,

Ladislau Nagy
local chair

First ATTOCHEM WORKSHOP postponed to September

The 1st Annual Workshop of the COST Action CA18222 on Attosecond Chemistry has been postponed to September, 9-11, 2020. It will be held at the same location (Babeş-Bolyai University, Cluj-Napoca, Romania) and will be jointly organized with two parallel Working Group (WG1&WG2) meetings.

COST Action CA18212

MOLECULAR DYNAMICS IN THE GAS PHASE (MD-GAS)

Develop a new physical and chemical toolbox to significantly advance the understanding of:

- Gas phase molecular dynamics induced in interactions between molecules or clusters and photons, electrons, or heavy particles
- Its consequences for a broad range of applications in e.g. astrochemical and atmospheric sciences, and molecular radiation damage
- Outstanding questions in science:
- How are interstellar molecules formed and how do they survive harsh radiation fields?
- How far ranging is the complexity of the molecules in the molecular universe?
- How do aerosol particles form in planetary atmospheres?
- How did the building blocks of life survive on Earth in the absence of a protective ozone layer?

1st Annual Meeting 18-21 February 2020 Caen, France

Centre de Recherche sur les Ions, les Matériaux et la Photonique



- By car**
 - 2h30 from Paris
- By train**
 - 2h from Paris
- By plane**
 - Caen Carpiquet

Normandy is famous for:



Cheese, cider
and calvados

Weather



A. Domaracka





1 / 1



AKADEMIJA NAUKA I UMJETNOSTI
BOSNE I HERCEGOVINE



АКАДЕМИЈА НАУКА И УМЈЕТНОСТИ
БОСНЕ И ХЕРЦЕГОВИНЕ

ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA

Sarajevo, 22. 6. 2020. godine

Broj: 10-6 – 09-2 – 289-17/18

Predmet: Okrugli sto „Harmonizacija sistema nauke u BiH – problemi i moguća rješenja“

Poštovane/i,

Zahvaljujem vam se na prihvatanju učešća u radu okruglog stola „Harmonizacija sistema nauke u BiH – problemi i moguća rješenja“. Posljednje razbuktavanje pandemije zahtjevalo je da okrugli sto održimo isključivo posredstvom informaciono-komunikacionih tehnologija. Dozvolite mi, stoga, nekoliko napomena o načinu rada.

Dnevni red:

1. Pozdravna obraćanja predstavnika Federalnog ministarstva obrazovanja i nauke, Federalnog zavoda za statistiku i ANUBiH;
2. Prezentacija rezultata teorijskih istraživanja projekta „Harmonizacija sistema nauke u BiH“;
3. Prezentacija rezultata empirijskog istraživanja u projektu „Harmonizacija sistema nauke u BiH“;
4. Diskusija;
5. Usvajanje zaključaka.

COVID-19 PROJEKTI



Epidemiološki lokacijsko-obavještajni sistem

Pedagoški i andragoški izazovi u kontekstu kućne izolacije
djeca do 18 godina u vrijeme pandemije COVID-19



ACTIVITIES



Introduction

Project Title, Duration, Subject of Research and Aims

Project Team

Project Status

Epidemic Surveillance

Methods

Dissemination and Exploitation of Results

Complementary and Further Research

References

Visite website:

ELIS geoportal

Epidemic Location Intelligence System: expert system for monitoring and prevention of the spread COVID-19

Introduction

At the end of 2019 the world became aware of the existence of a new virus from the Coronaviridae family and a specific disease - COVID-19 caused by it. In less than three months, the virus and its consequences developed into a global problem we all had to face. On March 11, 2020 the World Health Organization (WHO) declared a pandemic of COVID-19.

The Academy of Sciences and Arts of Bosnia and Herzegovina (ANUBiH) was one of the first institutions of the science system to respond to the outbreak of a pandemic by launching research projects to prevent it and mitigate the consequences for Bosnian society. At the initiative of the Committee for Microbiology and Related Disciplines, a team of scientists on a volunteer basis launched a project to establish the Epidemiological Location-Intelligence System (ELIS) and a geoportal that permanently monitors the spread of COVID-19 in Bosnia and Herzegovina.

Contents



**ANUBiH
ELIS**

Epidemic Location Intelligence System (ELIS)

Geoportal for epidemiological monitoring of COVID-19 epidemic spread in Bosnia and Herzegovina

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Maps

Bosna i Hercegovina

Prostorno-vremenska prezentacija
COVID-19 (podaci iz javnih izvora)

Karta svijeta

Podaci iz Svjetske zdravstvene
organizacije (World Health Organization)
27.07.2020

Quantum Battles in Attoscience

VIRTUAL WORKSHOP

01 - 03 July 2020, ONLINE



Conference picture with a small sample of the conference participants. It was impossible to gather over 300 people from 35 countries at the same time.



Vision & Aims

Attosecond science has emerged from the study of the interaction of matter with intense laser fields, and it is the natural successor of femtochemistry. Its main objective is to resolve and ultimately control electron dynamics in real time. Electrons play a key role in photosynthesis, destroy or modify molecules, and can be used for information processing in human-made devices. This wide range of applications and huge potential for attosecond imaging of matter has made it a hugely popular and expanding area. Unfortunately, this rapid growth has led to a vast, fragmented methodological landscape, with many conflicting views.

The present workshop is focused on the **quantum** aspects of attoscience. It aims at exploring areas of tension in a **collegial** and **controlled** way and at providing a debating platform for early career researchers and leaders in the field.

Structure

To make this event of use to the community, we have formulated it to answer three key questions:

- What is the current state of the theoretical and computational 'tool-box' to address quantum dynamics in attosecond physics?
- What questions are open in attosecond physics which may be answered best by each of the methodological tools which are currently available?
- Which new tools need to be developed to answer current and future questions?

1. Invited talks

Three to four leading experts each present a short (ca 30min) talk in a block of 45-60 minutes. These talks will be positioned at the start of each day in order to set the context for the ensuing "Quantum Battle".

2. Battles

The 'Quantum Battle' is essentially an open debate on a contentious topic involving several early career researchers ('combatants') and the entire audience of attendees. Each session will be mediated (refereed!) by a neutral party and by means of a sort of structured debate format combatants will present arguments, question each other, and field questions from the audience. We expect there to be some discussion not only of the applicability of current methodology to future questions, but also the development of new theory/experiment to tackle new questions.

Combatants will be invited to collaborate with organisers and each other **before** the event on the design of their battle- pre-agreeing the scope and focus of the session.

3. Contributed Clips & Twitter poster session

You are encouraged to submit a 2 minute video clip explaining an aspect of your research which will be visible on twitter before, during (and beyond) the conference.

Day 1: Tunnelling & coherence

Invited talks – Tunnelling Chair: Carla Faria		
Time (London Time)	Speaker	Title
10:00 – 10:30	Jan Michael Rost	Effects of Non-Adiabaticity in Strong Field Dynamics
10:30 – 11:00	Robert Moshammer	What is "time" in photoionization - in strong and weak fields?
11:00 – 11:30	Lars Bojer Madsen	Tunnelling theory of molecules
11:30 – 12:00	Break	
Quantum Battle 1 -- Tunnelling Chair: Jonathan Tennyson		
12:00 – 13:00	Nikolay Shvetsov-Shilovski, Alexander Bray, Hongcheng Ni, Cornelia Hofmann, Werner Koch	
13:00 – 14:00		Lunch Break

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Attendees +

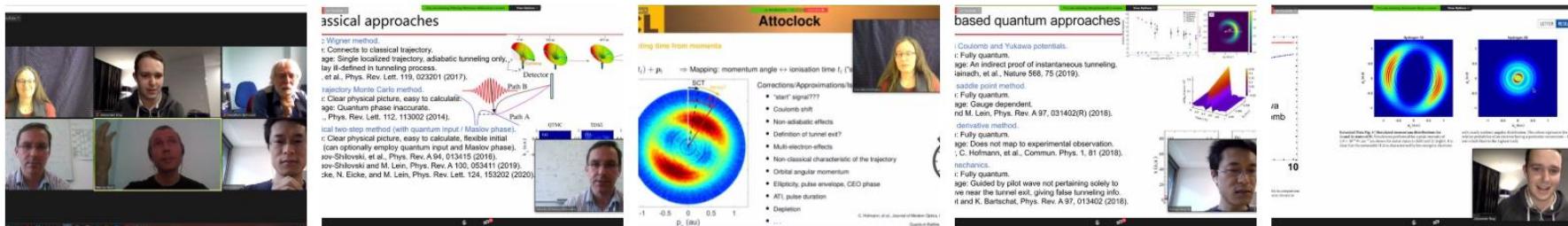
Programme +

Poster Session

Contributed Clips

Registration

More +



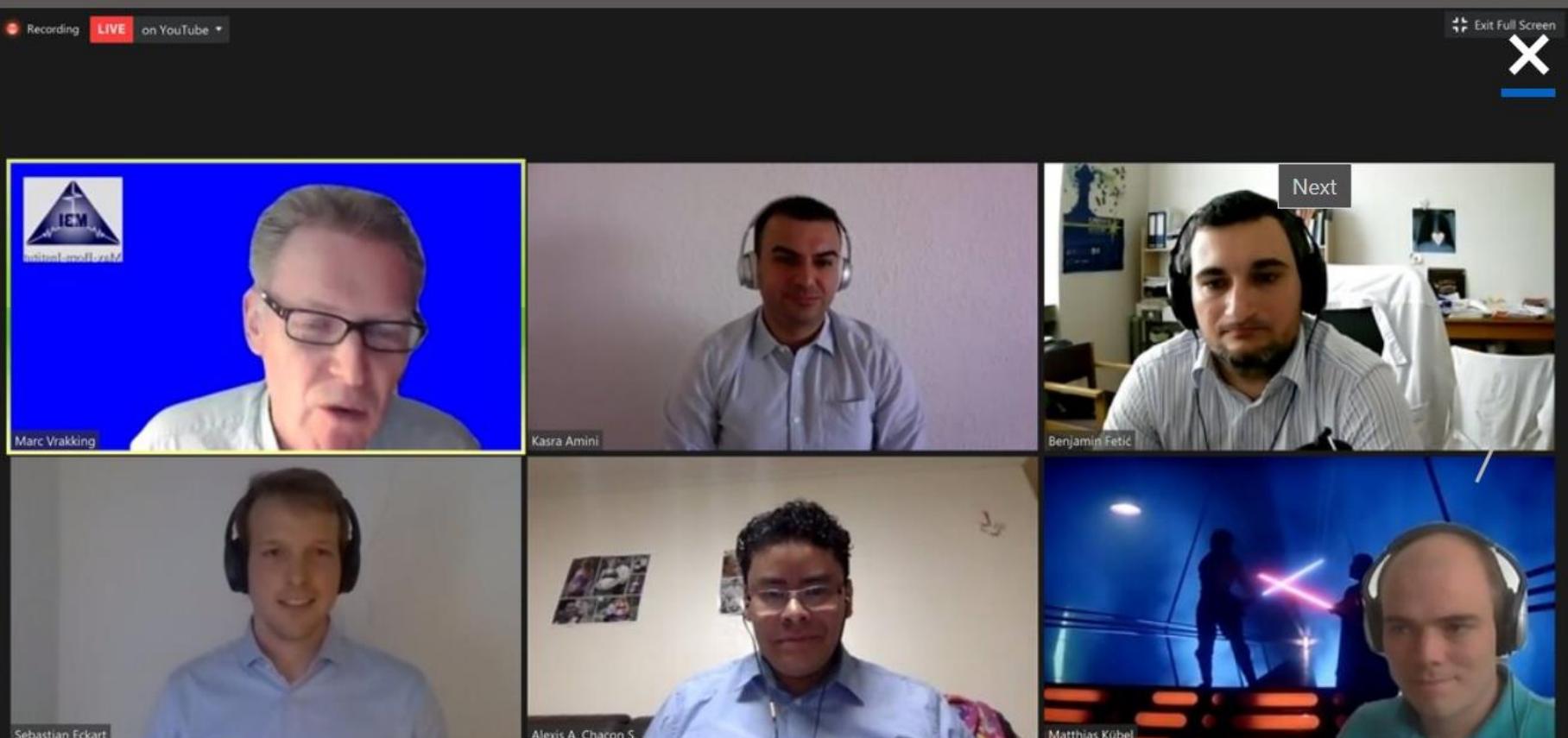


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Day 2 : Electron Correlation & Quantum Interference

Invited talks – Quantum Interference & Imaging Chair: Sergey Yurchenko		
Time (London Time)	Speaker	Title
09:30 – 10:00	Marc Vrakking	Attosecond Entanglement and Coherence
10:00 – 10:30	Pascal Salieres	Attosecond photoemission dynamics
10:30 – 11:00	Caterina Vozzi	Quantum interference in high-order harmonic spectroscopy
11:00 – 11:30	Klaus Bartschat	Coherent Control and Attosecond Dynamics with Pulsed XUV and IR Radiation
11:30 – 12:00	Break	
Quantum Battle 2 – Quantum interference & Imaging Chair: Marc Vrakking		
12:00 – 13:30	Sebastian Eckart, Matthias Kubel, Benjamin Fetic, Kasra Amini, Alexis Agustín Chacón Salazar	
13:30 – 14:30	Lunch Break	
Invited talks – Electron-electron correlation Chair: Camilo Ruiz		
14:30 – 15:00	Jing Chen	Interference effects: challenge in non-sequential

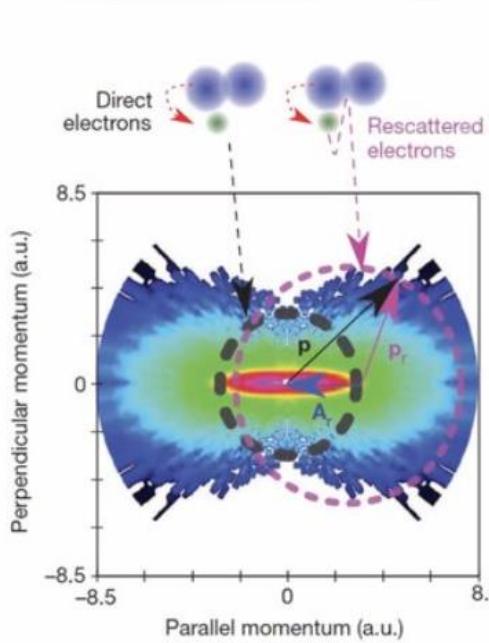


LIVE on YouTube

You are viewing Kasra Amini's screen

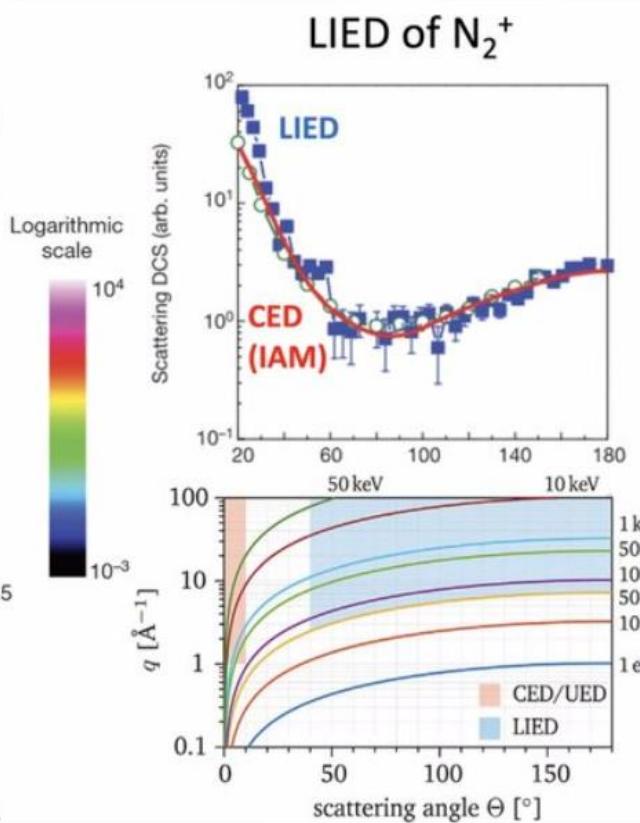
View Options

LIED works! - Kasra



$$p_r = p_{\parallel} - A_r$$

C. I. Blaga et al., Nature 483, 194 (2012).



X. Liu et al., JCP 151, 024306 (2019)

Audio Settings ^

Chat

Raise Hand

Q&A

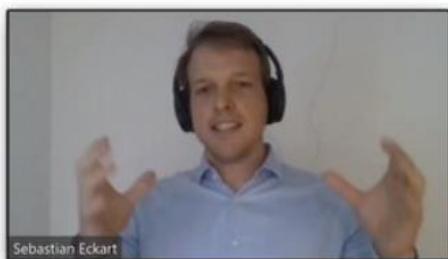
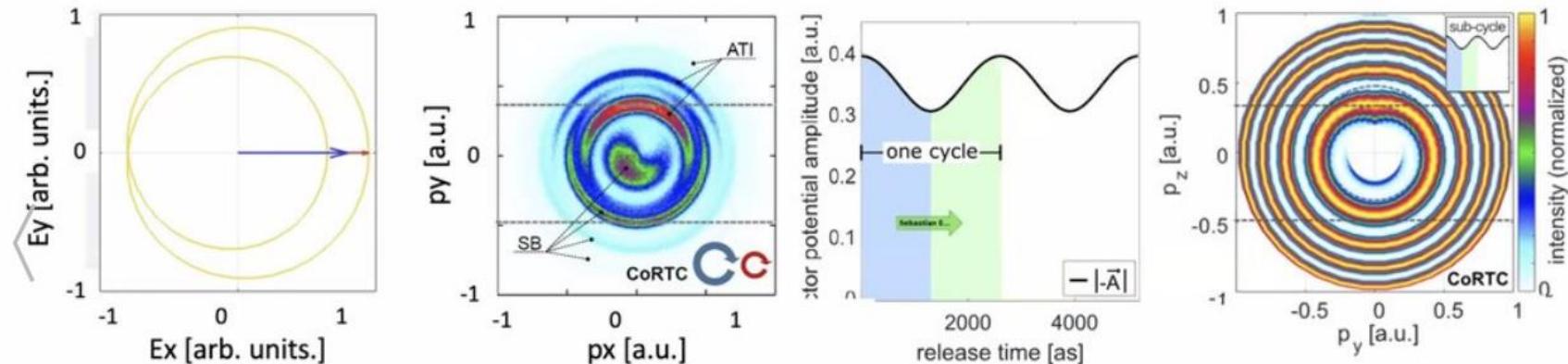
Approximate method used for extraction of the PCS from the time-dependent wave function should always be checked for the consistency with the PCS method.

Leave

LIVE on YouTube

Intra-cycle interference cannot be modeled by photons - Sebastian

How can position-information or time-information be retrieved from measured electron momentum distribution without recollisions?



Han, M., Ge, P., Shao, Y., Gong, Q. & Liu, Y., *Phys. Rev. Lett.* **120**, 73202 (2018)

Feng, Y. et al., *Phys. Rev. A* **100**, 63411 (2019)

Eckart, S., Preprint at <https://arxiv.org/abs/2003.07249> (2020)

Trabert, D. et al. Preprint at <https://arxiv.org/abs/2005.09584> (2020)

Eckart, S. et al. Preprint at <https://arxiv.org/abs/2005.04148> (2020)

Audio Settings ^

Chat Raise Hand Q&A

Approximation method used for extraction of the PCS from the time-dependent wave function should always be checked for the consistency with the PCS module.

Leave

Previous

weebly

Correlation & Quantum



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Conclusion - Benjamin



- ➊ In order to simulate an ionization experiment, one appropriate continuum state $\Phi_{\mathbf{k}}^{(-)}(\mathbf{r})$ which satisfy so-called incoming boundary condition.
- ➋ The problem with the window-operator method is that it does not single out the contribution of the solution $\Phi_{\mathbf{k}}^{(-)}$, but it includes an unknown linear superposition of the states $\Phi_{\mathbf{k}}^{(-)}$ and $\Phi_{\mathbf{k}}^{(+)}$. Therefore, it may lead and does lead to unphysical results, depending on the considered region of the spectrum.
- ➌ Approximate method used for extraction of the PES from the time-dependent wave function should always be checked for the consistency with the PCS method.

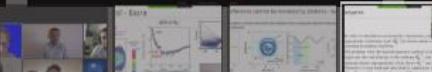
Audio Settings ^

Chat

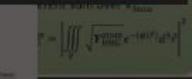
Raise Hand

Q&A

Leave



Approximate method used for extraction of the PES from the time-dependent wave function should always be checked for the consistency with the PCS method.



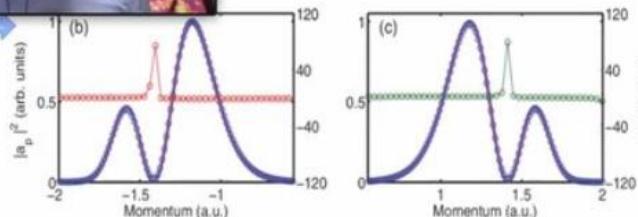
QSPIDER: Phase Interferometry for Direct EWP Reconstruction - Alex



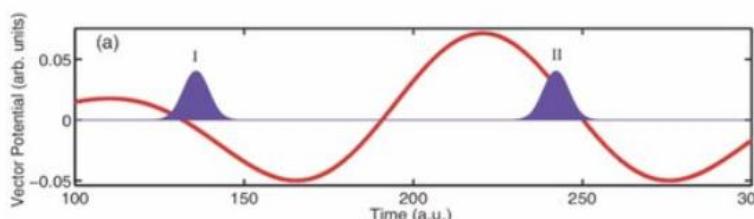
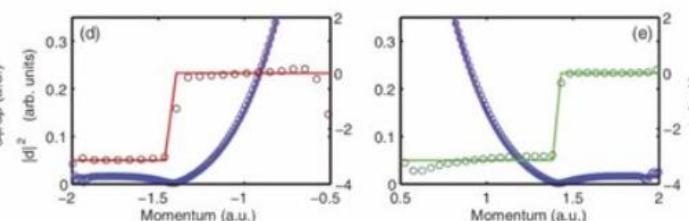
Applications of qspider to retrieve EWP_s And Dipole “phases”:

SFA- ionisation from 2pz states of He+

EWP-retrieval



Dipole Matrix Elems.



A. Chacon et al., PRA (2014)

Quantum Battles 2020

Battle 2 - Quantum Interference and Imaging

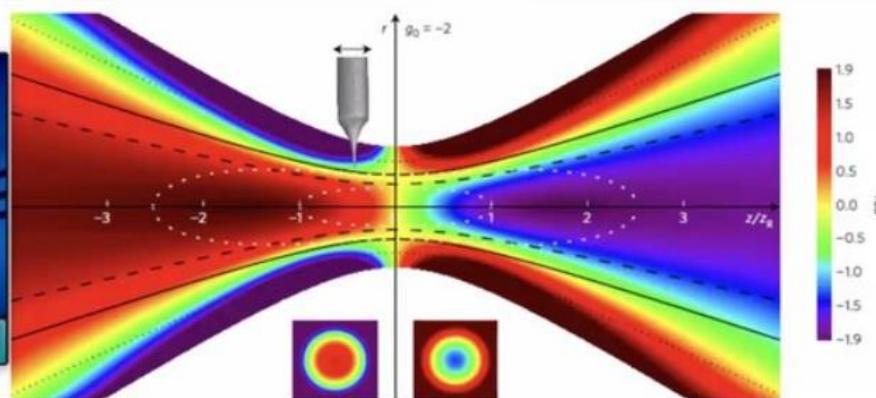
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You are viewing Kasir Amini's screen

View Options

Coherence and incoherence in strong fields - Matthias



HHG: Phase matching
coherent sum over V_{focus}

$$\mathbf{Y}_{\text{HHG}}^{\text{focus}} = \left| \iiint_V \sqrt{\mathbf{Y}_{\text{HHG}}^{\text{atom}}} e^{-i\phi(\vec{r})} d^3\vec{r} \right|^2$$

ATI: Focal volume averaging
incoherent sum over V_{focus}

$$\mathbf{Y}_{\text{ATI}}^{\text{focus}} = \iiint_V Y_{\text{ATI}}^{\text{atom}} d^3\vec{r}$$

Audio Settings

Chat Raise Hand Q&A

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Schedule



Quantum Battle 3 -- Q3

What does 'Scientific Discovery' look like in our field?

Analytical methods in physics

Approximate quantum systems can be solved analytically without approximation, e.g.:
• Ions in 1D
• 1D (first) electromagnetic field
• Harmonic oscillator
• Hydrogen atom

Commonly applied analytical method is perturbation theory
• Unsolvable Hamiltonian in terms of a series expansion of an analytically solvable system
• Few-photon ionization & excitation
• Shifting mean diagrams

initio ≠ exact

Ab initio methods offer a systematic way of improving the accuracy.
It does not rely on semiempirical fittings or parametrizations, giving the method "fidelity".

Correlation can be included to different levels of approximation (or neglect).
The basis sets used (subspace of solutions) can be optimized by fitting procedures to speed up the convergence towards exact solution.

The use of pseudopotentials (core electrons, relativistic effects) within ab initio frameworks leads to hybrid methods (not fully ab initio).

Problems can be solved faster computationally and often better with degrees of freedom

1. Can run this on a desktop computer in minutes, ab initio code would take 100s cores
2. Allows computations such as focal averaging that add at least 10x to computation time
3. Could perform in-depth scan through intensity and frequency to validate our predictions

Scientific Discovery. Resonant HHG through the challenges: ab initio

Time-dependent complete-active-space self-consistent-field (TD-CASSCF) & Time-dependent occupation-number (TD-ON) methods

Hydrogen PRA

TO BE CONTINUED...

Time-dependent Hartree-Fock (TD-HF)

MRII

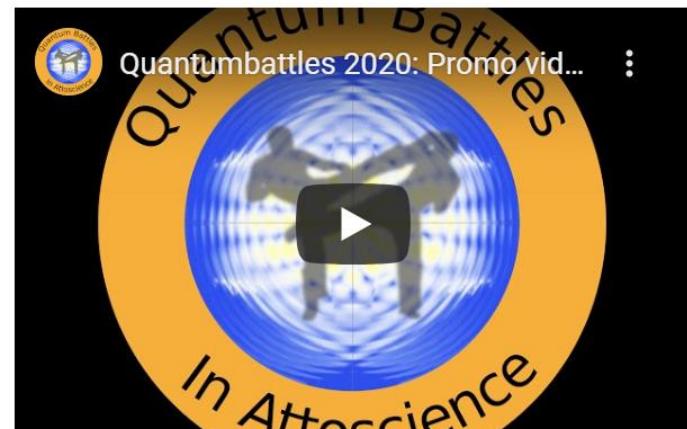
Hydrogen PRA

Day 3 : Ab initio vs Analytical Approaches

Youtube Channel

All the video content from the conference will be posted to our YouTube channel, including contributed clips, and (after the conference) the talks and battles.

[Click here for Quantum Battles on YouTube](#)

A screenshot of a web browser window. The address bar shows the URL: <https://www.quantumbattles.com/social-media.html>. The browser has several tabs open, including "Scientific Programme", "The European Physic", "quantumbattles on T", "QUANTUM BATTLES", "Social Media - QUAN", and another "Scientific Programme".

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Twitter

Up to the minute information about the conference, including links to all the conference posters will appear on our twitter feed.

Tweets by [@quantumbattles](#)



quantumbattles
[@quantumbattles](#)

Dear all, we would be grateful if you could take some time and fill in this form (<https://www.quantumbattles.com/feedback/>) This information is

[Click here for Quantum Battles on Twitter](#)



Ignore Delete Archive

Reply Reply All Forward More

 Move to: ? To Manager
 Team Email Reply & Delete
 Create New Move Rules OneNote
 Actions

Mark Unread Categorize Tags

Delete

Respond

Quick Steps

Move

Tags



čet 2.7.2020 21:27

Quantum Battles <quantumbattles@gmail.com>

Day 3 Zoom links

To undisclosed-recipients:

Dear conference attendees,

Below we list the Zoom **attendee/ regular participants** links for the three sessions on day 3 of quantum battles.

day3-am-talks

Invited talks on Numerical & Analytic Methods

09:30 - 11:30 (UK time/ BST/ UTC+01:00)

Chair: Dieter Bauer

<https://us02web.zoom.us/j/81197745693?pwd=amtyeE0rMFRhUThuN1JHL2xtcTVmUT09>

Password: 864503

Note this session will be recorded

day3-battle3

Third and Final Quantum Battle: Numerical vs Analytical Methods

12:00 - 13:00 (UK time/ BST/ UTC+01:00)

Chair: Stefanie Graefe

<https://us02web.zoom.us/j/85731227637?pwd=TmtEcCtPbVBwdDFxcS9kenRqUVNjZz09>

Password: 864503

Note this session will be recorded

day3-pm-talks

Invited talks on Liquids and Solids

14:00 - 15:30 (UK time/ BST/ UTC+01:00)

Chair: Jens Biegert

<https://us02web.zoom.us/j/83182047188?pwd=QkJjcXhMZmNTRGQ2dmxVMUFOeGwdx09>

Password: 864503

Note this session will be recorded

The strong-field approximation: strengths, shortcomings, and outlook

Wilhelm Becker, Jing Chen, and Dejan B. Milošević

Max Born Institut, Berlin, Germany
Institute of Applied Physics and Computational
Mathematics, Beijing, China
Faculty of Science, University of Sarajevo, Sarajevo,
and Academy of Sciences and Arts of Bosnia and
Herzegovina, Bosnia and Herzegovina

Quantum Battle, University College, London, July 1 - 3, 2020

Beauty in Strong Field Physics and Attoscience: Exhibition of Selected Figures from Published Works

Dejan B. Milošević

**Faculty of Science, University of Sarajevo and
Academy of Sciences and Arts of Bosnia & Herzegovina**

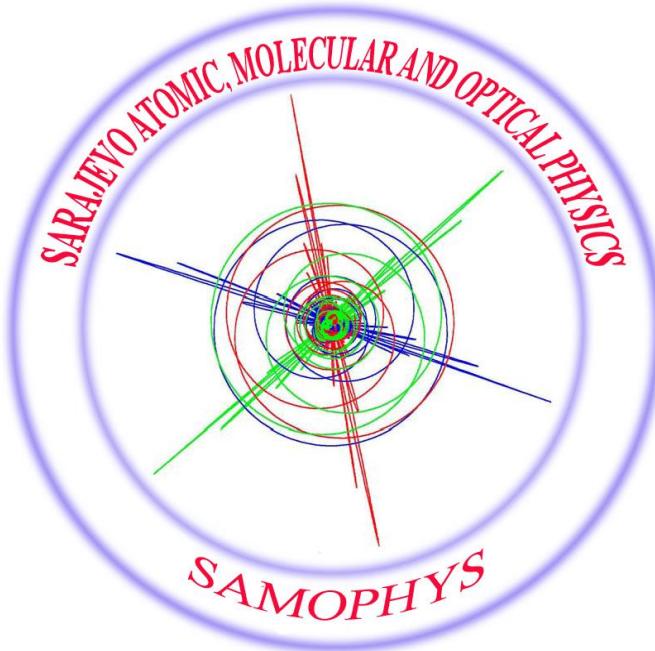
2020

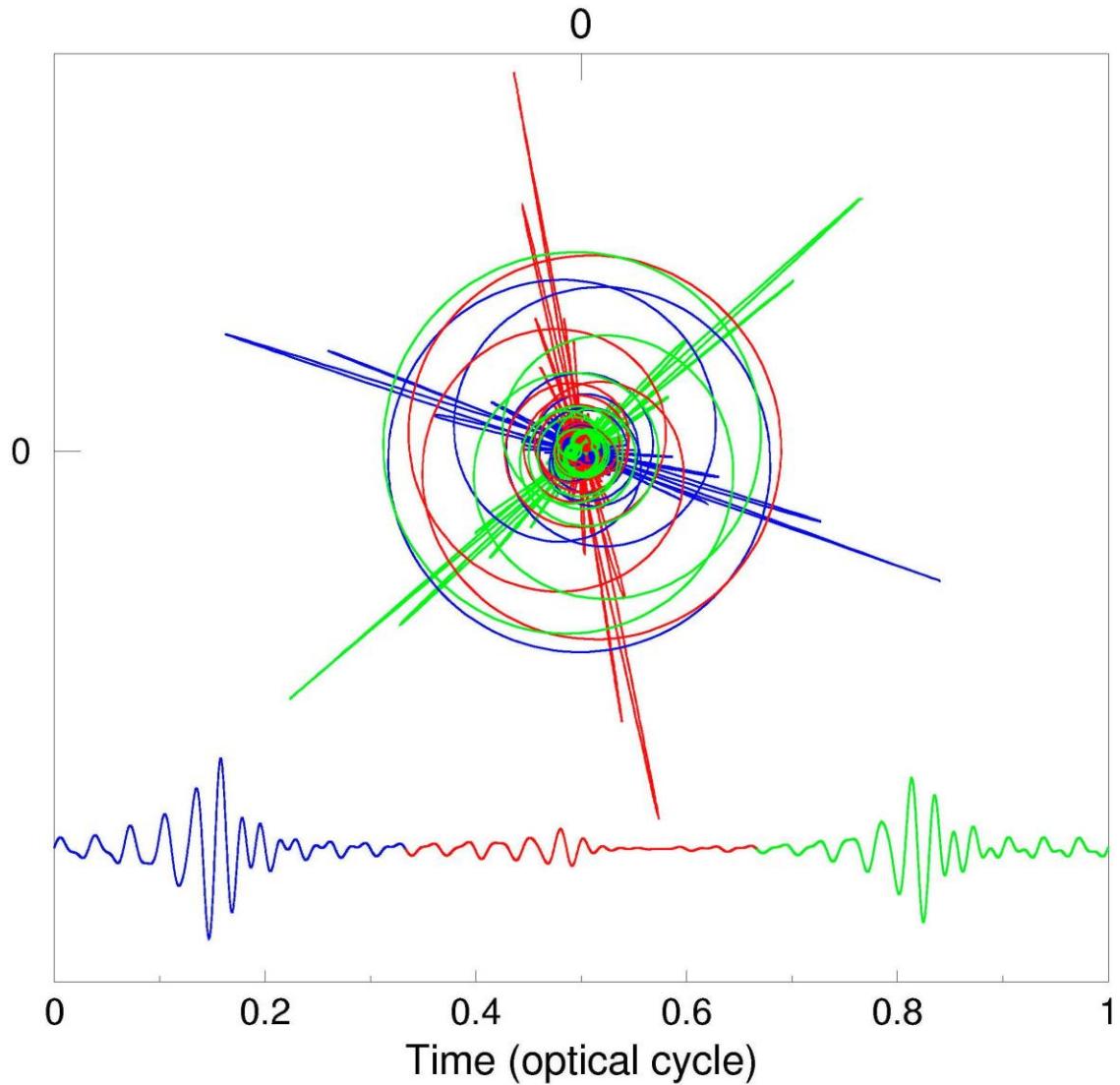
Outline

- Strong-field physics and attoscience are developed based on the discovery of the CPA method for generating high-intensity, ultra-short optical pulses for which Gérard Mourou and Donna Strickland shared 1/2 of the Nobel Prize in Physics 2018
- Chirped Pulse Amplification was discovered in 1985
- Dejan B. Milošević: first paper in strong-field physics in 1987, first paper in attoscience in 1996
- Scientific Research group Samophys 2000
- Cover pages in scientific journals
- Kaleidoscope selections in Physical Review are based on aesthetics merit

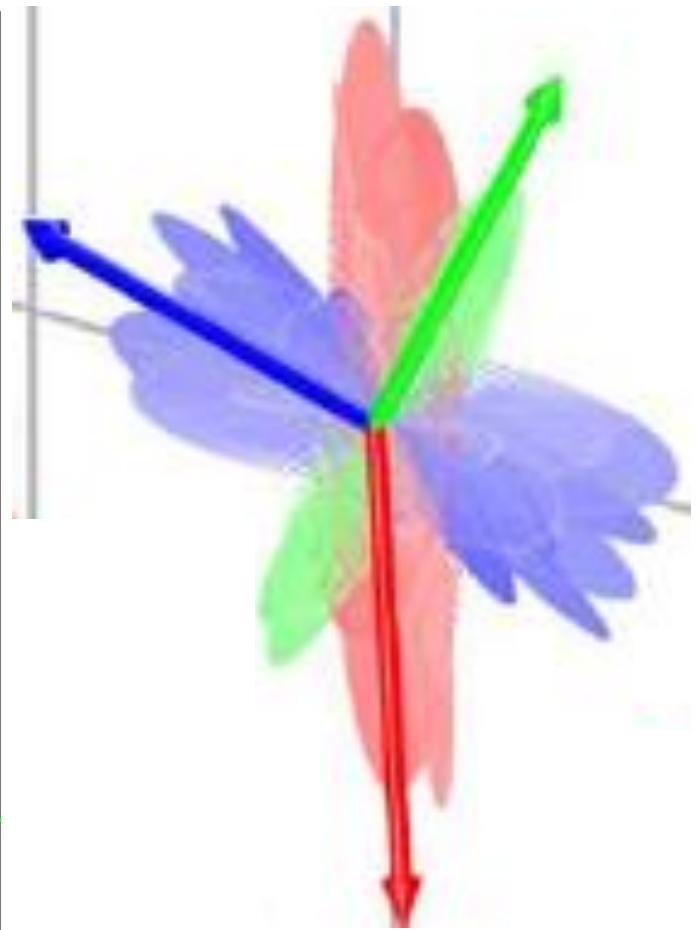
Research Group **SAMOPHYS**

- Prof. Dr. Mustafa Busuladžić
- Prof. Dr. Senad Odžak
- Prof. Dr. Azra Gazibegović-Busuladžić
- Prof. Dr. Aner Čerkić
- Prof. Dr. Elvedin Hasović
- Doc. Dr. Benjamin Fetić
- Dino Habibović (PhD student)
- Students ...





Theory: D. B. Milošević and W. Becker,
Phys. Rev. A **62**, 011403(R) (2000)



Experiment: 3D atto
metrology, Murnane et al
Science Advances **2**,
e1501333 (2016)

Field of the 2 components and the resulting bi-chromatic field



$$\vec{E}_{\omega_0}(t)$$

$\lambda = 790 \text{ nm}$

Left rotating

$$\vec{E}_{2\omega_0}(t)$$

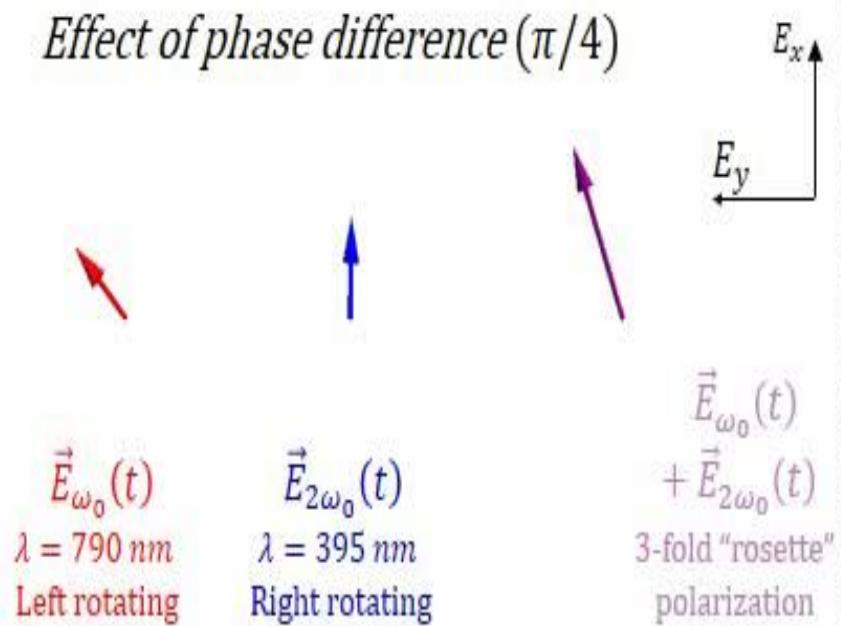
$\lambda = 395 \text{ nm}$

Right rotating

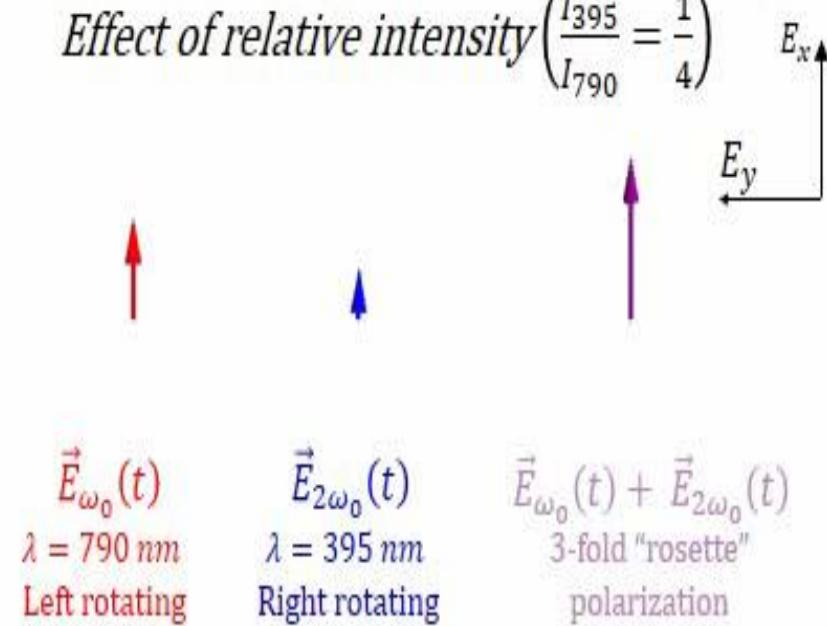
$$\vec{E}_{\omega_0}(t) + \vec{E}_{2\omega_0}(t)$$

3-fold "rosette" polarization

Effect of phase difference ($\pi/4$)



Effect of relative intensity ($I_{395} = \frac{1}{4} I_{790}$)



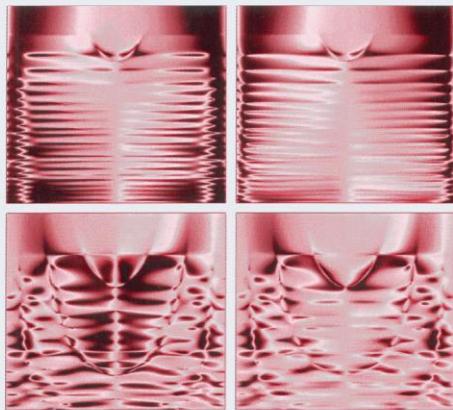
Journal of Physics B

Atomic, Molecular
and Optical Physics

Volume 44 Number 12 28 June 2011

Topical review

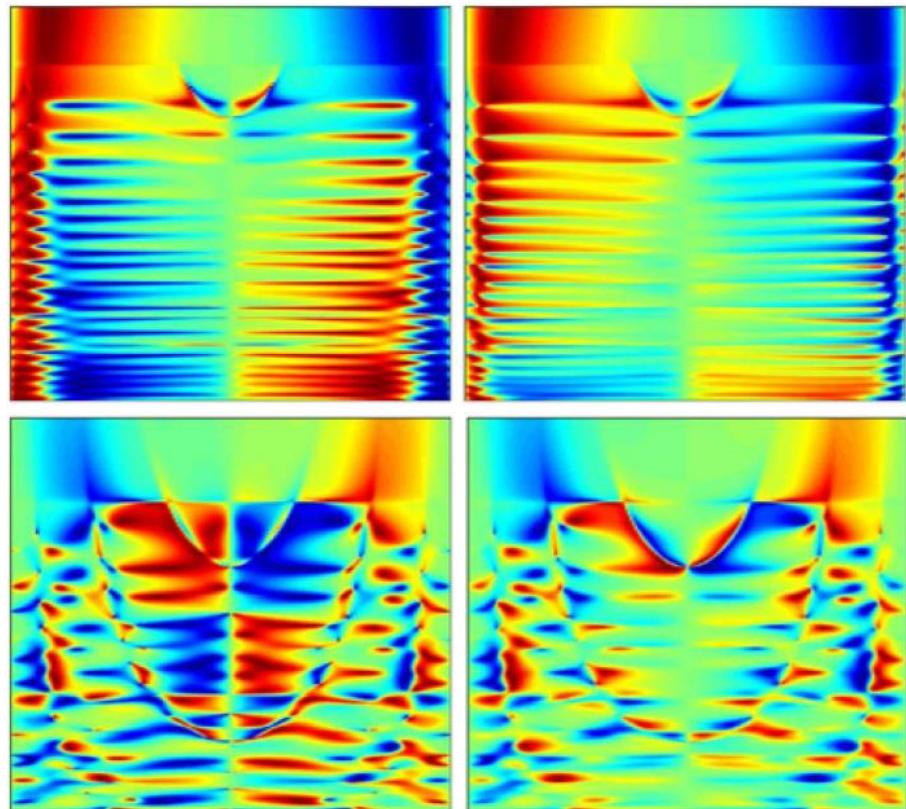
Current status of antiproton impact ionization of atoms and molecules:
theoretical and experimental perspectives
Tom Kirchner and Helge Knudsen



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Cover page in J. Phys. B
Vol. 44, Number 12, June 2011:



Ellipticity and the offset angle of high harmonics generated by
homonuclear diatomic molecules

S. Odžak and D. B. Milošević, J. Phys. B **44**, 125602 (2011)

COL 封面故事：中红外强激光阈上电离过程中的前后向散射

用强激光场电离原子或分子的阈上电离（ATI）过程中，大量的电子-光子相互作用会产生复杂的电子能谱。“单人模型”对 ATI 的半经典描述认为，电子被电离到最低的连续态，然后在激光场中做经典运动，至多再加一次束缚势的弹性散射，最终在激光场中朝着探测器方向传播。

近年来，利用中红外激光场 ATI 产生低能电子态，揭示了多种未知而有趣的效应。但是，在研究低能量 ATI 时使用“单人模型”中会夸大库仑势的影响；此外，在二次散射过程中，通常只考虑背向散射，因为这样可以得到其他方式得不到的高能电子。由于电子不需要二次散射就可以位于低能态，因此前向散射常被忽略。

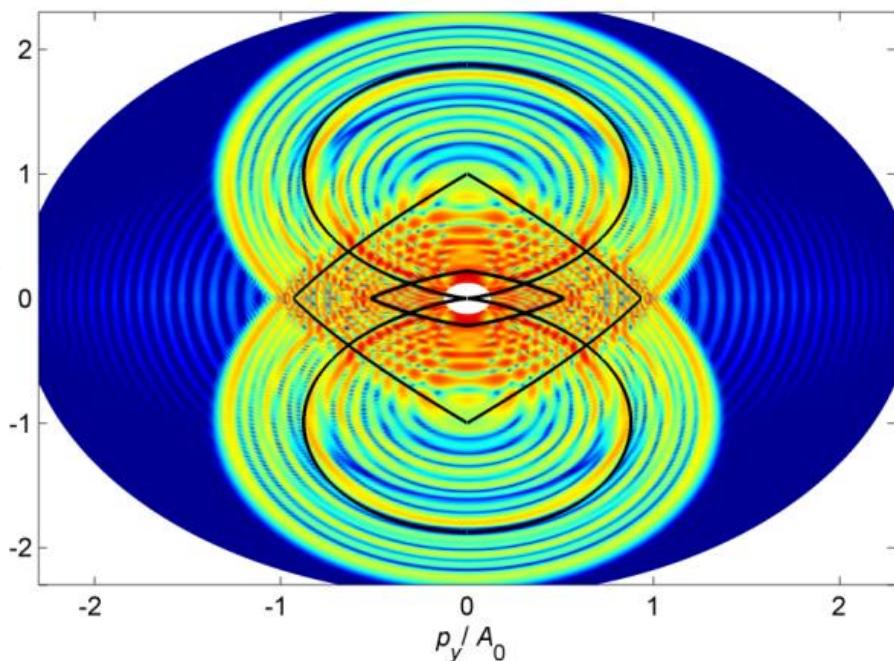
然而，中红外激光的 ATI 过程中，库仑势的前向散射非常强，并起主导作用。来自德国 Max-Born-Institute 的 W. Becker 教授和来自波斯尼亚和黑塞哥维那 University of Sarajevo 理学院的 D. B. Milošević 博士近期观察到中红外激光场低能 ATI 效应中的前向和后向二次散射过程。相关实验结果发表在 Chinese Optics Letters 2015 年第 7 期上。

在激光场的作用下电子会获得各种速度，上面结论可以扩展到任意方向运动的电子。量子力学的强场近似也包括了经典模型，可以得到与实验数据类似的结果。

作者 Wilhelm Becker 和 Dejan B. Milošević 说道：“用简单的经典模型（至多适用于一个二次散射过程）描述低能电子运动的丰富行为，这确实很奇妙。”

这项研究中描述的低能 ATI 特征是普遍适用的，与原子或分子种类无关。比较理论预测值与测量结果可以帮助区分激光物质相互作用过程的原子和分子的特性。

Cover page in Chin. Opt. Lett.
Vol. 13, Number 7, July 2015:



Quantum-orbit theory of low-energy above-threshold ionization on and off axis

W. Becker and D. B. Milošević, Chin. Opt. Lett. 13, 070006 (2015)

Journal of Physics B

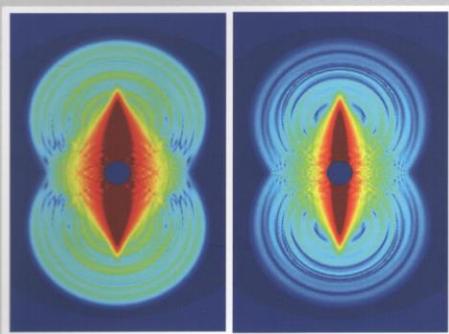
Atomic, Molecular
and Optical Physics

Volume 50 Number 16 28 August 2017

Topical Review

The fine tuning of carotenoid–chlorophyll interactions in light-harvesting complexes: an important requisite to guarantee efficient photoprotection via triplet–triplet energy transfer in the complex balance of the energy transfer processes

Marilena Di Valentin and Donatella Carbonera

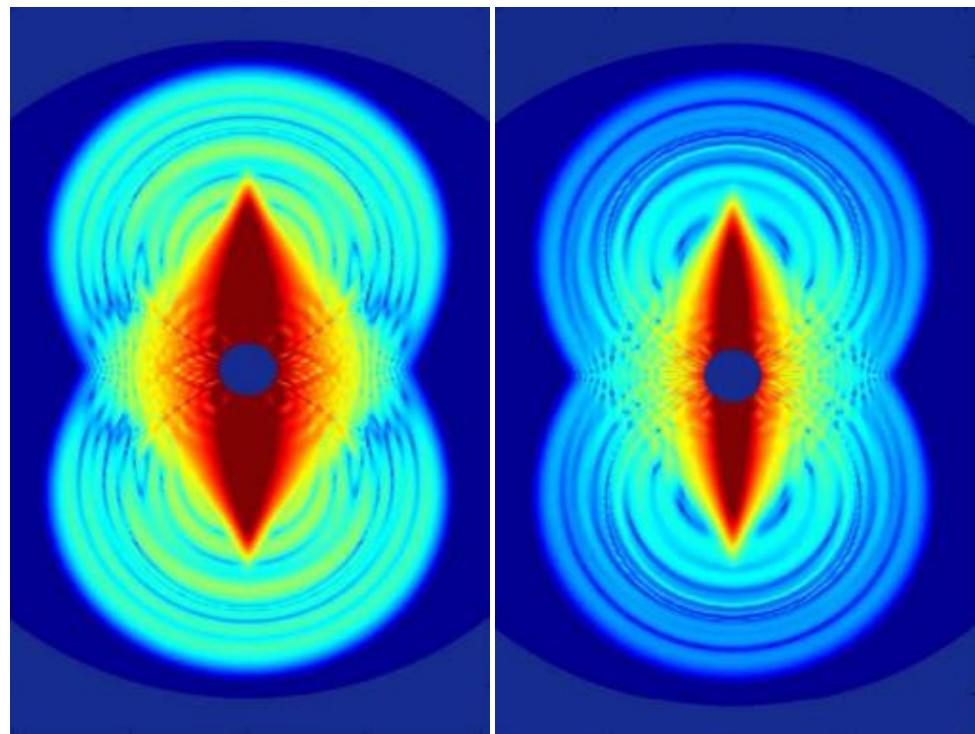


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Cover page in J. Phys. B
Vol. 50, Number 16, August 2017:

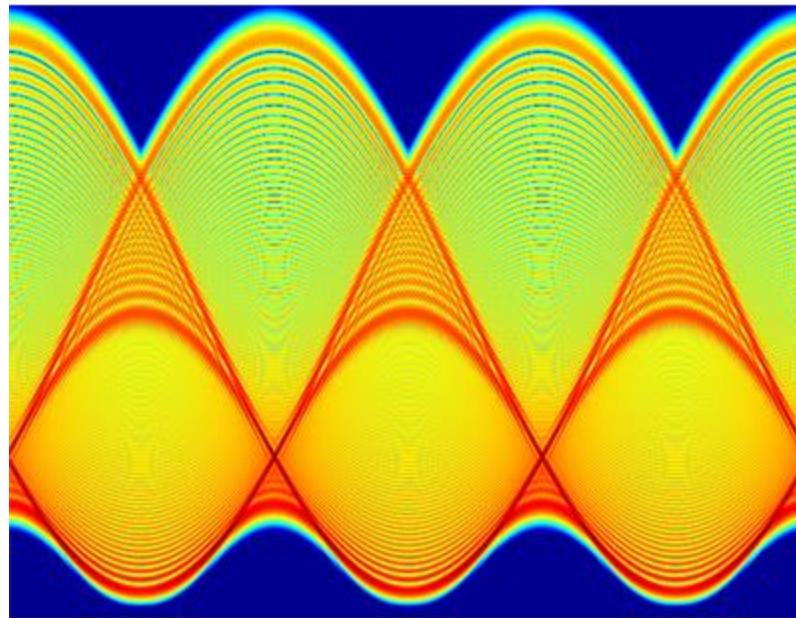


Spin-dependent effects in high-order above-threshold
ionization: spin–orbit interaction and exchange effects

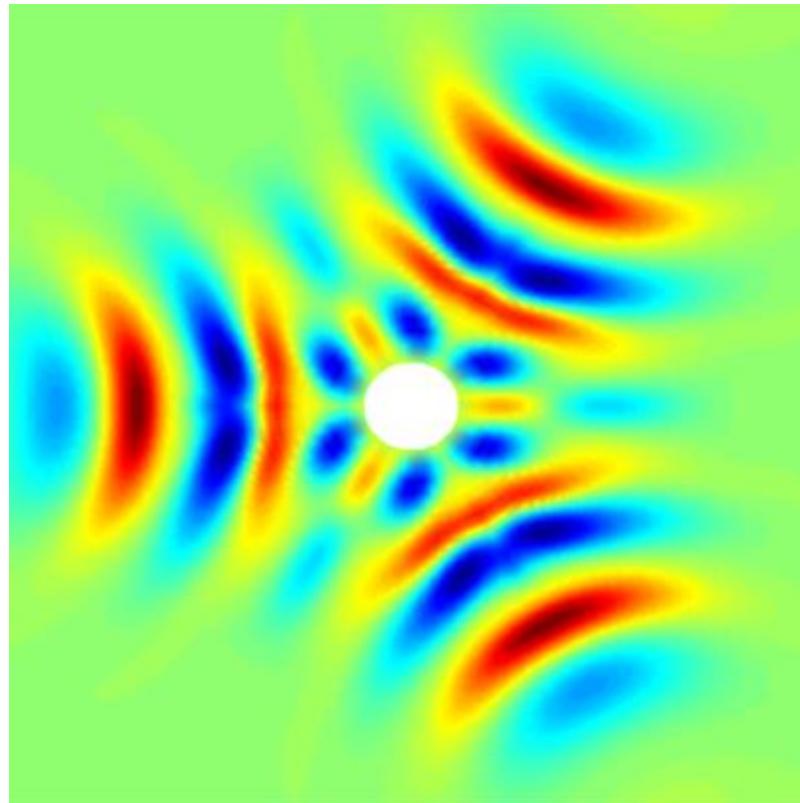
D. B. Milošević, J. Phys. B **50**, 164003 (2017)

Physical Review

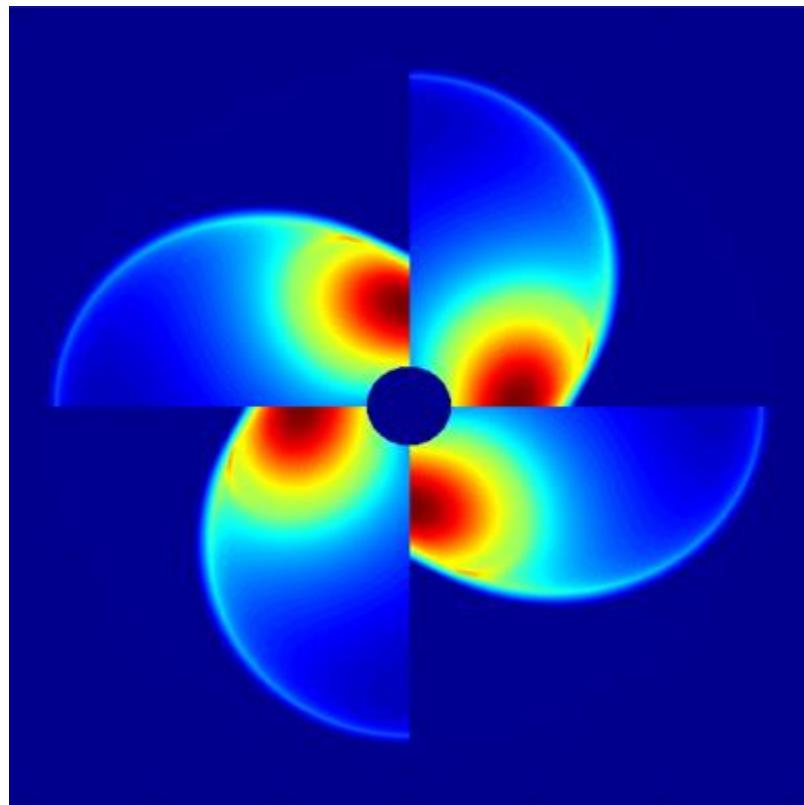
Kaleidoscope selections are based on aesthetic merit



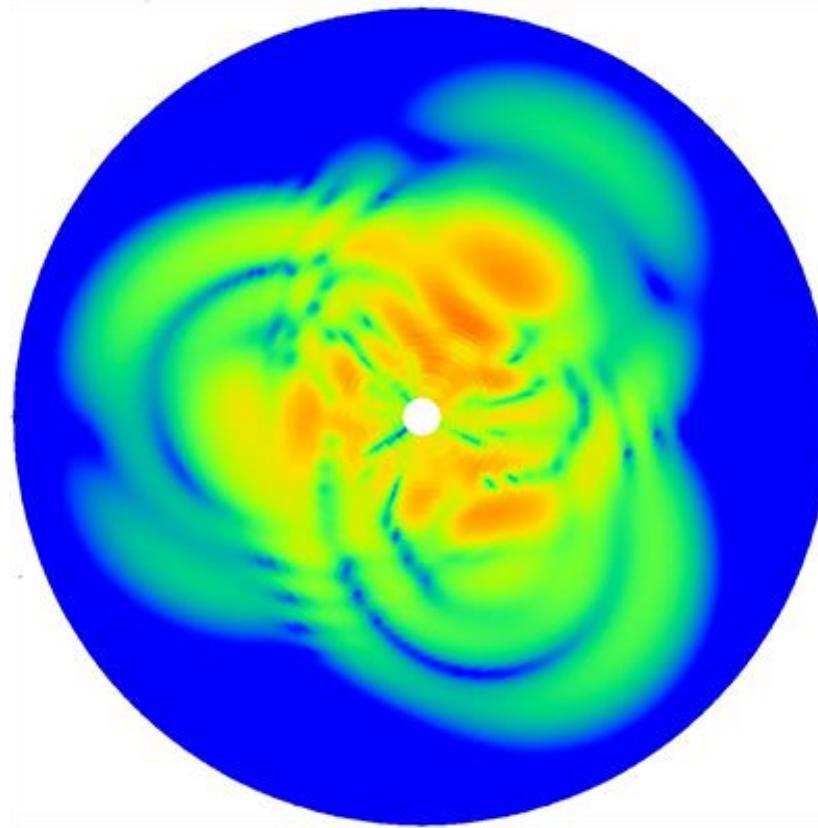
Kaleidoscope for November 2015:
Bicircular-laser-field-assisted electron-ion radiative recombination
S. Odžak and D. B. Milošević, Phys. Rev. A **92**, 053416 (2015)



Kaleidoscope for May 2016:
Possibility of introducing spin into attoscience with spin-polarized electrons produced by a bichromatic circularly polarized laser field
D. B. Milošević, Phys. Rev. A **93**, 051402(R) (2016)

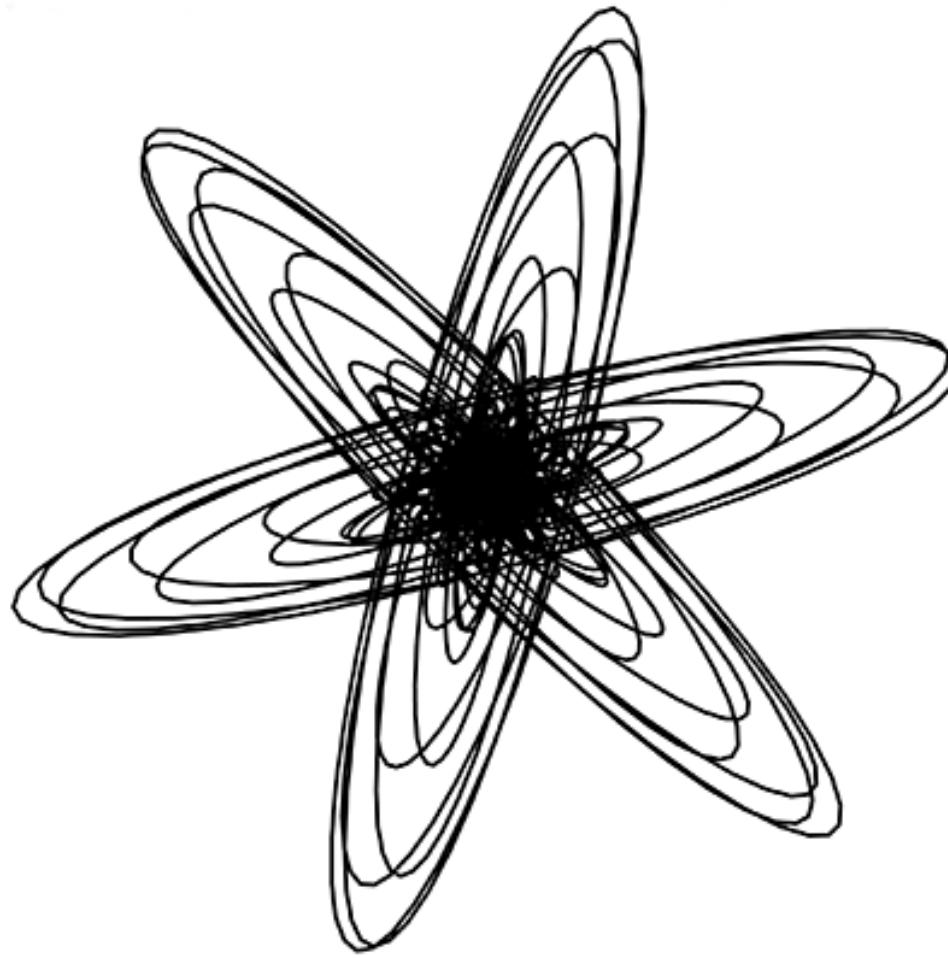


Kaleidoscope for June 2016:
Improved strong-field approximation and quantum-orbit theory:
Application to ionization by a bicircular laser field
D. B. Milošević and W. Becker, Phys. Rev. A **93**, 063418 (2016)



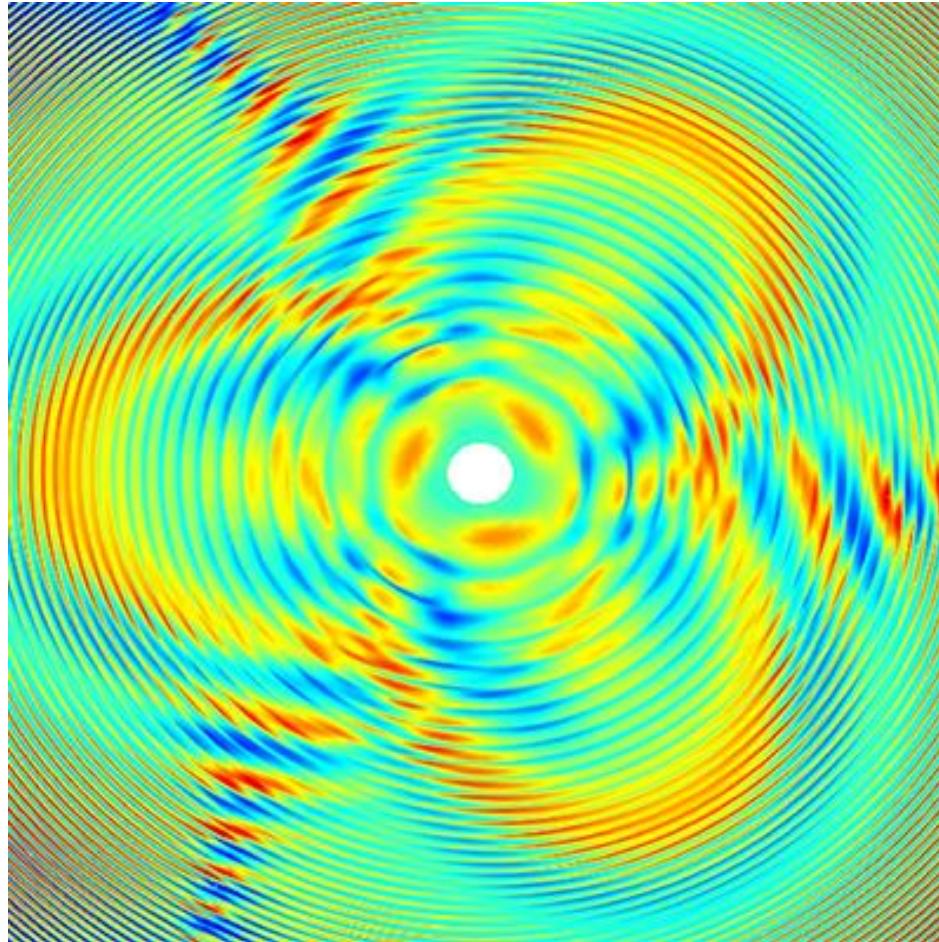
Kaleidoscope for March 2017:
Strong-field ionization of homonuclear diatomic molecules by
a bicircular laser field: Rotational and reflection symmetries

M. Busuladžić, A. Gazibegović-Busuladžić, and D. B. Milošević,
Phys. Rev. A **95**, 033411 (2017)

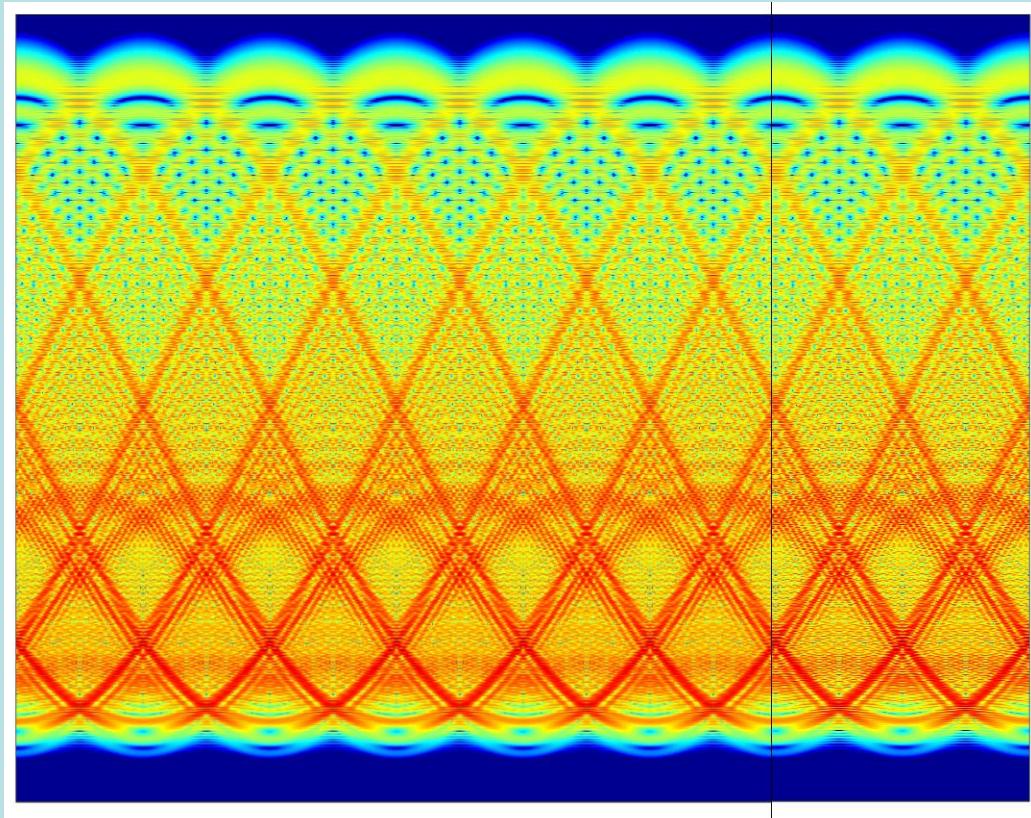


Kaleidoscope for September 2018:
Control of the helicity of high-order harmonics
generated by bicircular laser fields

D. B. Milošević, Phys. Rev. A **98**, 033405 (2018)



Kaleidoscope for November 2018:
Attospin and channel closings in high-order
above-threshold ionization by bicircular laser fields
D. B. Milošević, Phys. Rev. A **98**, 053420 (2018)



Thank you for your attention!