Prof. dr. Dejan Milošević
Prof. dr. Hrvoje Buljan
Prof. dr. Vanes Mešić

VIJEĆU UNIVERZITETA U SARAJEVU - PRIRODNO-MATEMATIČKI FAKULTET

Predmet: Izbor nastavnika u zvanje redovnog profesora za oblast "Teorijska fizika" na Odsjeku za fiziku

Odlukom Vijeća Univerziteta u Sarajevu – Prirodno-matematički fakultet (br. 01/06-3266/2-2022), donešenoj na elektronskoj 49. sjednici koja je održana 01.12.2022. godine, imenovana je komisija za pripremanje prijedloga za izbor nastavnika u zvanje redovnog profesora za oblast: "Teorijska fizika", jedan izvršilac sa punim radnim vremenom, u sastavu:

Dr. Dejan Milošević, akademik, redovni profesor Univerziteta u Sarajevu – Prirodno-matematički fakultet, uža naučna oblast: „Teorijska fizika", predsjednik;

Dr. Hrvoje Buljan, redoviti profesor u trajnom zvanjuna Zavodu za teorijsku fiziku, Fizički odsjek, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, uža naučna oblast: „Teorijska fizika", član;

Dr.Vanes Mešić, redovni profesor Univerziteta u Sarajevu – Prirodno-matematički fakultet, uža naučna oblast: „Fizika u obrazovanju", član.

Na konkurs objavljen 27.10.2022. godine u u dnevnom listu "Dnevni avaz", na web - stranici Fakulteta i na web - stranici Univerziteta u Sarajevu, kao jedini kandidat prijavio se dr. Aner Čerkić, vanredni profesorUniverziteta u Sarajevu - Prirodno-matematički fakultet, Odsjek za fiziku. Nakon uvida u priloženu dokumentaciju Komisija podnosi

I Z V J E Š T A J

BIOGRAFSKI PODACI KANDIDATA

Aner Čerkić je rođen u Mostaru 24.8.1968. godine, gdje je završio osnovnu školu, a nakon toga i srednju Elektrotehničku školu. Studij Fizike upisao je 1990. godine na Prirodno-matematičkom fakultetu Univerziteta u Sarajevu. Zbog ratnih dejstava studij je prekinuo u aprilu 1992. godine i isti nastavio u septembru 1996. godine. Diplomirao je u januaru 2000. godine sa prosječnom ocjenom 9,24. U junu 2000. godine zaposlio se u Federalnom Meteorološkom Zavodu BiH. U oktobru 2001. godine upisao je postdiplomski studij iz naučne oblasti Fizika na Filozofskom fakultetu Univerziteta u Tuzli. Nakon izdvajanja prirodnih nauka u zaseban fakultet, studij je nastavio na Prirodno-matematičkom fakultetu Univerziteta u Tuzli. Od novembra 2002. godine bavi se naučnoistraživačkim radom u oblasti teorijske laserske fizike, kao član istraživačkog tima pod vodstvom prof. dr. Dejana Miloševića. Aner Čekić je magistrirao u aprilu 2005. godine sa prosječnom ocjenom 9,86. Pod vođstvom mentora prof. dr. Dejana Miloševića izradio je doktorsku disertaciju, koju je odbranio u februaru 2008. godine na Prirodno-matematičkom fakultetu Univerziteta u Sarajevu. Od oktobra 2008. godine je zaposlen na Prirodno-matematičkom fakultetu Univerziteta u Sarajevu u zvanju docenta. U zvanje vanrednog profesora je izabran u maju 2017. godine. Težište naučnoistraživačkog rada dr. Anera Čerkića su atomski i molekularni procesi u laserskom polju. Objavio je 29 naučnih radova u časopisima sa međunarodnom recenzijom i 4 udžbenika. Učestvovao je na 10 naučno-istraživačkih projekata i 13 međunarodnih konferencija.

NAUČNI RADOVI I NAUČNOISTRAŽIVAČKA AKTIVNOST PRIJE IZBORA U ZVANJE VANREDNOG PROFESORA

Magistarski rad

A. Čerkić, "*Rasijanje elektrona na atomima u prisustvu jakog laserskog polja*", Magistarski rad, Prirodno-matematički fakultet Univerziteta u Tuzli, Tuzla, 2005.

Doktorska disertacija

A. Čerkić, "*Procesi rasijanja u jakom laserskom polju*", Doktorska disertacija, Prirodno-matematički fakultet Univerziteta u Sarajevu, Sarajevo, 2008.

Radovi registrirani u Web of Science Core Collectioni Scopus bazama podataka

1. A. Čerkić and D. B. Milošević, *Plateau structures in potential scattering in a strong laser field*, Phys. Rev. A **70**, 053402 (2004).
2. A. Čerkić and D. B. Milošević, *Potential scattering in a bichromatic laser field: plateau structures*, Laser Phys. **15**, 268 (2005).
3. A. Čerkić and D. B. Milošević, *Interferences of real trajectories and the emergence of quantum features in electron-atom scattering in a strong laser field*, Phys. Rev. A **73**, 033413 (2006).
4. A. Čerkić and D. B. Milošević, *The contribution of incoherent photoelectron scattering off neighbouring atoms to the above-threshold ionization and detachment spectra*, J. Phys. B **39**, 4419 (2006).
5. A. Čerkić and D. B. Milošević, *Focal averaging and incoherent scattering in laser-assisted radiative recombination and scattering processes*, Phys. Rev. A **75**, 013412 (2007).
6. A. Čerkić and D. B. Milošević, *The role of incoherent scattering in laser-induced and laser-assisted processes*, Laser Phys. **19**, 783 (2009).
7. A. Čerkić, E. Hasović, D. B. Milošević,and W. Becker, *High-order above-threshold ionization beyond the first-order Born approximation*, Phys. Rev. A **79**, 033413 (2009).
8. D. B. Milošević, A. Čerkić, B. Fetić, E. Hasović,and W. Becker, *Low-frequency approximation for high-order above-threshold ionization*, Laser Phys. **20**, 573 (2010).
9. A. Čerkić, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić, W. Becker,and D. B. Milošević, *Plateau structures in laser-assisted and laser-induced processes*, Phys. Scr. **T149**, 014043 (2012).
10. A. Čerkić, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić, S. Odžak, K. Kalajdžić,and D. B. Milošević, *Ellipticity dependence of plateau structures in atomic and molecular processes in a strong laser field*, Phys. Scr. **T149**, 014044 (2012).
11. A. Čerkić and D. B. Milošević, *Few-cycle laser-pulse-assisted electron-atom potential scattering*, Phys. Rev. A **87**, 033417 (2013).
12. A. Čerkić and D. B. Milošević, *Few-cycle laser-pulse-assisted electron-ion radiative recombination*, Phys. Rev. A **88**, 023414 (2013).
13. S. Odžak, A. Čerkić, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić,and D. B. Milošević, *Heteronuclear diatomic molecules in a strong laser field with an arbitrary polarization*, Phys. Scr. **T162**, 014012 (2014).
14. M. Busuladžić, A. Čerkić, S. Odžak, A. Gazibegović-Busuladžić, E. Hasović, D. Habibović,and D. B. Milošević, *Atomic and molecular processes generated by linearly polarized few-cycle laser pulses*, Phys. Scr. **T162**, 014008 (2014).
15. E. Hasović, D. B. Milošević, A. Gazibegović-Busuladžić, A. Čerkić,and M. Busuladžić, *Molecular above-threshold ionization spectra as an evidence of the three-point interference of electron wave packets*, J. Phys. Conf. Ser. **594**, 012056 (2015).
16. D. Habibović, S. Odžak, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić, A. Čerkić,and D. B. Milošević, *Interference structures in nonlinear processes in strong infrared laser fields*, Opt. Quant. Electron. **48**, 193 (2016).

17. S. Odžak, E. Hasović, A. Kramo, M. Busuladžić, A. Gazibegović-Busuladžić, A. Čerkić, B. Fetić,and D. B. Milošević, *Atomic processes in strong bichromatic elliptically polarized laser fields*, AIP Conf. Proc. **1722**, 200007 (2016).

Radovi na međunarodnim naučnim konferencijama

1. A. Čerkić, *Application of numerical weather products in weather forecast*, 1st International Workshop of Regional Meteorological Services on Application of Numerical Weather Products, Reading, UK, September 10-12 (2001).
2. A. Čerkić i D. B. Milošević, *Potential scattering in a strong laser field: plateau structures*, 13th International Laser Physics Workshop (LPHYS'04), Trieste, Italy, July 12-16, p. 146 (2004).
3. D. B. Milošević, E. Hasović, M. Busuladžić, A. Gazibegović-Busuladžić, A. Čerkić i W. Becker, *Simulation of the above-threshold ionization and detachment experiments using the strong-field approximation*, 15th International Laser Physics Workshop (LPHYS'06), Lausanne, Switzerland, July 24-28, p. 107 (2006).
4. A. Čerkić i D. B. Milošević, *The role of incoherent scattering in laser-induced and laser-assisted processes*, 17th International Laser Physics Workshop (LPHYS'08), Trondheim, Norway, June 30-July 4, p. 115 (2008).
5. D. B. Milošević, A. Čerkić, B. Fetić, E. Hasović, D. B. Milošević i W. Becker, *Low-frequency approximation for high-order above-threshold ionization*, 18th International Laser Physics Workshop (LPHYS'09), Barcelona, Spain, July 13-17, p. 133 (2009).
6. D. B. Milošević, A. Čerkić, B. Fetić, E. Hasović, D. B. Milošević i W. Becker, *Angle-resolved high-order above-threshold ionization spectra of inert gases in the low-frequency approximation*, Second International Conference on Attosecond Physics, Kansas State University, Manhattan, Kansas, USA, July 28-August 1, F30 (2009).
7. A. Čerkić, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić, D. B. Milošević i W. Becker, *Plateau structures in laser-assisted and laser-induced processes*, 3rd International School and Conference on Photonics (Photonica 2011), Belgrade, Serbia, August 29-September 2, p. 91-92 (2011).
8. A. Čerkić, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić, S. Odžak i D. B. Milošević, *Ellipticity dependence of the plateau structures in different atomic and molecular processes in strong laser field*, 3rd International School and Conference on Photonics (Photonica 2011), Belgrade, Serbia, August 29-September 2, p. 92-93 (2011).
9. S. Odžak, A. Čerkić, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić i D. B. Milošević, *Heteronuclear diatomic molecules in a strong laser field with an arbitrary polarization*, 4th International School and Conference on Photonics (Photonica 2013), Belgrade, Serbia, August 26-30, p. 71 (2013).
10. M. Busuladžić, A. Čerkić, S. Odžak, A. Gazibegović-Busuladžić, E. Hasović, D. Habibović i D. B. Milošević, *Atomic and molecular processes generated by linearly polarized few-cycle laser pulses*, 4th International School and Conference on Photonics (Photonica 2013), Belgrade, Serbia, August 26-30, p. 72 (2013).
11. A. Gazibegović-Busuladžić, E. Hasović, A. Čerkić, W. Becker, D. B. Milošević i M. Busuladžić, *Atomic and molecular processes generated by few-cycle laser pulses*, 23rd International Laser Physics Workshop (LPHYS'14), Sofia, Bulgaria, July 14-18, p. 58 (2014).
12. D. Habibović, S. Odžak, M. Busuladžić, E. Hasović, A. Gazibegović-Busuladžić, A. Čerkić i D. B. Milošević, *Interference structures in nonlinear processes in strong infrared laser fields*, 5th International School and Conference on Photonics (Photonica 2015), Belgrade, Serbia, August 24-28, p. 69 (2015).
13. B. Fetić, S. Odžak, E. Hasović, A. Kramo, M. Busuladžić, A. Gazibegović-Busuladžić, A. Čerkić i D. B. Milošević, *Atomic processes in strong bichromatic elliptically polarized laser fields*, 9th International Physics Conference of the Balkan Physical Union (BPU9), Istanbul, Turkey, August 24-27, p. 364, 04-PP46 (2015).

Naučnoistraživački projekti

1. “Atomski i molekularni procesi u jakom laserskom polju”, projekat finansiran odFederalnog ministarstva obrazovanja i nauke, 2004. (voditelj prof. dr. Dejan Milošević)
2. “Control of Atomic Processes with Strong Fields”, projekat podržan od strane Volkswagen Foundation, Programme: “Cooperation with Natural and Engineering Scientists in Central and Eastern Europe” (follow-up), 2007./2008.(voditelj prof. dr. Dejan Milošević)
3. “Jonizacija dvoatomskih molekula i generacija viših harmonika pomoću jakog laserskog polja”, projekat podržan od Federalnog ministarstva obrazovanja i nauke, 2007./2008. (voditelj prof. dr. Dejan Milošević)
4. “Primjena jakih laserskih polja u atofizici i atohemiji”, projekat podržan od Federalnog ministarstva obrazovanja i nauke, 2009. (voditelj prof. dr. Dejan Milošević)
5. “Towards a quantitative strong–field approximation and its application to attoscience”, projekat podržan od strane Alexander von Humboldt fondacije, 2010./2012. (voditelj prof. dr. Dejan Milošević)
6. „Analiza spektara poliatomskih molekula“, projekat podržan od Federalnog ministarstva obrazovanja i nauke, voditeljica: doc. dr. Azra Gazibegović-Busuladžić (2013.–2014.)
7. “Rezonantna pojačanja u jonizacionim spektrima molekula”, projekat podržan od Federalnog ministarstva obrazovanja i nauke, voditelj: doc. dr. Elvedin Hasović (2015.–2016.)
8. “Nelinearni atomski procesi u jakom bihromatskom laserskom polju”, projekat podržan od Federalnog ministarstva obrazovanja i nauke, voditelj: prof. dr. Senad Odžak (2015.–2016.)

Organizacija međunarodnih kongresa i skupova

„20th International Laser Physics Workshop LPHYS’11“, član lokalnog organizacionog komiteta, juli 2011, Sarajevo, BiH.

UDŽBENICI I MONOGRAFIJEPRIJE IZBORA U ZVANJE VANREDNOG PROFESORA

1. A. Čerkić, S. Odžak i D. Hadžiahmetović: *Statističkafizika*, Univerzitetskoizdanje, Sarajevo, 2013, ISBN 978-9958-592-37-9.

2. M. Busuladžić, A. Čerkić, A. Gazibegović-Busuladžić, E. Hasović, J. Stahov:*FIZIKA I sa primjenama u biologiji i medicini*, Prirodno-matematički fakultet Sarajevo, 2015, ISBN 978-9958-592-59-1.

PEDAGOŠKE AKTIVNOSTI PRIJE IZBORA U ZVANJE VANREDNOG PROFESORA

Prije nego što se zaposlio na Odsjeku za fiziku Prirodno-matematičkog fakulteta u Sarajevu Aner Čerkić je kao šef Odjeljenja za vremenske analize i prognoze u Federalnom Hidro-Meteorološkom Zavodu BiHvršio obuku mlađih kadrova. Pored toga, održao je više predavanja i seminara na Odsjeku za fiziku Prirodno-matematičkog fakulteta u Sarajevu.

Na Odsjeku za fiziku Prirodno-matematičkog fakulteta Univerziteta u Sarajevu je kao docent od 2008. godine vodio nastavu iz predmeta: Odabrana poglavlja savremene fizike I (od 2008.), Uvod u programiranje za fizičare (od 2008.), Statistička fizika (od 2008.), Odabrana poglavlja statističke fizike (od 2008.), Atomska i molekularna fizika I – prvi ciklus (od 2008.), Atomska i molekularna fizika I – drugi ciklus (od 2010.), Atomska i molekularna fizika II (od 2010.), Teorija rasijanja (od 2010.), Biofizika – Odsjek za biologiju (od 2011.)

Docent dr. Aner Čerkić je bio mentor pet diplomskih radova i jednog magistarskog rada.

NAUČNI RADOVI I NAUČNOISTRAŽIVAČKA AKTIVNOST NAKON IZBORA U ZVANJE VANREDNOG PROFESORA

Radovi registrirani u Web of Science Core Collection (WoS) i Scopus bazama podataka

Radovi iz uže naučne oblasti „Teorijska fizika“

Radovi kandidata su iz oblasti atomske, molekularne i optičke fizike i laserske fizike. Kandidat teorijski analizira različite atomske i molekularne procese koji su indukovani ili asistirani jakim laserskim polje. Ovdje navodimo naslove i apstrakte radova koji su objavljeni nakon izbora kandidata u zvanjevanrednogprofesora.

1. A. Čerkić, M. Busuladžić, and D. B. Milošević, *Electron-ion radiative recombination assisted by a bichromatic elliptically polarized laser field*, Phys. Rev. A **95**, 063401 (2017)(WoS)
Abstract:Electron-ion radiative recombination assisted by a bichromatic (two-component) elliptically polarized laser field is analyzed in the frame of the *S*-matrix theory. The second Born approximation is applied in the expansion of the S-matrix element where the first term in the expansion corresponds to the direct recombination of electrons with ionic targets, while the second term corresponds to the recombination preceded by an electron-ion scattering. The latter process is possible in the presence of a laser field. If the electron scatters on an ionic target, it may be subsequently driven back by the laser field and recombine with the same ion. The photon emitted in this process may have a high energy. We have studied the dependence of the energy spectrum on various laser-field and incident electron parameters. The energy spectra obtained show plateaulike structures with abrupt cutoffs. These cutoffs are explained by a classical analysis.

2. J. Dakić, D. Habibović, A. Čerkić, M. Busuladžić, and D. B. Milošević, *Electron-molecule scattering in a strong laser field: Two-center interference effects*,Phys. Rev. A **96**, 043406 (2017)(WoS)
Abstract:Laser-assisted scattering of electrons on diatomic molecules is considered using the *S*-matrix theory within the second Born approximation. The first term of the expansion in powers of the scattering potential corresponds to the direct or single laser-assisted scattering of electrons on molecular targets, while the second term of this expansion corresponds to the laser-assisted rescattering or double scattering. The rescattered electrons may have considerably higher energies in the final state than those that scattered only once. For multicenter polyatomic molecules scattering and rescattering may happen at any center and in any order. All these cases contribute to the scattering amplitude and the interference of different contributions leads to an increase or a decrease of the differential cross section in particular electron energy regions. For diatomic molecules there are two such contributions for single scattering and four contributions for double scattering. Analyzing the spectra of the scattered electrons, we find two interesting effects. For certain molecular orientations, the plateaus in the electron energy spectrum, characteristic of laser-assisted electron-atom scattering, are replaced by a sequence of gradually declining maxima, caused by the two-center interference effects. The second effect is the appearance of symmetric U-shaped structures in the angle-resolved energy spectra, which are described very well by the analytical formulas we provide.

3. A. Korajac, D. Habibović, A. Čerkić, M. Busuladžić, and D. B. Milošević, *Electron-atom potential scattering assisted by a bichromatic elliptically polarized laser field*, Eur. Phys. J. D **71**, 251 (2017)(WoS)
Abstract: Electron-atom potential scattering assisted by a bichromatic (two-component) elliptically polarized laser field is analyzed in the frame of the *S*-matrix theory. The second Born approximation is applied in the expansion of the S-matrix element. The first term in the expansion corresponds to the single scattering, while the second term in the expansion corresponds to the double scattering of electrons on atomic targets. The double scattering is possible in the presence of a laser field. The electron that has scattered on an atomic target may be driven back by the laser field and scatter again on the same atom. The double-scattered electrons may have considerably higher energies than those that scattered only once. We have investigated the dependence of the energy spectrum on various laser-field and incident electron parameters. The calculated electron energy spectra show the plateau-like structures with abrupt cutoffs. These cutoffs are explained by a classical analysis.

4. D. Habibović, A. Čerkić, M. Busuladžić, A. Gazibegović-Busuladžić, S. Odžak, E. Hasović, and D. B. Milošević:*Molecules in a bicircular strong laser field*, Opt. Quant. Electron. **50**: 214, 1-10 (2018)(WoS)
Abstract: Strong-field ionization of nonlinear planar triatomic molecules by a bicircular laser field is analyzed within the improved molecular strong-field approximation. Our calculations include additional interaction between the liberated electrons and atomic or ionic centers of the parent molecular ion. The used bicircular field consists of two counterrotating circularly polarized fields having angular frequencies $r\omega$ and $s\omega$, with integer r and s. In the case when the laser-field-polarization plane is parallel to the plane of the considered molecule (example of ozone molecule is analyzed), the corresponding photoelectron spectra are not rotationally symmetric. On the other hand, when these planes are mutually perpendicular, for the

($r\omega$,$s\omega$)=(ω,3ω) bicircularfield, the electron spectra satisfy the corresponding rotational symmetries. Analyzing the obtained spectra and the corresponding symmetries, one can extract information about molecular orientation and structure. This technique may also be useful for more complex polyatomic molecules.

5. M. Busuladžić, A. Čerkić, A. Gazibegović-Busuladžić, E. Hasović, and D. B. Milošević: *Molecular-orientation-dependent interference and plateau structures in strong-field ionization of a diatomic molecule by a corotating bichromatic elliptically polarized laser field*, Phys. Rev. A: General Physics **98** (1), 013413, 1-8 (2018) (WoS)

Abstract:We investigate strong-field ionization of homonuclear diatomic molecules, exemplified with the N_2 molecule, by a bichromatic elliptically polarized laser field having corotating components.We assume that both the emitted electron momentum vector and the internuclear vector of the diatomic molecule lay in the laser-field polarization plane. Our analysis of the low-energy electron spectra caused by the direct above-threshold ionization (ATI) and of the high-energy rescattered electron spectra that can form an extended plateau (high-order ATI or HATI) isbased on the improved molecular strong-field approximation. The photoelectron spectra obtained by (H)ATI of molecular targets are more complex and have a reacher structure in comparison to the analogous spectra for atomic targets. We explain the observed interference structures by the interference of two electron wave packets emitted from the two centers of the diatomic molecule. Particular attention is devoted to the HATI spectra. For small values of the ellipticity the photoelectron spectra exhibit a plateau whose length can be as high as $17U_p$,with U_p the electron ponderomotive energy. The yield of high-energy electrons emitted nearly antiparallel to thesemimajor axis of the laser-field polarization ellipse is one order of magnitude higher for perpendicular than forthe parallel molecular orientation.

6. A. Gazibegović-Busuladžić, M. Busuladžić, A. Čerkić, E. Hasović, W. Becker, and D. B. Milošević:*Strong-Field Ionization of Linear Molecules by a Bichromatic Elliptically Polarized Laser Field with Coplanar Counterrotating or Corotating Components of Different Frequencies*, Journal of Physics: Conf. Series **1206**, 012003, 1-11 (2019) (Scopus)

Abstract: We investigate strong-field ionization of linear molecules by a two-color laser field of frequencies $r\omega$ and $s\omega$ having coplanar counterrotating or corotating elliptically polarized components (ω is the fundamental laser field frequency and r and s are integers). Using the improved molecular strong-field approximation we analyze direct above-threshold ionization (ATI) and high-order ATI (HATI) spectra. More precisely, reection and rotational symmetries of these spectra for linear molecules aligned in the laser-field polarization plane are considered. The reflection symmetries for particular molecular orientations, known to be valid for a bicircular field (this is the field with circularly polarized counterrotating components), are valid also for arbitrary component ellipticities. However, specific rotational symmetries that are satisfied for HATI by a bicircular field, are violated for an arbitrary elliptically polarized field with counterrotating components. For the corotating case and the N_2 molecule we analyze molecular orientation-dependent interferences and plateau structures for various ellipticities.

7. A. Tutmić, A. Čerkić, M. Busuladžić, and D. B. Milošević, *Role of the relative phase and intensity ratio in electron-ion recombination assisted by a bicircular laser field*, Eur. Phys. J. D **73**, 231 (2019) (WoS)

Abstract: *S*-matrix theory is used in order to analyze the energy spectra of electron-ion radiativerecom-bination assisted by a bicircular (two-component circularly polarized) laser field. The analysis includes the cases of corotating and counterrotating laser-field components. The scattering effects are also included by applying the second Born approximation in the expansion of the *S*-matrix element. We have investigated the sensitivity of the emitted photon energy spectra to the relative phase and intensity ratio of the laser-field components. The obtained energy spectra show the plateau-like oscillatory structures with abrupt cutoffs. Positions of these cutoffs in the energy spectra are confirmed by a classical analysis. Scattering effects may be observed in the calculated energy spectra not only in the case of counterrotating, but also in the case of corotating laser-field components. This is different from the process of above-threshold ioniza-tion/detachment by a bicircular laser field, where the scattering effects in the photoelectron energy spectra may be observed only in the case of counterrotating laser-field components.

8. S. Kovačević, A. Čerkić, M. Busuladžić, and D. B. Milošević, *Electron-atom potential scattering in a corotating bicircular laser field*, Laser Phys. **30**, 055301 (2020) (WoS)

Abstract: *S*-matrix theory is used in order to analyze the energy spectra of electron-atom potential scattering assisted by a bicircular (two-component circularly polarized) laser eld having corotating field components. The double scattering (rescattering) is also included in the analysis by applying the second Born approximation in the expansion of the *S*-matrix element. We have investigated how the energy spectrum of

scattered electrons is affected by the scattering angle. We have also analyzed the sensitivity of the energy spectrum to the relative phase and intensity ratio of the laser-field components. The calculated energy spectra are characterized by the plateau-like oscillatory structures with abrupt cutoffs. Positions of these cutoffs in the energy spectra are con rmed by a classical analysis. Rescattering effects can be observed in the calculated energy spectra for certain values of the scattering angle. These effects are represented by the second plateau in the energy spectrum. This is different from the process of above-threshold ionization/detachment by a bicircular laser eld, where the (re)scattering effects in the photoelectron energy spectra cannot be observed in the case of corotating laser-field components.

9. M. Busuladžić, A. Gazibegović-Busuladžić, A. Čerkić, and D. B. Milošević: *Signature of molecular symmetry in the plateau region of the photoelectron spectra: Above-threshold ionization of the C_2 molecule*, Phys. Scr. **95**, 075402 (2020) (WoS)

Abstract: By analyzing angular and energy distributions of the photoelectrons emitted in strong-laser-field-inducedionization of molecules, one can obtain information about the molecular structure and theground-state symmetry. High-energy part of the photoelectron spectra in the above-thresholdionization (ATI) is characterized by a plateau region in which the ionization probability is practicallyenergy independent. The photoelectron yield drops off exponentially for electron energies higher thansome critical energy, i.e. the mentioned plateau is followed by an abrupt cutoff. We investigate theinfluence of the molecular ground state symmetry on this plateau region and show that, analyzing thecorresponding high-order ATI spectra, one can obtain information about the highest occupiedmolecular orbitals (HOMOs) of the considered molecules. We present results for differenthomonuclear diatomic molecules: N_2, O_2, Ar_2 and C_2 having, respectively, the σ_g, π_g, σ_u and $\pi_u$symmetries of the HOMO. Particular attention is devoted to the C_2 molecule since high-order ATIspectra for this molecule have not been analyzed yet. We consider ATI by a linearly polarized laserfield for which the mentioned plateau can be well-developed, depending on the orientation of themolecular axis with respect to the laser-field polarization axis. The HOMO-symmetry-dependent (dis)appearance of the plateau is particularly pronounced for the parallel and perpendicular orientations.Our findings are valid for a wide range of the laser-field intensities and wavelengths, which isimportant for realization of the suggested experiments. Using the improved molecular strong-fieldapproximation, the theory which is particularly suitable for the analysis of high-energy ATI spectra,for the case of the C_2 molecule and different molecular and laser parameters, we investigate variousfeatures of the plateau, such as its length and the interference minima and their positions.

10. D. Habibović, A. Gazibegović-Busuladžić, M. Busuladžić, A. Čerkić, and D. B. Milošević:*Strong-field ionization of homonuclear diatomic molecules using orthogonally polarized two-color laser fields*,Phys. Rev. A: General Physics **102**, 023111 (2020) (WoS)

Abstract: Using the improved molecular strong-field approximation we investigate high-order above-threshold ionization (HATI) of homonuclear diatomic molecules by an orthogonally polarized two-color (OTC) laser field. The OTC field components are linearly polarized, having the relative phase ϕ and frequencies $r\omega$ and $s\omega$ (r and s are integers and ω is the fundamental frequency). The molecule is aligned in the laser-field polarization plane. We have found that for even values of $r + s$ the HATI spectra obey the C_2 rotational symmetry regardless of the relative phase, component intensities, and molecular orientation, while the spectra calculated for odd values of $r + s$ and for certain molecular orientations exhibit the reflection symmetry. We have also explored the symmetry transformations of the HATI spectra for a shift of the relative phase by 180° and for various values of r and s. These symmetries are illustrated by numerical examples of the HATI spectra of the N_2 molecule. For particular values of the laser-field parameters, internuclear distance, and the electron emission angle we observed minima in the ionization yield as a function of the molecular orientation angle and the photoelectron energy. These minima are well fitted with the curve obtained using a condition for the destructive interference minima which we derived for an arbitrary laser field and applied to the OTC field. The relative phase between the OTC field components can be used to control the length and shape of the HATI plateau, as well as the appearance of these destructive interference minima.

11. D. Habibović, A. Gazibegović-Busuladžić, M. Busuladžić, A. Čerkić, and D. B. Milošević:*Laser-induced processes with homonuclear diatomic molecules in orthogonally polarized two-color laser field*, J. Phys.: Conf. Ser. **1814**, 012001 (2021) (Scopus)

Abstract: Using our theory which is based on the strong-field approximation we analyze high-order above-threshold ionization and high-order harmonic generation processes for the case of the homonuclear diatomic molecules exposed to an orthogonally polarized two-color (OTC) laser field. The OTC field represents a superposition of two linearly polarized fields with mutually orthogonal polarizations and different frequencies. We analyze the photoelectron energy spectra and the harmonic ellipticity as a function of the ratio of the intensities of the OTC laser-field components and the relative phase. Some combinations of the

values of these parameters lead to the high-energy electrons, while the harmonic ellipticity depends strongly on the ratio of the intensities of the laser-field components. It is possible to find the value of this ratio for which the ellipticity of the emitted harmonics is large. The signs of ellipticity are opposite for the molecular orientations which are connected through the reection with respect to the axis along the first OTC field component. This symmetry is explained using the expression which relates the *T*-matrix element and the harmonic ellipticity.

12. K. Kavazović, A. Čerkić,and D. B. Milošević, *Electron-molecule scattering in a bichromatic elliptically polarised laser field: Plateau structures and two-centre interference minima,* Mol. Phys. **119**(14), e1948123 (2021) (WoS)

Abstract:Scattering of electrons off diatomic molecules in a bichromatic elliptically polarised laser field is considered by applying the *S*-matrix theory within the second Born approximation. Two characteristic plateaus appear in the energy spectrum of scattered electrons. The higher plateau is observed in the low-energy part of the spectrum and describes the single scattering, while the lower plateau extends to the high-energy part of the spectrum and describes the double scattering. Scattering and rescattering of electrons off molecular targets may occur at any molecular centre and in any order. Interference of contributions results in increasing/decreasing the differential cross section in particular regions of the energy spectrum of scattered electrons. Two contributions for single scattering and four contributions for double scattering exist in the case of diatomic molecules. For some molecular orientations, a sequence of declining maxima may be observed instead of the plateaus in the electron energy spectrum. We have also observed parabolic structures in the angle-resolved energy spectra. Analytical formulas that explain these structures have been provided. We have also explored the impact of the laser-field ellipticity on the scattered-electron energy spectra. The bichromatic ω–2ω and ω–3ω laser fields have been considered.

Naučnoistraživački projekti

1. "Novi metodigeneracijemekih X zraka i rasijanihelektronapomoćukompleksnihlaserskihpolja",projektpodržanodMinistarstvazaobrazovanje, nauku i mlade, Kanton Sarajevo, voditelj: prof. dr. Dejan Milošević (2019.-2020.)
2. "Uticajelektromagnetskogzračenjanamolekularneanione",projekat podržan od Federalnog ministarstva obrazovanja i nauke, voditelj: prof. dr. Dejan Milošević (2019.-2020.)

UDŽBENICI I MONOGRAFIJENAKON IZBORA U ZVANJE VANREDNOG PROFESORA

1.Aner Čerkić, Azra Gazibegović-Busuladžić, Mustafa Busuladžić, Edvin Škaljo: *FIZIKA II sa primjenama u biologiji i medicini,* Prirodno-matematički fakultet Sarajevo, 2018, ISBN 978-9926-453-06-0.

2. Mustafa Busuladžić, Hedim Osmanović, Aner Čerkić, Azra Gazibegović-Busuladžić:*ZBIRKA ZADATAKA IZ FIZIKE sa primjenama u biologiji i medicini,* Prirodno-matematički fakultet Sarajevo, 2019, ISBN 978-9926-453-24-4.

PEDAGOŠKE AKTIVNOSTINAKON IZBORA U ZVANJE VANREDNOG PROFESORA

Predmeti koje je kandidat držaona Odsjeku za fiziku u periodu od 2017.-2022. godine:

Prvi ciklus studija:

Statistička fizika
Matematičke metode fizike III
Osnove nelinearne fizike i teorije haosa (do 2020. godine)
Osnove teorije haosa (od 2020.godine)
Simetrije u fizici (do 2021. godine)
Atomska i molekularna fizika I (do 2020. godine)
Atomska i molekularna fizika II (do 2018. godine)
Atomska molekularna fizika (od 2021. godine)

Drugi ciklus studija:

Teorija rasijanja

Predmeti koje je kandidat držao na Odsjeku za biologiju u periodu od 2017.-2022. godine:

Prvi ciklus studija:

Biofizika

Mentorstva završnih radova II ciklusa na Prirodno-matematičkom fakultetu Univerziteta u Sarajevu

1. "Rasijanjeelektronanamolekulama u jakomlaserskompolju", kandidatkinje Jelene Dakić. Završni rad uspješno odbranjen 14.07.2017. godine.
2. "Rasijanjeelektronanamolekulama u eliptičkipolarizovanombihromatskomlaserskompolju", kandidataKristijana Kavazovića. Završni rad uspješno odbranjen 15.07.2019. godine.
3. "Rasijanjeelektronanamolekulama u ultrakratkomlaserskompulsu", kandidatkinje Milice Dragaš. Završni rad uspješno odbranjen 19.10.2021. godine.
4."Elektron-jonskarekombinacija u ortogonalnombihromatskomlaserskompolju", kandidatkinje Ilhane Katkić. Završni rad uspješno odbranjen 21.10.2021. godine.
5."Elektron-atomskarekombinacija u bihromatskomlaserskompolju", kandidataNihada Hidića. Završni rad uspješno odbranjen 22.04.2022. godine.

PRIJEDLOG SA OBRAZLOŽENJEM

Na osnovu Zakona o visokom obrazovanju Kantona Sarajevo ("Službene novine Kantona Sarajevo broj 33/17"), člana 96. stav f) i člana 194. Statuta Univerziteta u Sarajevu, jediniprijavljeni kandidat, dr. Aner Čerkić, vanredni profesor Univerziteta u Sarajevu – Prirodno-matematičkog fakulteta, ispunjava sve zakonske uslove za izbor u zvanje redovnog profesora za oblast "Teorijska fizika", jer:

- je proveo jedan izborni period u zvanju vanrednog profesora,
- ima dvanaest naučnih radova iz oblasti za koju se bira, objavljenih u priznatim publikacijama koje se nalaze u relevantnim naučnim bazama podataka,
- ima dvije objavljene knjige,
- ima originalni stručni uspjeh – učesnik jedva uspješno završena projekta,
- ima uspješno mentorstvo pet kandidata na drugom ciklusu studija.Pošto kandidat iz objektivnih razloga nema mentorstvo kandidata na trećem ciklusu studija, u skladu sa članom 115. stav (2) Zakona o visokom obrazovanju Kantona Sarajevo i članom 199. Statuta Univerziteta u Sarajevu, moguća je supstitucija mentorstva satri dodatna naučna rada objavljena u citatnim bazama podataka, u odnosu na minimalne uslove utvrđene zakonom, što kandidat ispunjava.**Obrazloženje**: Zbog malog broja kandidata na trećem ciklusu studija iz oblasti "Teorijska fizika" za vrijeme trajanja posljednjeg izbornog perioda kandidata koji se bira, kandidat nije određen za mentora, pa u skladu sa članom 199. Statuta Univerziteta u Sarajevu, postoji mogućnost supstitucije mentorstva sa tri dodatna naučna rada objavljena u relevantnim bazama podataka.

Navedeni rezultati su ostvareni nakon izbora kandidata u zvanje vanrednog profesora. Vanredni profesor dr. Aner Čerkić postigao je veoma značajne naučne rezultate. Prema Web of Science Core Collection citatnoj bazi podataka do sada je objavio27 radova koji su citirani 250 puta. Odgovarajući h indekstih radova je 9. Pored toga, posjeduje bogato pedagoško iskustvo, mentor je više magistarskih radova i koautor je više univerzitetskih udžbenika.

S obzirom na navedene činjenice, članovi Komisije smatraju da kandidat ispunjava sve zakonom predviđene uslove za izbor u zvanje redovnog profesora. Sa zadovoljstvom predlažemo Vijeću Univerziteta u Sarajevu – Prirodno-matematičkog fakulteta da **izabere** dr. **Anera Čerkića**, **u zvanje redovnog profesora za oblast "Teorijska fizika"** na Univerzitetu u Sarajevu – Prirodno-matematički fakultet.

U Sarajevu, 13. 12. 2022. godine

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dr. Dejan Milošević, redovni profesor

_____
dr. HrvojeBuljan, redovitiprofesor

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dr. Vanes Mešić,redovniprofesor