

Mohsen Vafae – Curriculum Vitae

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I. R. Iran <http://www.modares.ac.ir/>

Personal Born on Jun 27, 1973 in Isfahan, Iran

Iranian citizen

University education

1992 - 1996 Bachelor of Science in Chemistry

University of Isfahan, Isfahan 81744, Islamic Republic of Iran

1996 - 1999 Master of Science (MSC) in Physical Chemistry

with the Thesis Title:

“Quantum corrections of kinetical equations at moderate intensities”

Supervisor: Prof. A. Maghari

University of Tehran, Tehran, Islamic Republic of Iran

1999 - 2004 Doctor of Philosophy (PhD) in Physical Chemistry

with the Thesis Title:

“Investigation of ultrashort intense laser field effect

on simple systems such as H_2^+ and D_2^+ ”

Supervisor: Dr. Hassan Sabzyan

Tarbiat Modares University, Tehran 14115-175, I. R. Iran

Awards

1996 The first rank in the national entrance examination of MSC of universities of I. R. Iran

1996 The second rank of chemistry in the first student’s Olympiad examination of I. R. Iran

INTERESTS

- Electron and nucleus dynamics of atoms and molecules in ultra-short intense laser field
- Quantum optics, ultra-short science
- Theoretical femtosecond physics: atoms and molecules in strong laser fields
- Theoretical and numerical study of time-dependent Schrödinger equation
- Parallel computing and building cluster

Publications

1. Mohsen Vafae, Hassan Sabzyan

“A detailed and precise study of the ionization rates of H_2^+ in intense laser fields”,
[Journal of Physics B: Atomic, Molecular and Optical Physics](#), **37**, 4143-4157 (2004).

2. Hassan Sabzyan, Mohsen Vafae

“Intensity dependence of the H_2^+ ionization rates in Ti:sapphire laser fields above Coulomb explosion threshold”,

[Physical Review A](#), **71**, 063404 (2005),

republication in [Virtual Journal of Ultrafast Science](#) 4, issue 7 (2005).

3. Mohsen Vafae, Hassan Sabzyan, Zahra Vafae, Ali Katanforoush

“Instantaneous ionization rate of H_2^+ in intense laser field; Interpretation of the Enhanced Ionization”,

<http://arxiv.org/physics/0509072>.

4. Mohsen Vafae, Hassan Sabzyan, Zahra Vafae, Ali Katanforoush

“Detailed instantaneous ionization rate of H_2^+ in intense laser field”,

[Physical Review A](#), **74**, 043416 (2006),

5. Mohsen Vafae, Hassan Sabzyan

“Reply to ‘Comment on ‘Detailed instantaneous ionization rate of H_2^+ in intense laser field’ ””,

[Physical Review A](#), **76**, 067402 (2007),

6. Mohsen Vafae

“Nuclear kinetic energy spectra of D_2^+ in intense laser field: Beyond Born Oppenheimer approximation”,

[Physical Review A, 78, 023410 \(2008\)](#),

7. Mohsen Vafae, Babak Shokri

“Pathway of D^+ in Sequential Double Ionization of D_2 in Intense Laser Pulse”, [Physical Review A, 81, 053408 \(2010\)](#),

8. Firoozeh Sami, Mohsen Vafae, Babak Shokri

“Nuclear classical dynamics of H_2 in an intense laser field”,

[Journal Physics B, 44, 16560, 2011](#),

9. M Vafae, F Sami, B Shokri, B Buzari, H Sabzyan

“Precise Calculation of Single and Double Ionization of Hydrogen Molecule in Intense Laser Pulses”,

[The Journal of Chemical Physics 137, 044112, 2012](#).

10. M Vafae, F Sami, B Shokri, B Buzari, H Sabzyan

“Mapping electron dynamics in molecular H_2 using high-order-harmonic-generation time profiles”,

[Physical Review A 85 \(3\), 033407, 2012](#).

11. B Buzari, M Vafae, H Sabzyan

“High harmonic generation from pre-ionized H_2 in ultrashort intense laser fields”,

[J. Phys. B: At. Mol. Opt. Phys. \(46\), 245401, 2013](#).

12. H Sabzyan, S. H. Ahmadi, M Vafae,

“High-order harmonic generation of H_2^+ in superintense xuv ultrashort laser pulses”,

[J. Phys. B: At. Mol. Opt. Phys. \(47\), 105601, 2014](#).

13. H. Ahmadi, A. Maghari, H. Sabzyan, A. R. Niknam, and M. Vafae

“Effect of nuclear motion on high-order-harmonic generation of H_2^+ in intense ultrashort laser pulses”,

[Physical Review A 90 \(4\), 043411, 2014](#).

14. M. Eidi, M. Vafae, A. R. Niknam, N. Morshedian

“A new version of fermion coupled coherent states method: Theory and applications in simulation of two-electron systems”,

Chemical Physics Letters 653 (1 June 2016), 60–66

[arXiv:1510.06267](#).

15. H. Ahmadi, A. Maghari, and M. Vafae

“Complicated high-order harmonic generation due to the falling edge of a trapezoidal laser pulse”,

[Journal of Physics B: Atomic, Molecular and Optical Physics 49 \(3\), 035602, 2016.](#)

16. H. Ahmadi, A. Maghari, and M. Vafae

“Identifying spatially asymmetric high-order harmonic emission in the falling edge of an intense laser pulse”,

[Journal of Physics B: Atomic, Molecular and Optical Physics 50 \(2\), 025601](#)

[arXiv:1603.00767](#).

17. H Ahmadi, M Vafae, A Maghari

“Understanding molecular harmonic emission at relatively long intense laser pulses: Beyond the Born-Oppenheimer approximation”,

[Physical Review A 94 \(3\), 033415](#)

18. H Iravani, M Vafae

“Breakdown of odd-harmonic rule in the high harmonic generation spectra of the hydrogen molecular ion”,

[Journal of Physics: Conference Series 869 \(1\), 012004](#)

19. M Nasrollahpour, M Vafae, MR Hosseini, H Iravani

“Ab initio study of sodium diffusion and adsorption on boron-doped graphyne as promising anode material in sodium-ion batteries”,

[Physical Chemistry Chemical Physics 20 \(47\), 29889-29895](#)

20. H Iravani, H Sabzyan, M Vafae, B Buzari

“Contribution of the pre-ionized H_2 and the ionized H_2^+ subsystems to the HHG Spectra of H_2 in intense laser fields”,

[Journal of Physics B: Atomic, Molecular and Optical Physics 51 \(7\), 074003](#)

21. M Eidi, M Vafae, M Rooein

“Complementary version of fermion coupled coherent states method and gram–schmidt algorithm: Theory and applications for electronic states of H_2 and H_2^+ ”,

[Journal of computational chemistry 39 \(11\), 679-684](#)

22. M Eidi, M Vafae, A Landsman

“Static Coherent States Method: One-and Two-Electron Laser-Induced Systems with Classical Nuclear Dynamics”,
[Applied Sciences 8 \(8\), 1252](#)

23. S Taghipour, M Vafae
“Nonadiabatic electron dynamics effects on high-harmonic generation spectrum of H: minima and oscillatory pattern”,
[Journal of Physics B: Atomic, Molecular and Optical Physics 51 \(7\), 074003](#)

24. A Ebadati, M Vafae, B Shokri
“Four-photon Kapitza-Dirac effect as an electron spin filter”,
[Physical Review A 98 \(3\), 032505](#)

Oral and Poster Presentations

- 1) "H₂⁺ and D₂⁺ molecular ions in ultrashort intense laser fields", Mohsen Vafae and Hassan Sabzyan, *The 3rd SESAME Users' Meeting*, 2004, 11-13 October, Antalya TURKEY.
- 2) "Calculation of the ionization rates of H₂⁺ in intense laser fields", Hassan Sabzyan and Mohsen Vafae, *The 7th Physical Chemistry Seminar*, Iran, 2004.
- 3) "Ionization rates of H₂⁺ in the laser fields above Coulomb explosion threshold", Mohsen Vafae and Hassan Sabzyan, *The 8th Physical Chemistry Seminar*, Iran, 8-10 March 2005.
- ۴) "سرعت یونش لحظه ای H₂⁺ در میدان شدید لیزر"، محسن وفايي، حسن سبزيان، زهرا وفايي و علی کتانفروش، دوازدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، ۱۱-۱۳ بهمن ماه ۱۳۸۴.
- ۵) "لیزر های تپی فروکوتاه و کاربردهای آن"، حسن سبزيان و محسن وفايي، دوازدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، ۱۱-۱۳ بهمن ماه ۱۳۸۴.
- 6) "Instantaneous ionization rate of H₂⁺ in intense laser field; Interpretation of the enhanced ionization", Mohsen Vafae and Hassan Sabzyan, *The 9th Physical Chemistry Seminar*, Rasht, Iran, June 13-15, 2006.
- 7) "Rising time effects of ultrashort intense laser field on the enhanced ionization rate H₂⁺", Hassan Sabzyan and Mohsen Vafae, *The 10th Physical Chemistry Seminar*, Isfahan, Iran, June 21-24, 2007.
- 8) "Nuclear kinetic energy spectra of D₂⁺ in intense laser field: Beyond Born Oppenheimer approximation", Mohsen Vafae, *The 11th Physical Chemistry Seminar*, Ardebil, Iran, June, 2008.
- 9) "Electron dynamics of H₂⁺ in a half cycle of intense laser field", Hassan Sabzyan and Mohsen Vafae, *The 11th Physical Chemistry Seminar*, Ardebil, Iran, June, 2008.
- ۱۰) "H₂⁺ در میدان فمتوثانیه شدید لیزر به روش نیمه کلاسیکی: بررسی اثرات طول دوره تپ لیزر"، محمد حسن میرزایی و محسن وفايي، پانزدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، دانشگاه اصفهان، بهمن ماه ۱۳۸۷.
- 11) "1s-2p resonance Rabi oscillation of Hydrogen atom in intense laser field", Behnaz Bouzari and Mohsen Vafae, *The 12th Physical Chemistry Seminar*, Sanandaj, Iran, 2009.

(۱۲) "مسیر یون D^+ با انرژی جنبشی بالا در یونش دوگانه و متوالی D_2 در تپ شدید لیزر"، محسن وفایی و بابک شکری، شانزدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، دانشگاه یزد، بهمن ماه ۱۳۸۸.

(۱۳) "دینامیک کوانتومی الکترون و دینامیک کلاسیک هسته‌ای در معرض تابش میدان لیزر فروکوتاه شدید" فیروزه سامی، محسن وفایی و بابک شکری، کنفرانس فیزیک ایران، دانشگاه همدان، شهریور ماه ۱۳۸۹.

(۱۴) "شبه‌حالت‌های گذار ناشی از یونش دوگانه (متوالی و همزمان) H_2 در میدان شدید فروکوتاه لیزر"، بهناز بوذری، حسن سبزیان و محسن وفایی، شانزدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، دانشگاه کرمان، بهمن ماه ۱۳۸۹.

(۱۵) "دینامیک وابسته به زمان سیستم برهمکنشی H_2 - میدان شدید فرو کوتاه لیزر بر اساس طیف هماهنگ‌های مرتبه بالا"، بهناز بوذری، حسن سبزیان و محسن وفایی، شانزدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، دانشگاه کرمان، بهمن ماه ۱۳۸۹.

(۱۶) "تحول بسته موج الکترون آزاد به تابع موج الکترون مقید"، حسن سبزیان، فاطمه علوی و محسن وفایی، شانزدهمین کنفرانس انجمن اپتیک و فوتونیک ایران، دانشگاه کرمان، بهمن ماه ۱۳۸۹.

17) "Covalent and ionic doorway states of H_2 in ultrashort intense laser field", Mohsen Vafaei, Hassan Sabzyan, Behnaz Buzari, *14th Iranian Physical Chemistry Conference*, University of Tehran, Kish, Iran, February 25-28, 2011.

18) "Evolution of the free electron wavepacket into bound electron wave function", H. Sabzyan, S. F. Alavi, M. Vafaei, *14th Iranian Physical Chemistry Conference*, University of Tehran, Kish, Iran, February 25-28, 2011.

19) "High-order harmonic generation of H_2^+ in intense ultrashort laser pulses", S. H. Ahmadi, A. Maghari, H. Sabzyan, M. Vafaei, *16th Iranian Physical Chemistry Conference*, University of Mazandaran, Babolsar, Iran, February 29-31, 2013.

20) "Numerical calculation of the Hydrogen molecule ground state using coherent states", M. Eidi, A. R. Niknam, M. Vafaei, *16th Iranian Physical Chemistry Conference*, University of Mazandaran, Babolsar, Iran, February 29-31, 2013.

(۲۱) "تولید هماهنگ مرتبه بالا در سامانه H_2^+ تحت تپ‌های لیزری شدید فوق‌کوتاه: ورای تقریب بورن-اپنهاইمر"، سید حامد احمدی، علی مقاری، حسن سبزیان، محسن وفایی، و علی‌رضا نیکنام، سومین کنفرانس لیزر و کاربردهای آن، دانشگاه تربیت مدرس، شهریور ۱۳۹۳.

22) “Correlated Nuclear and Electronic Motions on High-Order Harmonic Generation of H₂⁺”, H. Ahmadi a , A. Maghari a , H. Sabzyan b , A. R. Niknam and M. Vafae , *16th Iranian Physical Chemistry Conference, K.N.Toosi University of Technology*, Tehran, Iran, October 21-24, 2013.

23) “Interaction of ultrashort intense laser pulse with atoms and molecules”, M. Vafae (Invited Speaker), *Fourth Theoretical and Computational Chemistry Workshop and Seminar*, Chemistry and Chemical Engineering Research Center of Iran (CCERCI), Tehran, Iran, January 28-29, 2015.

Research Projects and Contracts

Pathway of Dissociation-Ionization of D₂⁺ in Intense Laser Pulse, 2008-2010

Other Professional Activities, Experiences and Membership

Assistant Professor in University of Isfahan 2005-2008

Postdoc researcher in Laser-Plasma Research Institute, Shahid Beheshti University 2008-

Member of Optics and Photonics Society of IRAN

Member of the Iranian Chemical Society

Teaching Graduate Courses

Quantum mechanics

Atoms and molecules

Advanced Quantum chemistry I

Advanced Quantum chemistry II

Molecular Spectroscopy II

Teaching Undergraduate Courses

Quantum chemistry

Physical Chemistry I

Chemistry I

Acted as referee for:

Physical Review A. Atomic, Molecular, and Optical Physics Published by Institute of Physics in USA

Journal of the Iranian Chemical Society Published by Iran’s chemistry Association

Graduate Students

Number of the students in past or presently under supervision or co-supervision

PhD: 3 MSc: 12

Students Thesis

The prepared or in preparation PhD or MSc thesis as supervisor or advisor:

1. *Investigation of interaction of hydrogen molecule ion under femto second intense laser field by semiclassical method.* (Msc Thesis) M. Mirzaie, 2008, Supervisor.
2. *The solution for the Time Dependent Schrodinger Equation of the H_2 under irradiation of the high intensity ultrashort laser pulses.* (Msc Thesis) F. Sami, 2010, Advisor.
3. *Time-dependent evolution of two electronic systems in ultra-short intense laser pulse.* (PHD Thesis) B. Buzari, 2012, Supervisor.
4. *Control of the states in nanostructures through quantum Zeno effect.* (Msc Thesis) F. Farzam, Advisor.
5. *Quantum optics of nanostructures in attosecond scales: fundamental theory and experiment.* (Msc Thesis) A. Allahy, 2011, Advisor.
6. *Evolution of the Two-Dimensional electron and nuclear wavepackets under magnetic and electric fields of ultrashort intense laser pulse.* (Msc Thesis) H. Ahmadi, 2011, Advisor.
7. *Evolution of free electron wavepacket to bound electron wavefunction* (Msc Thesis) Alavee, 2011, Advisor.
8. *Investigation of high- order harmonic generation of H_2^+ under ultrashort intense laser pulses.* (PHD Thesis) H. Ahmadi, 2014-20xx, Supervisor.
9. (PHD Thesis) A. Ebadati, 2014-20xx, Advisor.
10. *Simulation of two electronic systems using coupled coherent states approach in the phase space.* (Msc Thesis) M. Eidi, 2014, Advisor
11. *Simulation of Quantum Dynamics of Multi-Dimensional Systems with Coupled Coherent States.* (Msc Thesis) Dolati, 2014, Advisor
12. *Investigation on principles time-dependent density functional theory and its application to H_2 in intense laser field.* (Msc Thesis) A. Beshartnic, 2014-20xx, Supervisor.
13. *Investigation of Hydrogen molecular system in the ultra short intense laser field using coupled coherent state.* (Msc Thesis) M. Roien, 2014-20xx, Advisor.
14. *Effect of wavelength of ultra-short intense laser pulses on the high-order harmonic spectrum of H_2^+ .* (Msc Thesis) H. Taghipour, 2014-20xx, Supervisor.
15. *A theoretical study of phosgene gas adsorption on graphene and doped graphene.* (Msc Thesis) M. Zare, 2014-20xx, Supervisor.

References

Dr. Hassan Sabzyan

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