

Hamidreza Mohammadi Khoshoei



CONTACT INFORMATION	Faculty of Physics Quantum Optics Research Group Center of Quantum Science and Technology University of Isfahan, Hezar Jarib Avenue, Isfahan, Iran	<i>Tel:</i> (+9831) 37934720 <i>E-mail:</i> <i>hr.mohammadi@sci.ui.ac.ir</i> <i>hamidreza.mohammadi@gmail.com</i>
RESEARCH INTERESTS	Experimental Quantum Optics, Quantum Metrology, Quantum Imaging, Quantum Spectroscopy Quantum Information Theory (QIT), Quantum Entanglement Theory Quantum Electronics, Lasers, Laser-Plasma Interaction, Plasma	
EDUCATION	Ph.D., University of Isfahan (March 2010) • Thesis Topic: Investigation of Quantum Entanglement in nano-structures. • Area of Study: Quantum Information Theory M.Sc., Rafsanjan Vali-e-Asr University (September 2005) • Thesis Topic: Design, performance and optimization of a high repetition rate $T.E.A - CO_2$ Laser. • Area of Study: Lasers and Quantum Optics B.Sc., Azad University of Shahreza (March 2000) • Thesis Topic: Relativistic Quantum Mechanics (Wave equations) • Area of Study: Theoretical Physics	
LANGUAGE SKILLS	Persian (Mother tongue), English (Advanced), Arabic (Intermediate)	
TECHNICAL SKILLS	<i>Programming:</i> Basic, Pascal, Fortran, AUTOCAD, Mathematica, MATLAB, Maple, Python, Lumerical, COMSOL, L^AT_EX,... <i>Applications:</i> Arduino programming, Micro-controllers	

PUBLICATIONS

1. S. Akbari-Kourbolagh, A. Mahdifar, H. Mohammadi, " *Thermal non-linear coherent states on a circle*," Physica A, 674, 130765 (2025).
2. A. Aaliray and H. Mohammadi, " *Quantum speed limit time in two-qubit system by dynamical decoupling method*," Scientific Reports, 15, 8338 (2025).
3. R. Alinaghipor and H. Mohammadi, " *Implementation of controlled-NOT quantum gate by nonlinear coupled electro-nano-optomechanical oscillators*," Phys. Rev. A 110, 032412 (2024).
4. Sh. Moazen Dehkordi and H. Mohammadi, " *Improvement of directivity in plasmonic nanoantennas based on structured cubic gold nanoparticles*," Scientific Reports, 14, 17153 (2024).
5. M.B. Arjmandi, H. Mohammadi, A. Saguia, M. S. Sarandy and A. C. Santos, " *Localization effects in disordered quantum batteries*," Phys. Rev. E, 108, 064106 (2023).
6. M.B. Arjmandi, A. Shokri, E. Faizi and H. Mohammadi, " *Performance of quantum batteries with correlated and uncorrelated chargers*," Phys. Rev. A 106, 062609 (2022).
7. M.B. Arjmandi, H. Mohammadi and A. C. Santos, " *Enhancing self-discharging process with disordered quantum batteries*," Phys. Rev. E, 105, 054115 (2022).
8. S. Dashtestani and H. Mohammadi, " *Laser induced electron drift in the magnetized quantum plasma: electron spin effects*," JOSA B, 39, 2194 (2022).
9. A. Motavalibashi, H. Mohammadi and A. Akhond, " *Non-Markovianity as a resource for quantum correlation teleportation*," JOSA B, 38, 1200(2021).
10. M. Ardforoushan, D. Ghanbarian, R. Maddahian and H. Mohammadi, " *Effect of cutting location for aerodynamic separation of saffron stigma and selection of apparatus*," Iranian Journal of Food Science and Technology, 18(115), 363 (2021)(in persian)
11. M. Omrani, H. Mohammadi and H. Fallah, " *Ultrahigh sensitive refractive index nanosensors based on nanoshells, nanocages and nanoframes: effects of plasmon hybridization and restoring force*," Scientific Reports, 11, 2065 (2021).

12. A. Motavalibashi, A. Akhond and H. Mohammadi, "*Teleportation based non-degenerate discordant remote state preparation*", Laser Physics Letters, **17**, 095204 (2020).
13. T. Makaremi, and H. Mohammadi, "*Degeneracy removal of left and right quantum discord in an in-homogeneous magnetic field,*" Physics Research Journal of Iran, **19** (3), 587 (2019)(in persian).
14. S. Dashtestani, A. Parvazian, and H. Mohammadi, "*Influence of non-linearity of medium on the laser induced filamentation instability in magnetized plasma,*" Physics of Plasmas **25**, 082119 (2018).
15. H. Mohammadi, "*Post markovian dynamics of quantum correlations: Entanglement and Discord,*" Quantum Inf. Process. **16**, 39 (2017).
16. A. Kheirollahia, H. Mohammadi and S. J. Akhtarshenas, "*Two-qubit quantum cloning machine and quantum correlation broadcasting,*" Phys. Rev. A **94**, 052107 (2016).
17. A. Kheirollahia, S. J. Akhtarshenas, and H. Mohammadi, "*Quantifying Nonclassicality of Correlations based on the Nondisruptive Local State Identification,*" Quantum Inf. Process. **15**, 1585 - 1599 (2016).
18. S. Hamedani Raja, H. Mohammadi and S. J. Akhtarshenas, "*Geometric discord of the Jaynes-Cummings model: pure dephasing regime,*" Eur. Phys. J. D **69**, 14 (2015).
19. S. J. Akhtarsenas, H. Mohammadi, F. Mosavi, V. Nasajpour, "*Progress on Quantum Discord of Two-Qubit States: Optimization and Upper Bound,*" Int. J. Theor. Phys. **54**:72-84 (2015).
20. S. J. Akhtarsenas, H. Mohammadi, S. Karimi, Z. Azmi, "*Computable measure of quantum correlation,*" Quantum Inf. Process. **14**:247-267 (2015).
21. M. Rafiee, M. Soltani, H. Mohammadi, and H. Mokhtari, "*Entanglement transfer via XXZ Heisenberg chain with DM interaction,*" Eur. Phys. J. D **63**, 473-482 (2011).
22. H. Mohammadi, S.J. Akhtarshenas, and F. Kheirandish, "*Influence of dephasing on the entanglement teleportation via a two-qubit Heisenberg XYZ system,*" Eur. Phys. J. D **62**, 439-447 (2011).
23. F. Kheirandish, S.J. Akhtarshenas, and H. Mohammad, "*Non-equilibrium entanglement dynamics of a two-qubit Heisenberg XY system in the presence of an inhomogeneous magnetic field and spin-orbit interaction,*" Eur. Phys. J. D **57**, 129-140 (2010).

24. F. kheirandish, S. Javad Akhtarshenas, Hamidreza Mohammadi, " *Effect of spin-orbit interaction on entanglement of two qubit Heisenberg XYZ systems in an inhomogeneous magnetic field,*" Phys. Rev. A **77**, 042309 (2008).

CONFERENCE PUBLICATIONS

1. F. Kheirandish, S. Javad Akhtarshenas, Hamidreza Mohammadi, " *Influence of spin-orbit interaction on thermal entanglement of spin states of Double Coupled Quantum Dots,*" Proceeding of 14th Conference on Optics and Photonics, Rafsanjan Vali-e-Asr University, Iran, 29-31 Jan. 2008 (in Persian).
2. H. Mohammadi, S. J. Akhtarshenas, F. Kheirandish, " *Influence of Dephasing on the Entanglement Teleportation Dynamics via a two-qubit Heisenberg XYZ System,*" Proceeding of 17th Conference on Optics and Photonics, Mahan University of high tech., Iran, 08-10 Feb. 2011 (in Persian).
3. H. Mohammadi, M. Soltani, M. Rafiee, H. Mokhtari, " *Quantum Cloning in Spin star Network with Heisenberg Interaction and Local Magnetic Field,*" Proceeding of 17th Conference on Optics and Photonics, Mahan University of high tech., Iran, 08-10 Feb. 2011 (in Persian).
4. R. Torabi, H. Saghaiffar, M. Sovizi and H. Mohammadi, " *Simulation of T.E.A. CO₂ Laser,*" Proceeding of 2nd Conference on Laser and optic engineering, Malek-Ashtar University of technology, Iran, 18-19 May 2011 (in Persian).
5. S. Hamedani, H. Mohammadi, S. J. Aktarshenas, " *Geometric quantum discord and comparison of it with quantum entanglement in the Jaynes-Cummings model*", Proceeding of 1st Conference of Quantum Informaion, Shahrood University of technology, Iran, 4-5 Sep. 2013 (in Persian).
6. H. Mohammadi, V. Nassajpour, S. J. Aktarshenas, " *Quantum discord dynamics of a two-qubit Heisenberg XY system in the presence of an inhomogeneous magnetic field and spin-orbit interaction: asymptotic state*", Proceeding of 1st Conference of Quantum Informaion, Shahrood University of technology, Iran, 4-5 Sep. 2013 (in Persian).
7. S. J. Akhtarshenas, H. Mohammadi, S. Karimi and Z. Azmi, " *A Geometrical Approach to Quantum Correlation,*" Proceeding of 20th Conference on Optics and Photonics, Shiraz University of tech., Iran, 28-30 Jan. 2014 (in Persian).

8. S. J. Akhtarshenas, H. Mohammadi, V. Nassajpour and F. Mousavi,
” *Quantum Discord of two-qubit states*,” Proceeding of 20th Conference on Optics and Photonics, Shiraz University of tech., Iran, 28-30 Jan. 2014 (in Persian).

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PUBLICATION
(CONTINUE))

9. P. Khavanin, S. Mousavi, F. Kheirandish, and H. Mohammadi, "*Decay rate of an excited atom in the presence of surface plasmons*," Proceeding of 20th Conference on Optics and Photonics, Shiraz University of tech., Iran, 28-30 Jan. 2014 (in Persian).
10. S. Hafezabadian, H. Mohammadi, "*Quantum discord teleportation*," Proceeding of 21th Conference on Optics and Photonics, Shahid Beheshti University, Tehran, Iran, Feb. 2015 (in Persian).
11. T. Makaremi, H. Mohammadi, "*Degeneracy removing of the left and right quantum discord in an inhomogeneous magnetic field*," Proceeding of 21th Conference on Optics and Photonics, Shahid Beheshti University, Tehran, Iran, Feb. 2015 (in Persian).
12. H. Jafary, A.Yadi, M. Soltanolkotabi, H. Mohammadi and Gh. Kohmarch, "*Unsaturable polyester hardening by CO₂ laser based on FT-IR spectroscopy*," Proceeding of 21th Conference on Optics and Photonics, Shahid Beheshti University, Tehran, Iran, Feb. 2015 (in Persian).
13. H. Jafary, A.Yadi, M. Soltanolkotabi, H. Mohammadi and Gh. Kohmarch, "*Unsaturated polyester hardening by CO₂ Laser and analysis its chemical structure by Raman and FT-IR Spectroscopy*," Proceeding of 21th Conference on Optics and Photonics, Shahid Beheshti University, Tehran, Iran, Feb. 2015 (in Persian).
14. A.Yadi, H. Jafary, H. Mohammadi and M. Soltanolkotabi, "*Photo thermal effect of unsaturated polyester at He-Ne laser beam*," Proceeding of 21th Conference on Optics and Photonics, Shahid Beheshti University, Tehran, Iran, Feb. 2015 (in Persian).
15. H. Jafary, A.Yadi, H. Mohammadi and M. Soltanolkotabi, "*Detection of breaking carbon double band (C=C) and creation cross link in polymers by Laser-induced breakdown spectroscopy (LIBS) technique*," Proceeding of 21th Conference on Optics and Photonics, Shahid Beheshti University, Tehran, Iran, Feb. 2015 (in Persian).
16. S. Goli, H. Mohammadi, "*Dynamics of Left and Right Quantum Discord: Markovian and Non-Markovian regimes*," Proceeding of Physics Conference of Iran 1394, 24 Aug. 2015

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CONFERENCE PUBLICATION (CONTINUE))

17. S. Izadi, H. R. Mohammadi, H. R. Fallah, and H. Zabolian, " *Design of high damage threshold all-dielectric and metal-dielectric total reflector for CO₂ gas laser,*" Proceeding of 22th Conference on Optics and Photonics, Yazd University, Iran, 26 Jan. 2016 (in Persian).
18. S. Izadi, H. R. Mohammadi, H. R. Fallah, and H. Zabolian, " *Design of high damage threshold partial reflector mirror at 10.6 micron,*" Proceeding of 22th Conference on Optics and Photonics, Yazd University, Iran, 26 Jan. 2016 (in Persian).
19. A. Tangestani, H. Mohammadi, " *Characterizing of proper nonlinear crystal for temporal width measurement of ultra- short pulse Ti:Sapphire laser by SHG-FROG method,*" Proceeding of 4th conference on Lasers and their applications, Sharif University of technology, Iran, 2-3 Nov. 2016 (in Persian).
20. M. Ardforoushan, D. Ghanbarian, H. Mohammadi and R. Maddahian " *Feasibility study of laser cutting of saffron flower stems to separate stigmas ,*" Proceeding of 5th National Conference of Saffron, Torbat Heidarieh University, 14-15 Nov. 2018 (in Persian).
21. Sh. Torabi, J. Bakhtiar, H. R. Mohammadi, R. Kafieh " *Image processing in OCT images for precise calculation of capillary density around macula,*" Proceeding of 28th Conference on Optics and Photonics, Shahid Chamran University of Ahvaz, Iran, 1-2 Feb. 2022 (in Persian).

PROFESSIONAL EXPERIENCES

Teaching Experiences

Sep. 2004 to Present

Lecture (University of Isfahan)

Sep. 2007 to Present

- Fundamental Physics and labs.
- Lasers course
- Optics
- Electromagnetism
- Application of Lasers
- Spectroscopy
- Atomic Physics
- Electronics
- Vacuum techniques and equipment

- Classical Mechanics
- Quantum mechanics
- Advanced Quantum Mechanics
- Quantum Information Theory
- Quantum Entanglement Theory
- Electrodynamics
- Experimental Methods in Quantum Optics
- Special topics in Quantum Optics
- Electronics Lab.

Lecture (Azad University of Shahreza)

2006 to 2009

- Quantum mechanics
- Analytical mechanics
- Optics
- Electronics
- Spectroscopy
- Vacuum techniques and equipment
- The experimental methods in Atomic Physics
- Fundamental Physics
- Modern Physics lab.

Empirical Experiences

Lasers:

- Implementation of a *C.W.* – CO_2 laser for performing an intracavity spectroscopy of NH_3 and Morphine.
- Built and performance of a 5 J *T.E.A* – CO_2 laser with Ernest Profile electrodes and dielectric corona pre-ionization.
- Built and performance of a *T.E.A* – N_2 laser.
- Design, built and performance of a Cathode plasma *T.E.A* – CO_2 laser.
- Design, built, performance and optimization a one module high repetition rate *T.E.A* – CO_2 laser with the PRF=100Hz.
- Design, built, performance and optimization a two module high repetition rate *T.E.A* – CO_2 laser with the PRF=200Hz.
- Design, built and performance of a high repetition rate switch (Rotary Spark Gap (RSG)) for driving high repetition rate lasers.
- Performance and implementation of optical and electrical component of the above mentioned systems.
- Implementation of high voltage circuits for driving and triggering the C.W., T.E.A and H.R.R.-T.E.A lasers.

EMPIRICAL
EXPERIENCES
(CONTINUE)

Quantum Technology:

- Implementation of Bell's inequality test experiment based on photon polarization setup.
- Quantum State Tomography of the polarization state of the entangled photons.
- Realization of the Quantum Imaging with undetected photons setup in laboratory
- Implementation of the Quantum Spectroscopy setup
- Realization of some fundamental Quantum Optics Experiments such as Hong-Ou Mandel setup and so on.