

Georgios M. Nikolopoulos

Principal Researcher

Education

- 1997–2001 **PhD in Physics**, *University of Crete, Greece.*
Dissertation title: Multiple Excitations in Structured Radiation Reservoirs
- 1996–1997 **MSc in Microelectronics-Optoelectronics**, *University of Crete, Greece.*
- 1992–1996 **Diploma in Physics**, *University of Patras, Greece.*
Grade: 8 4/10

Employment

- 2014– ... **Principal Researcher**,
Institute of Electronic Structure & Laser/FORTH, Heraklion, Greece.
- 2011–2014 **Assistant Researcher**,
Institute of Electronic Structure & Laser/FORTH, Heraklion, Greece.
- 2008–2011 **Junior Researcher**,
Institute of Electronic Structure & Laser/FORTH, Heraklion, Greece.
- 2007–2008 **Research Associate**,
Institute of Electronic Structure & Laser/FORTH, Heraklion, Greece.
- 2003–2006 **Research Associate**,
Institut für Angewandte Physik, Technische Universität Darmstadt, Germany.
- 1997–1999 **Max-Planck Research Fellow**,
Max-Planck Institut für Quantenoptik, Garching, Germany.
(Two semesters during PhD studies)
- 1996–2001 **Teaching Assistant**,
Physics Department, University of Crete, Greece.
(During PhD studies)

Miscellaneous

- 2001–2002 **Mandatory Military Service**, *Greek Army.*

Academic Visits

- 2019 **Mercator Fellow**,
Technical University Darmstadt, Darmstadt, Germany,
Duration: One year.
- 2015 **Visiting Scientist**,
Laboratoire Traitement et Communication de l'Information, Télécom ParisTech,
Paris, France,
Duration: Three months.
- 2015 **Visiting Scientist**,
University of Glasgow, Glasgow, UK,
Duration: Three months.
- 2014 **Visiting Scientist**,
Technical University in Prague, Prague, Czech Republic,
Duration: One month.
- 2012 **Visiting Professor**,
Technical University in Prague, Prague, Czech Republic,
Duration: Two months.
- 2011 **Visiting Scientist in the framework of "X-Ray Frontiers" program**,
Kavli Institute for Theoretical Physics, UCSB, Santa Barbara, California,
Duration: Two weeks.
- 2010 **Visiting Scientist**,
Institut für Angewandte Physik, Technische Universität Darmstadt, Germany,
Duration: One month.

Scholarships and Awards

- 2019 **Mercator Fellowship from Deutschen Forschungsgemeinschaft (DFG)**,
Technical University Darmstadt, Darmstadt, Germany,
(participation in SFB Crossing program for Cryptography-Based Security Solutions:
Enabling Trust in New and Next Generation Computing Environments.).
- 2008 **2nd Prize for distinguished scientific achievements**,
Technical University in Prague, Prague, Czech Republic,
Awarded for my work on state transfer in collaboration with V. Kostak and I. Jex.
- 1996 **3rd Prize in Summer School on Physics**,
Physics Department, University of Crete, Heraklion, Greece,
(participation of students from all of the Greek Universities).
- 1995 **Fellowship**,
Physics Department, University of Patras, Patras, Greece,
(given to top undergraduate students by the Greek Ministry of Education).

Research Interests

- **Quantum Cryptography:** Protocols for quantum key-distribution and beyond.
- **Quantum Information Processing:** Physical implementations of quantum communication and computation, engineering of quantum networks, faithful state transfer and entanglement distribution.
- **Quantum Optics:** Interaction between Radiation and Matter, linear & nonlinear processes, Markovian & non-Markovian dynamics, stochastic processes.
- **Ultracold Quantum Gases:** Bose-Einstein condensation and atom lasers, interaction between radiation and atomic systems/condensates, out-coupling in atom lasers, matter waves, ultracold atoms in optical lattices.

Scientific Output, Impact & Statistics (last update 26.10.2019)

- 50 articles in peer-reviewed journals
- 1 edited volume
- 3 chapters in books
- 1006 citations (excluding self citations); h-index = 16 (Web of Science)
- 1594 citations; h-index = 19 (Google Scholar)
- 7 single-author articles; first author in 21 articles; $\simeq 2.63$ authors per article

Publications

Papers in peer-reviewed journals

1. *Intercept-Resend Emulation Attacks Against a Continuous-Variable Quantum Authentication Protocol with Physical Unclonable Keys*, Lukas Fladung, Georgios M. Nikolopoulos, Gernot Alber, and Marc Fischlin, *Cryptography* **3**, 25 (2019).
2. *Optical scheme for cryptographic commitments with physical unclonable keys*, G. M. Nikolopoulos, *Optics Express* **27**, 29366 (2019).
3. *Cryptographic one-way function based on boson sampling*, G. M. Nikolopoulos, *Quantum Information Processing* **18**, 259 (2019).
4. *Photon-assisted quantum state transfer and entanglement generation in spin chains*, A. Gratsea, G. M. Nikolopoulos and P. Lambropoulos, *Physical Review A* **98**, 012304 (2018).
5. *Continuous-variable quantum authentication of physical unclonable keys: Security against an emulation attack*, G. M. Nikolopoulos, *Physical Review A* **97**, 012344 (2018).
6. *Continuous-variable quantum authentication of physical unclonable keys*, G. M. Nikolopoulos and E. Diamanti, *Scientific Reports* **7**, 46047 (2018).
7. *Decision and function problems based on boson sampling*, G. M. Nikolopoulos and T. Brougham, *Physical Review A* **94**, 012315 (2016).
8. *Evaluation of performance of two state-transfer Hamiltonians in the presence of static disorder*, A. K. Pavlis, G. M. Nikolopoulos, and P. Lambropoulos, *Quantum Information Processing*, **15** 2553 (2016).
9. *Resonantly enhanced multiphoton ionization under XUV FEL radiation: a case study of the role*

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of harmonics

- G. M. Nikolopoulos and P. Lambropoulos, *Journal of Physics B* **48**, 244006 (2015).
10. *Transfer of optical signals around bends in two-dimensional linear photonic networks*
G. M. Nikolopoulos, *Journal of Physics B* **47**, 035505 (2015).
 11. *Time-dependent density-functional theory of strong-field ionization of atoms by soft x rays*,
A. Crawford-Uranga *et al.*, *Physical Review A* **90**, 033412 (2014).
 12. *Multiple Ionization of Neon under soft x-rays: Theory versus Experiment*,
G. M. Nikolopoulos and P. Lambropoulos, *Journal of Physics B* **47**, 115001 (2014).
 13. *Assessing the number of atoms in a Rydberg-blockaded mesoscopic ensemble*,
D. Petrosyan and G. M. Nikolopoulos, *Physical Review A* **89**, 013419 (2014).
 14. *Multiple ionization under strong XUV to X-ray radiation*,
P. Lambropoulos and G. M. Nikolopoulos, *Eur. Phys. J. Special Topics* **222**, 2067 (2013).
 15. *Frequency response of an atomic resonance driven by weak free-electron-laser fluctuating pulses*,
G.M. Nikolopoulos and P. Lambropoulos, *Journal of Physics B* **46**, 164010 (2013).
 16. *Statistics of a quantum-state-transfer Hamiltonian in the presence of disorder*,
G.M. Nikolopoulos, *Physical Review A* **87**, 042311 (2013).
 17. *Faithful communication Hamiltonian in photonic lattices*,
M. Bellec, G.M. Nikolopoulos, and S. Tzortzakis, *Optics Letters* **37**, 4504 (2012).
 18. *Effects of FEL field fluctuations on the frequency response of driven atomic resonances*,
G.M. Nikolopoulos and P. Lambropoulos, *Physical Review A* **86**, 033420 (2012).
 19. *Analysis and minimization of bending losses in discrete quantum networks*,
G.M. Nikolopoulos, A. Hoskovec, and I. Jex, *Physical Review A* **85**, 062319 (2012).
 20. *Symmetries and security of a quantum-public-key encryption based on single-qubit rotations*,
U. Seyfarth, G. M. Nikolopoulos, G. Alber, *Physical Review A* **85**, 022342 (2012).
 21. *Route to direct multiphoton multiple ionization*,
P. Lambropoulos, G. M. Nikolopoulos, K. G. Papamihail, *Physical Review A* **83**, 021407(R) (2011).
 22. *Perfect transfer of multiple excitations in quantum networks*,
T. Brougham, G. M. Nikolopoulos, and I. Jex, *Physical Review A* **83**, 022323 (2011).
 23. *Passage-time statistics of superradiant light pulses from Bose-Einstein condensates*,
L. F. Buchmann, G. M. Nikolopoulos, O. Zobay, and P. Lambropoulos, *Journal of Physics B* **44**, 025301 (2011).
 24. *Early stage of superradiance from Bose-Einstein condensates*,
L. F. Buchmann, G. M. Nikolopoulos, O. Zobay, and P. Lambropoulos, *Physical Review A* **82**, 023608 (2010).
 25. *Atom-number filter in an optical lattice*,
G. M. Nikolopoulos and D. Petrosyan, *Fast Track Communication in Journal of Physics B* **43**, 131001 (2010).
 26. *State transfer in static and dynamic spin chains with disorder*,
D. Petrosyan, G. M. Nikolopoulos, and P. Lambropoulos, *Physical Review A* **81**, 042307 (2010).
 27. *Correlated directional atomic clouds via four heterowave mixing*,
L. F. Buchmann, G. M. Nikolopoulos, O. Zobay, and P. Lambropoulos, *Physical Review A* **81**, 031606(R) (2010).
 28. *Communication in quantum networks of logical bus topology*,
T. Brougham, G. M. Nikolopoulos, and I. Jex, *Physical Review A* **80**, 052325 (2009).
 29. *Deterministic quantum-public-key encryption: Forward search attack and randomization*,

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- G. M. Nikolopoulos and L. M. Ioannou, *Physical Review A* **79**, 042327 (2009).
30. *Role of the relative phase in the merging of two independent Bose-Einstein Condensates*, L. Buchmann, G. M. Nikolopoulos, and P. Lambropoulos, *Physical Review A* **79**, 013631 (2009).
 31. *Directional coupling for quantum computing and communication*, G. M. Nikolopoulos, *Physical Review Letters* **101**, 200502 (2008).
 32. *Applications of single-qubit rotations in quantum public-key cryptography*, G. M. Nikolopoulos, *Physical Review A* **77**, 032348 (2008).
 33. *Effects of relative phase and interactions on atom-laser outcoupling from a double-well BEC: Markovian and non-Markovian dynamics*, G. M. Nikolopoulos, C. Lazarou, and P. Lambropoulos, *Journal Physics B* **41**, 025301 (2008).
 34. *Non-Markovian dynamics in atom-laser outcoupling from a double-well Bose-Einstein condensate*, C. Lazarou, G. M. Nikolopoulos and P. Lambropoulos, *Journal of Physics B* **40**, 2511 (2007).
 35. *Perfect state-transfer in networks of arbitrary topology and coupling configuration*, V. Kostak, G. M. Nikolopoulos and I. Jex, *Physical Review A* **75**, 042319 (2007).
 36. *Sequential superradiant scattering from atomic Bose-Einstein condensates*, O. Zobay and G. M. Nikolopoulos, *Laser Physics* **17**, 180 (2007).
 37. *Postponement of dark-count effects in practical quantum key-distribution by two-way post-processing*, A. Khalique, G. M. Nikolopoulos and G. Alber, *European Physics Journal D* **40**, 453 (2006).
 38. *Provable entanglement and information cost for qubit-based quantum key-distribution protocols*, G. M. Nikolopoulos, A. Khalique and G. Alber, *European Physical Journal D* **37**, 441 (2006).
 39. *Error tolerance of two-basis quantum key-distribution protocols using qudits and two-way classical communication*, G. M. Nikolopoulos, K. S. Ranade and G. Alber, *Physical Review A* **73**, 032325 (2006).
 40. *Spatial effects in superradiant Rayleigh scattering from Bose-Einstein condensates*, O. Zobay and G. M. Nikolopoulos, *Physical Review A* **73**, 013620 (2006).
 41. *Dynamics of matter-wave and optical fields in superradiant scattering from Bose-Einstein condensates*, O. Zobay and G. M. Nikolopoulos, *Physical Review A* **72** 041604(R) (2005).
 42. *Security bound of two-bases quantum key distribution protocols using qudits*, G. M. Nikolopoulos and G. Alber, *Physical Review A* **72**, 032320 (2005).
 43. *Electron wavepacket propagation and entanglement in a chain of coupled quantum dots*, G. M. Nikolopoulos, D. Petrosyan and P. Lambropoulos, *Journal of Physics: Condensed Matter* **16**, 4991 (2004).
 44. *Coherent electron wavepacket propagation and entanglement in array of coupled quantum dots*, G. M. Nikolopoulos, D. Petrosyan and P. Lambropoulos, *Europhysics Letters* **65**, 297 (2004).
 45. *Effects of interatomic collisions on atom laser outcoupling*, G. M. Nikolopoulos, P. Lambropoulos and N. P. Proukakis, *Journal of Physics B* **36**, 2797 (2003).
 46. *Collective behaviour in a system of two-level atoms at the edge of a photonic band-gap*, G. M. Nikolopoulos and P. Lambropoulos, *Journal of Modern Optics* **49**, 61 (2002).
 47. *Few-photon quantum electrodynamics in a structured continuum*, G. M. Nikolopoulos and P. Lambropoulos, *Journal of Optics B* **3**, 115 (2001).
 48. *Beyond single-photon localization at the edge of a Photonic Band Gap*, G. M. Nikolopoulos and P. Lambropoulos, *Physical Review A* **61**, 053812 (2000).
 49. *Fundamental quantum optics in structured reservoirs*, P. Lambropoulos, G. M. Nikolopoulos, T. R. Nielsen and S. Bay, *Reports on Progress in Physics*

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63, 455 (2000).

50. *Quantum systems coupled to a structured reservoir with multiple excitations*, G. M. Nikolopoulos, S. Bay and P. Lambropoulos, *Physical Review A* **60**, 5079 (1999).

Chapters in books

1. *Communication in Engineered Quantum Networks*, G. M. Nikolopoulos, T. Brougham, A. Hoskovec and I. Jex, in "Quantum State Transfer and Network Engineering", edited by G. M. Nikolopoulos & I. Jex (Springer-Verlag, 2014).
2. *State transfer Hamiltonians in photonic lattices*, M. Bellec, G. M. Nikolopoulos and S. Tzortzakis, in "Quantum State Transfer and Network Engineering", edited by G. M. Nikolopoulos & I. Jex (Springer-Verlag, 2014).
3. *Quantum electrodynamics of a qubit*, G. Alber and G. M. Nikolopoulos, "Lectures on Quantum Information" edited by D. Bruss & G. Leuchs (Wiley-VCH, Weinheim, 2007).

Books

1. *Quantum State Transfer and Network Engineering*, G. M. Nikolopoulos and I. Jex (Eds.), Springer-Verlag (2014).

Selected Invited Talks, Lectures and Seminars

- Sept. 2019 **Quantum-safe entity authentication with physical unclonable keys**, *Invited Talk*, Crossing Summer School, Darmstadt, Germany.
- May 2019 -, *Invited Talk*, XVI International Conference on Quantum Optics and Quantum Information 2019, Minsk, Belarus.
(Declined)
- May 2019 **Photon-assisted quantum state transfer and entanglement generation in spin chains**, *Invited Talk*, TU Dortmund, Dortmund, Germany.
- Feb. 2019 **Quantum-safe entity authentication with physical unclonable keys**, *Invited Talk*, University of Twente, Enschede, Netherlands.
- Nov. 2017 - , *Invited Talk*, XV International Conference on Quantum Optics and Quantum Information, Minsk, Belarus.
(Declined)
- May 2017 **Continuous-variable authentication of Physical Unclonable Keys** , *Invited Talk*, Institut für Angewandte Physik, TU Darmstadt, Darmstadt, Germany.
- June 2016 **Boson Sampling: The dawn of a new era for cryptography and communication?** , *Invited Talk*, 23rd Central European Conference on Quantum Optics, Kolymbari, Crete, Greece.
- June 2016 -, *Invited Talk*, EMN Meeting on Optoelectronics, Cancun, Mexico.
(Declined)
- Sept. 2015 **Quantum Public-key Cryptography**, *Invited Talk*, Laboratoire Traitement et Communication de l'Information, Télécom ParisTech, Paris, France.
- Aug. 2015 -, *Invited Talk*, 24th annual International Laser Physics Workshop, Shanghai, China.
(Declined)
- July 2015 **Quantum Public-key Cryptography**, *Invited Talk*, Joint Meeting of Theory groups from Glasgow & Strathclyde Universities, Strathclyde University, Glasgow, UK.

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- June 2015 **Transfer of Quantum States & Network Engineering in the Quest for Quantum Processors**, *Invited Talk*, Heriot-Watt University, Edinburgh, UK.
- June 2015 -, *Invited Talk*, EMN Meeting on Optoelectronics, Cancun, Mexico.
(Declined)
- Sept. 2014 **Modeling the Effect of FEL Field Fluctuations on Multiphoton Multiple Ionization**, *Invited talk at 2nd annual XLIC meeting*, Gdansk, Poland.
- Oct. 2012 **Engineering of Quantum Networks in the Quest for the Quantum Computer**, *Colloquium at the Physics Department*, University of Crete.
- March 2012 **Modelling the fluctuations of Free-Electron-Laser radiation and their effect on the interaction with atoms**, *Seminar at the Doppler Institute*, Prague, Czech Republic.
- March 2012 **Faithful state transfer**, *Four lectures at the Czech Technical University*, Prague, Czech Republic.
- Sept. 2010 **Modelling the fluctuations of Free-Electron-Laser radiation and their effect on the interaction with atoms**, *Kavli Institute for Theoretical Physics*, UCSB, Santa Barbara, California.
- June 2010 **Quantum communication and Quantum public-key cryptography**, *Laboratoire Traitement et Communication de l'Information CNRS*, Paris, France.
- April 2010 **Modelling the fluctuations of Free-Electron-Laser radiation and their effect on the interaction with atoms**, *Two lectures at the WG1 COST meeting*, Hans-sur-Lesse, Belgium.
- Sept. 2009 **Principles of quantum cryptography**, *Two lectures in the framework of FASTQUAST '09*, Rethymnon, Greece.
- July 2009 **Role of the relative phase in the merging of two independent Bose-Einstein condensates**, *Laser Physics '09*, Barcelona, Spain.
- June 2008 **Aspects of quantum cryptography**, *IESL/FORTH*, Heraklion, Greece.
- May 2008 **Quantum public-key cryptography**, *Modern trends in Quantum Optics and Quantum Information*, Prague, Czech Republic.
- Feb. 2006 **Quantum cryptography: Quantum physics at the service of secrecy**, *Colloquium at the Physics Department*, University of Crete, Greece.
- Feb. 2006 **Superradiant Rayleigh Scattering from Atomic Bose-Einstein Condensates: Dynamics of Matter-Wave and Optical Fields**, *Seminar at IESL/FORTH*, Heraklion, Greece.
- Dec. 2004 **Quantum Cryptography**, *Seminar at the Physics Department*, University of Patras, Greece.
- June 2004 **Quantum Cryptography**, *Two lectures in the 16th Summer School in Advanced Physics*, Heraklion, Greece.
- July 2004 **Electron wavepacket propagation and entanglement in a chain of coupled quantum dots**, *MPI-PKS Seminar on Quantum Dynamics*, Dresden, Germany.
- Apr. 2004 **Robustness of the BB84 quantum-key-distribution protocol against coherent attacks**, *DFG Workshop*, Hirschegg, Austria.

Feb. 2004 **Multiple excitations in Structured Reservoirs**, *Ringberg Meeting on Finite Systems, Ringberg, Germany.*

Teaching Experience

- 2015-now "Quantum Optics and Quantum Information"
Undergraduate course at University of Crete.
- 2003-2004 "Quantum Theory"
Undergraduate course at TU Darmstadt.
- 2003-2004 "Quantum Information"
Undergraduate course at TU Darmstadt.
- 1999-2000 "Quantum Electronics"
Postgraduate course at University of Crete
- 1996-1998 "General Physics II" and "Advanced Physics Labs"
Undergraduate courses at University of Crete

Refereeing and Editorship

- Referee for various scientific journals including: Phys. Rev. Lett., Phys. Rev. X, Phys. Rev. A, Quant. Sci. Tech., J. Opt. Soc. Am. B, J. Phys. B, Phys. Scr., Phys. Lett. A., Quant. Inf. Proc., etc
- Editor of the volume: *Quantum State Transfer and Network Engineering, Springer-Verlag (2014).*

Graduate Student Supervision

- Yannick Deller, MSc student at TU Darmstadt.
[Co-supervised with Prof. G. Alber (2019).]
- Lukas Fladung, MSc student at TU Darmstadt.
[Co-supervised with Prof. G. Alber (2019).]
- Sascha Hauck, Diploma student at TU Darmstadt.
[Co-supervised with Prof. G. Alber (2019).]
- Aikaterini Gratsea, Diploma student at University of Crete, Greece.
[Co-supervised with Prof. P. Lambropoulos (2017-2018).]
- Alexander Pavlis, MSc student at University of Crete, Greece.
[Co-supervised with Prof. P. Lambropoulos (2014-2015).]
- Lukas F. Buchmann, PhD student at University of Crete, Greece.
[Co-supervised with Prof. P. Lambropoulos (2007-2010).]
- Kedar S. Ranade, PhD student at TU Darmstadt, Germany.
[Co-supervised with Prof. G. Alber (2005-2006).]
- Aeysha Khaliq, PhD student at TU Darmstadt, Germany.
[Co-supervised with Prof. G. Alber (2004-2006).]
- Falko Strenzke, MSc student at TU Darmstadt, Germany.
[Co-supervised with Prof. G. Alber (2005).]

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Research Programs and Funding

- 2019 **SFB CROSSING, Deutschen Forschungsgemeinschaft (DFG)**,
"Cryptography-Based Security Solutions: Enabling Trust in New and Next Generation Computing Environments",
Mercator Fellow.
- 2014–2018 **COST Action NQO**,
Nanoscale Quantum Optics,
Member of WG1.
- 2013–2017 **COST Action XLIC**,
XUV/X-ray Light and fast Ions for ultrafast Chemistry,
Member of the Management Committee and member of the IESL/FORTH team.
- 2008–2012 **COST Action CUSPFEL**,
Chemistry with Ultrashort Pulses and Free-Electron Lasers: Looking for Control Strategies Through Exact Computations, Member of IESL/FORTH research team.
- 2007–2010 **FP6 Marie Curie RTN EMALI**,
Engineering, Manipulation and Characterization of Quantum States of Matter and Light, Member of IESL/FORTH research team.
- 2003–2006 **FP6 IP SECOQC**,
Development of a Global Network for Secure Communication based on Quantum Cryptography, Member of IAP/TU Darmstadt research team.