Curriculum Vitae

Personal Information

First name / Surname:	Piotr Migdał
Date of birth:	1986-03-13
Citizenship:	Polish
E-mail:	pmigdal@gmail.com
Homepage:	http://migdal.wikidot.com
Phone:	+48 537 459 068 (Polish) / +34 644 226 536 (Spanish)
Profiles:	GitHub, StackExchange

Research Interests

complex systems, complex networks, data science, mathematical modelling in psychology, geometry of quantum states, quantum optics, quantum information

Education

ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain
Quantum Optics Theory Group, advisor: prof. Maciej Lewenstein **Feb 2011 – Dec 2014**

- Thesis (submitted):
  Symmetries and self-similarity of many-body wavefunctions. Sept 2014
- Polynomial invariants for permutation-symmetric pure states, application to linear optics.
- Application of sequence-analysis methods for quantum states.
- Complex quantum networks: walks, community detection.
- Collaboration: mathematical psychology.

University of Warsaw, Warsaw, Poland
Inter-faculty Studies in Mathematics and Natural Sciences **2005 – 2011**

- Master's Degree (5 year programme) Jan 2011
  Physics (Theoretical Physics — Quantum Optics and Atomic Physics)
  thesis: Quantum codes immune to collective decoherence and photon loss,
  advisor: Konrad Banaszek, grade: 5/5
- Bachelor's Degree, Mathematics Sept 2009
  thesis: A mathematical model of the mafia game, advisor: Jacek Miekisz, grade: 5/5

Research Experience

ISI Foundation, Turin, Italy
Jacob Biamonte Gorup **May – Jun 2013**

- Quantum complex networks: quantum walks, community detection, weak time-symmetry.

The Institute for Theoretical Physics (IFT) UAM-CSIC, Cantoblanco (Madrid), Spain
German Sierra and Javier Rodriguez-Laguna **March 2013, July 2014**

- Complex systems and classical information for quantum states.
- Local-unitary equivalence for permutation-symmetric states.

Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw, Warsaw, Poland
Dariusz Plewczyński Group, mathematical psychology collaboration: **Nov 2010 –**

- Cognitive computing: human information sharing models, models of human perception.

Institute of Theoretical Physics, University of Warsaw, Warsaw, Poland
Konrad Banaszek Group, quantum optics (theoretical physics) , TEAM Programme operated by the Foundation for Polish Science **Jan – Sep 2010**

- Quantum-enhanced protocols in realistic environments: Generation schemes for robust entangled states.

ICFO - The Institute of Photonic Science,
Castelldefels (Barcelona), Spain
Maciej Lewenstein Group, quantum optics (theoretical physics) **Oct 2009**

- Ultra-cold atomic gases in non-abelian gauge fields.

Faculty of Physics, Nicolaus Copernicus University, Toruń, Poland
Konrad Banaszek Group, quantum optics (theoretical physics) **2007 – 2009**

- Analysis of spontaneous parametric down-conversion, estimation of the quantum noise.
- Averaging procedures for generating decoherence-free states.

Faculty of Physics, University of Warsaw, Warsaw, Poland
Czesław Radzewicz Group, applied optics (experimental physics) **2006 – 2007**

- Wavefront sensor with Fresnel zone plates for use in an undergraduate laboratory.

Francis Bitter Magnet Laboratory, Massachusetts Institute of Technology,
Jagadeesh Moodera Group, spintronics (experimental physics) Cambridge (MA), USA
during the Research Science Institute 2005 scholarship **Jul — Aug 2005**

- Experimental work on organic tunneling barriers.

Professional Experience

Freelancing in data analysis and data visualization **Jan 2014 –**
Selected projects:

- Processing data of Polish schools for project Szkolomat (projekt:polska) — data consultancy, data cleaning and merging, geocoding, item response theory (Python: SciPy, Pandas; R: mirt).
- Custom interactive charts for Data4Cure (D3.js).
- Evaluation of investment potential for Startup Compass (Python: scikit-learn, Pandas; R: party).

Startup Compass Inc., San Francisco, CA, USA
Data Science Intern **Jul – Oct 2013**

- Designing distance function for software companies, based on a multidimensional dataset.
- Data processing (Python: SciPy, Pandas; MongoDB), data exploration and visualization (Gephi, D3.js).

Projects, Activities

Teaching, popularization and organizational work

- Referee for Physical Review A — 2014–
- Started an unconference series Offtopicarium — Jan 2012–
- a moderator of Theoretical Physics - Stack Exchange — Nov 2011–May 2012
- prepared and lead a month-length course *Introduction to quantum cryptography* for 2 talented high-school students for Caixa Catalunya (Jovenes y Ciencia) — Jun 2011, Jul 2012
- co-organizer of the 6th and 7th Summer Scientific Schools — 2010-2011
- co-organizer of Flaszki (a series of 5-min talks) — 2010
- member of the *Neurobiology Students' Scientific Society*, Univ. of Warsaw — 2008–2011
- voluntary tutor of the Polish Children's Fund during 9 scientific workshops (for gifted high school individuals), the last one: Physics of Herd — 2006–2011
- mentor of A. Kubica and W. Pilewski, winners (1st prize) of the 21st European Union Contest for Young Scientists in Paris — 2009
- head organizer of the 7th Polish Physics Students' Societies Conference (7–10.11.2008, University of Warsaw, 80 participants from 15 universities, 36 talks) — 2007–2009
- co-founder and president of the Physics Students' Society, Univ. of Warsaw — 2006–2009
- problem setter of the Polish Physics Olympiad — 2006–2008

Courses and conferences — participant

- BigDive (a 4-week long hands-on workshop in data science and big data processing, for 20 participants), Turin, Italy — 2012
- Quantum Information meets Statistical Mechanics, Innsbruck, Austria — 2012
- ECCS12: European Conference on Complex Systems, Brussels, Belgium — 2012
- QCMC2012: 11th Intl. Conference on Quantum Communication, Measurement and Computing, Vienna, Austria — 2012
- 44 Symposium on Mathematical Physics: New Developments in the Theory of Open Quantum Systems, Toruń, Poland — 2012
- ECCS2011: European Conference of Complex Systems, including events: Complex Dynamics of Human Interactions and PhD 'Research in Progress' Workshop, Vienna, Austria — 2011
- NetSci 2011: The International School and Conference on Network Science — 2011
- Balaton Summer School in Physics: Self-organization and complex systems, Hungary — 2010
- International Conference on Optical Angular Momentum, York, UK — 2010
- Summer Course: Quantum Engineering, Advanced Level, Warsaw, Poland — 2009
- Quantum Optics VII - Quantum Engineering of Atoms and Photons Zakopane, Poland — 2009
- Quantum Optics and Quantum Information, Toruń, Poland — 2008

Other

- co-founder of Confrenzy — a website listing scientific events — 2011–2012

Awards, Scholarships

- ICFO Innovation Fund grant awarded for Confrenzy — Oct 2011
- Scholarship of the Minister of Science and Higher Education for exceptional achievements in science — 2007–2010
- 2nd place in the Didactic Show Competition (Faculty of Physics, University of Warsaw) — 2008
- Research Science Institute (Massachusetts Institute of Technology, Cambridge, MA, USA) — 2005
- Scholarship of the Polish Children's Fund — 2003–2005
- Scholarship of the Minister of Education, Science and Sport — 2003–2005
- Bronze Medal in the International Physics Olympiad (Pohang, South Korea) — 2004
- 2nd place in the 53rd Polish Physics Olympiad — 2004
- 7th place in the 52nd Polish Physics Olympiad — 2003

Technical skills

- Languages: Polish (native), English (fluent)
- Programming languages and tools: Python, JavaScript, Mathematica, LaTeX, Git
- Systems (user): Mac OS X, Linux, Windows

Publications

Papers

- P. Migdał, K. Rodríguez-Laguna, M. Oszmaniec, M. Lewenstein, Multiphoton states related via linear optics, Phys. Rev. A 89, 062329 (2014), arXiv:1403.3069, featured in the Editor's Suggestions of Physical Review A.
- M. Denkiewicz, J. Rączaszek-Leonardi, P. Migdał, D. Plewczynski, Information-Sharing in Three Interacting Minds Solving a Simple Perceptual Task, 35th Annual Cognitive Science Conference, 2172.
- M. Faccin, P. Migdał, T. Johnson, J. Biamonte, V. Bergholm, Community Detection in Quantum Complex Networks, Phys. Rev. X 4, 041012 (2014), arXiv:1310.6638.
- M. Faccin, T. Johnson, J. Biamonte, S. Kais, P. Migdał, Degree Distribution in Quantum Walks on Complex Networks, Phys. Rev. X 3, 041007 (2013), arXiv:1305.6078, featured on Azimuth blog
- P. Migdał, J. Rodriguez-Laguna, M. Lewenstein, Entanglement classes of permutation-symmetric qudit states: symmetric operations suffice, Phys. Rev. A 88, 012335 (2013), arXiv:1305.1506
- J. Rodriguez-Laguna, P. Migdał, M. Ibanez Berganza, M. Lewenstein, G. Sierra, Qubism: self-similar visualization of many-body wavefunctions, New J. Phys. 14 053028 (2012), arXiv:1112.3560, in the NJP Highlights of 2012
- P. Migdał, M. Denkiewicz, J. Rączaszek-Leonardi, D. Plewczynski, Information-sharing and aggregation models for interacting minds, Journal of Mathematical Psychology 56, 417-426 (2012), arXiv:1109.2044, blog post
- P. Migdał, K. Banaszek, Immunity of information encoded in decoherence-free subspaces to particle loss, Phys. Rev. A 84, 052318 (2011), arXiv:1107.3786
- P. Migdał, A mathematical model of the Mafia game, arXiv:1009.1031
- P. Migdał, W. Wasilewski, Noise reduction in 3D noncollinear parametric amplifier, Appl. Phys. B 99, 657-671 (2010), arXiv:0908.2207
- K. Banaszek, R. Demkowicz-Dobrzański, M. Karpinski, P. Migdał, C. Radzewicz, Quantum and semiclassical polarization correlations, Opt. Comm. 283, 713-718 (2010), arXiv:0908.3548
- P. Migdał, P. Fita, C. Radzewicz, Ł. Mazurek, Wavefront sensor with Fresnel zone plates for use in an undergraduate laboratory, Am. J. Phys. 76, 229 (2008)
- T. S. Santos, J. S. Lee, P. Migdal, I. C. Lekshmi, B. Satpati, J. S. Moodera, Room-Temperature Tunnel Magnetoresistance and Spin-Polarized Tunneling through an Organic Semiconductor Barrier, Phys. Rev. Lett. 98, 016601 (2007)

Departamental talks (selected)

- Quantum complex networks: random walks and community-detection (BarabasiLab and CCNR, Northeastern University, Boston) Oct 2013
- Qubism: self-similar visualization of many-body wavefunctions (IQIM Seminar, Caltech, Pasadena) Oct 2013
- Two heads are better than one... and what about n heads? (Tamas Vicsek Group, ELTE, Budapest) Jun 2011

Meetup talks (selected)

- Graph Visualization in D3.js, Bay Area d3 User Group, San Francisco, Sept 2013
- Machine learning in Python, Barcelona Python Meetup Feb 2013

Conference talks — presenting author

- P. Migdał, *Limits of quantum interference*, Science. Polish Perspectives (24-25.10.2014, Oxford, UK)
- P. Migdał, M. Denkiewicz, J. Rączaszek-Leonardi, D. Plewczynski, *Two and more heads deciding: models of information-sharing and aggregation for two-choice discriminative tasks*, Complex Dynamics of Human Interactions (a ECCS2011 satellite) (12-16.09.2011, Vienna, Austria)

Conference posters — presenting author

- J. Rodriguez-Laguna, P. Migdał, M. Ibanez Berganza, M. Lewenstein, G. Sierra, Self-similar visualization and sequence analysis of many-body wavefunctions (2012)
- P. Migdał, K. Banaszek, Immunity of information encoded in singlet states against one particle loss (2012)
- A. Kubica, P. Migdał, The spatial shape of the Spiral Zone Plate foci (2010)
- P. Migdał, W. Wasilewski, Optimization of a 3D noncollinear parametric amplifier (2009)

Popular science and education-related articles (selected)

- P. Migdał, Two heads are better than one. How about more?, The EGG blog (2014)
- M. Kotowski, M. Kotowski, P. Marczewski, P. Migdał, An independent camp for high school geeks, Summer Scientific School (2012)
- M. Kotowski, P. Migdał, Open Science and Science 2.0, 1st Offtopicarium (2012)
- P. Migdał, S. Krawczyk, Zespół Aspergera, nauki ścisłe i kultura nerdów (Asperger Syndrome, Hard Science and Nerd Culture), V Krakowska Konferencja Kognitywistyczna (2011), a popular science article
- M. Kotowski, M. Kotowski, P. Migdał, K. Sołtys, Drogowskaz Pasjonata, czyli jak rozwijać się w szkole i w trakcie studiów (Guidelines for the Curious - how to develop oneself during high school and university years), (2010), a collection of advice
- P. Migdał, Mafia, zdradziecka parzystość oraz pi (Mafia, treacherous parity and pi), Delta - miesięcznik popularnonaukowy, 14-15, 07/2010 (2010), a short popular science article
- P. Migdał, Zapaleńcy i Wypaleńcy, czyli rzecz o utracie pasji w trakcie studiów (Flames of passion... and of burnout, or: about the loss of motivation during studies), (2010), an essay
- eds: M. Zientkiewicz, P. Migdał, M. Nowaczyk, M. Pomorski, B. Szczygieł, 7th Polish Physics Students' Societies Conference - proceedings, ISBN: 978-83-61026-05-1, (2009), a book (132 pages, 10 reviewed papers)