

Curriculum Vitae

PERSONAL INFORMATION

First name / Surname: Piotr Migdal
Date of birth: 1986-03-13
Citizenship: Polish
E-mail: pmigdal@gmail.com
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Profiles: GitHub, StackExchange

RESEARCH INTERESTS

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

EDUCATION

ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain
Quantum Optics Theory Group of Maciej Lewenstein **2011 – 2014**
• PhD Degree, *cum laude* Dec 2014
thesis: [Symmetries and self-similarity of many-body wavefunctions](#)
advisors: Maciej Lewenstein, Javier Rodríguez-Laguna
reviewers: Seth Lloyd (MIT), Karol Życzkowski (Jagiellonian University)

- Polynomial invariants for permutation-symmetric pure states, application to linear optics.
- Application of sequence-analysis methods for quantum states, data visualization.
- 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 Miękisz, grade: 5/5

PROFESSIONAL EXPERIENCE

Freelancing in data analysis and data visualization **Jan 2014 –**
Selected projects:
• [2-day intensive training in machine learning and big data for DeepSense.io](#) in San Francisco; New York and London scheduled (IPython Notebook, scikit-learn, Spark)
• 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).

- DELab, University of Warsaw**, Warsaw, Poland **Apr 2015 –**
Principal Investigator
- Analysis and visualization of the Polish nationwide high school exam results, <https://github.com/stared/delab-matury>
 - An intensive 5-day introduction to data analysis in Python, for social science students and academic workers, <https://github.com/DELabUW/szkola-letnia-2015>
- CeNT, University of Warsaw**, Warsaw, Poland **Mar 2015 –**
Data Visualization Specialist, Dariusz Plewczynski Group
- Interactive visualization of the similarity between influenza strains
- ISI Foundation**, Turin, Italy **May – Jun 2013**
Jacob Biamonte Group
- Quantum complex networks: quantum walks, community detection, weak time-symmetry.
- The Institute for Theoretical Physics (IFT) UAM-CSIC**, Cantoblanco (Madrid), Spain **Mar 2013, Jul 2014**
German Sierra and Javier Rodriguez-Laguna
- 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 **Jan – Sep 2010**
Konrad Banaszek Group, quantum optics (theoretical physics) , TEAM Programme operated by the Foundation for Polish Science
- Quantum-enhanced protocols in realistic environments: Generation schemes for robust entangled states.
- ICFO - The Institute of Photonic Science**,
Castelldefels (Barcelona), Spain **Oct 2009**
Maciej Lewenstein Group, quantum optics (theoretical physics)
- Ultra-cold atomic gases in non-abelian gauge fields.
- Faculty of Physics, Nicolaus Copernicus University**, Toruń, Poland **2007 – 2009**
Konrad Banaszek Group, quantum optics (theoretical physics)
- 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 **2006 – 2007**
Czesław Radzewicz Group, applied optics (experimental physics)
- 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.

PROJECTS,
ACTIVITIES

Teaching, popularization and organizational work

- Designing and developing [Quantum Game](#) May 2015–
- Designed and lead an intensive one-week training [Data Analysis Summer School in Python](#) for sociologists and psychologists Jul 2015
- Referee for Physical Review A 2014–2015
- 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 2007–2009
(7–10.11.2008, University of Warsaw, 80 participants from 15 universities, 36 talks)
- 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

- Personal grant for Matura Exam Data Analysis from DELab UW Apr 2015
- 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, R, Mathematica, LaTeX, Git
- Systems (user): Mac OS X, Linux, Windows

- P. Migdał, J. 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. Denkiwicz, 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. Rodríguez-Laguna, M. Lewenstein, [Entanglement classes of permutation-symmetric qudit states: symmetric operations suffice](#), Phys. Rev. A 88, 012335 (2013), arXiv:1305.1506
- J. Rodríguez-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. Denkiwicz, 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)

Departmental 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. Denkiwicz, J. Rączaszek-Leonardi, D. Plewczyński, *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, [There are no projects like side projects](#), The Crastina Column (2015)
- 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)