

Curriculum vitæ for Géza Tóth

April 2, 2017

Date of birth	August, 1971	Citizenship	Hungarian
Marital status	Family with 1 child (Dec 2005)		
Contact	Department of Theoretical Physics, University of the Basque Country UPV/EHU, P.O. Box 644, E-48080 Bilbao, Spain.	Phone: +34-94-601-7926 (office) E-mail: geza.toth@ehu.es http://www.gtoth.eu/	
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Education and working experience

Sep 2008-	<u>Research Professor of IKERBASQUE</u> , the Basque Foundation for Science (permanent), Dept. of Theoretical Physics, University of the Basque Country UPV/EHU, Bilbao, Spain.
Feb 2007-Aug 2008	<u>Research fellow</u> at the Institute of Photonic Sciences, ICFO (M. Lewenstein), Barcelona, Spain.
Feb 2006-	<u>Postdoctoral research associate</u> at the Department of Quantum Optics and Quantum Information (J. Janszky), Wigner Research Centre for Physics, Budapest, Hungary*.
Jan 2003-Jan 2006	<u>Postdoctoral research associate</u> at the Theoretical Division (J.I. Cirac), Max Planck Institute for Quantum Optics, Munich, Germany.
Oct 2000-Sep 2002	<u>Postdoctoral research associate</u> at the sub-department of theoretical physics (J. Yeomans), University of Oxford, UK.
Aug 2000	<u>Ph.D. in electrical engineering</u> from the University of Notre Dame (C.S. Lent), Indiana, USA. <u>Thesis: Coherence and Correlation in Quantum-dot Cellular Automata.</u> Average grade (GPA): 3.875 (maximum: 4.00).
May 1994	<u>Diploma in electrical engineering <i>with honor</i></u> from the Technical University of Budapest [†] and the Computer and Automation Research Institute (A. Radványi and T. Roska), <u>Thesis: Depth detection using cellular neural networks - Three dimensional reconstruction of incompletely defined surfaces. Later research associate at the same institute.</u>

Grants as PI: ERC Starting Grant GEDENTQOPT (individual, 1.3 million euros, 5 years),
CHIST-ERA QUASAR (collaborative project, 1.3 million euros, 2 years),
Ramon y Cajal Fellowship of the Spanish Ministry of Education (5 years),
Marie Curie Intra-European (Individual) Fwsp of the EU (2 years), etc. [see full list later]

Referee for: Nature, Nat. Commun., Phys. Rev. Lett. (≥ 40), Phys. Rev. A, Phys Rev. X, New J. Phys.,
ERC, START (FWF, Austria), DFG, Feodor Lynen Fellowship (Germany), NSERC (Canada),
OTKA (Hungary), NCN (Poland) [see full list later]

Pub. stat.: 65 papers: 1 Science, 16 Phys. Rev. Lett. (2 Editors' Suggestion, 1 Synopsys), 5 Appl. Phys. Lett.,
1 Phys. Rep., 6 New J. Phys., 22 Phys. Rev. A, 1 Phys. Rev. B, 1 Phys. Rev. E
> 3600 citations, h-index: 33 (ISI), see <http://www.researcherid.com/rid/A-6693-2008>
> 6100 citations, h-index: 38 (Google Scholar)

*Affiliated, but unpaid from February 2007.

[†]The name of the university changed to Budapest University of Technology and Economics.

Fellowships, projects and grants

- 2016-2022 **Quantum Information, Science and Technology.**
Project of the Basque Government, IT986-16
PI: J.G. Muga
- 2016-2020 **COST Action "Quantum Technologies in Space", CA15220**
Proposer of the Action: A. Bassi
Management Committee of Hungary: L. Diósi, G. Tóth.
- 2016-2018 **Quantum matter: From foundations to applications**
Project of the Spanish Ministry of Education, FIS2015-67161-P (MINECO/FEDER)
PI: J. G. Muga co-PI: M. Modugno
Participants: I. Lizuain, M. Pons, J. Siewert, G. Tóth, D. Sokolovski, L. A. Wu.
- 2012-2014 **Financial support for our Unidad de Formación e Investigación (UFI)**
Funded by: University of the Basque Country UPV/EHU, Bilbao, UFI 11/55
PI: J. G. Muga
Participants: M. Modugno, I. Lizuain, M. Pons, J. Siewert, G. Tóth,
D. Sokolovski, E. Solano, L. A. Wu.
- 2013 Sept **Financial support for the 4th International Conference on Quantum Entanglement and its Detection (QED4), Siegen**
Partly funded by: J. Phys. A, organizers: O. Gühne and G. Tóth
- 2013-2016 **Quantumness, quantum control and devices**
Project of the Spanish Ministry of Education, FIS2012-36673-C03-03
PI: L.A. Wu (Coordinator: J.G. Muga.)
- 2012 Sept **Financial support for the 3rd International Conference on Quantum Entanglement and its Detection (QED3), Bilbao**
Partly funded by: J. Phys. A, organizers: G. Tóth and O. Gühne
- 2012-2014 **CHIST-ERA Project Quantum States: Analysis and Realizations (QUASAR)**
Funding: European Union
PI of Spanish group: G. Tóth, International PI: H. Weinfurter.
PIs of other groups: R. Demkowicz-Dobrzanski, O. Gühne,
P. Mataloni, S. Pitassi, A. Zeilinger, M. Zukowski.
- 2011-2014 **Quantum optical and quantum information processing networks and their nonclassical properties**
Participant in the project of the National Research Fund of Hungary OTKA, K83858.
PI: T. Kiss, 11 people.
- 2011- 2017 **Generation and detection of entanglement in quantum optical systems**
European Research Council (ERC) Starting Grant, GEDENTQOPT (258647)
PI: G. Tóth (Individual grant). Employment of several postdocs and students.
- 2010-2015 **Quantum Information, Science and Technology.**
Project of the Basque Government, IT4720-10
PI: J.G. Muga
[90 points: fourth group in the category of consolidated groups (A) in the Basque Country.]

Fellowships, projects and grants (continued from previous page)

- 2010-2012 **Quantum control of microscopic and mesoscopic systems.**
Project of the Spanish Ministry of Education, FIS2009-12773-C02-02
PI: G. Tóth (Coordinator: J.G. Muga.)
- 2009 **Quantum State Engineering of Ultracold Atomic Systems.**
Full-time participant of the project of the Spanish Ministry of Education, FIS2008-00784
PI: M. Lewenstein
[G.T. left the project before its start due to taking a permanent research position of IKERBASQUE and applying to a project of the Spanish Ministry of Education as a PI.]
- Sep 2009-Aug 2011 Start-up grant of IKERBASQUE, the Basque Foundation for Science
- Jun 2007- **Quantum Optical Information Technology**
Incorporated into the Consolider-Ingenio 2010 Project of the Spanish Ministry of Education
Coordinator J. Eschner.
- Feb 2007-Aug 2008 **Quantum Information: Multi-party Quantum Entanglement and its Applications in Physical Systems.**
Five-year Ramon y Cajal Fellowship of the Spanish Ministry of Education.
[Discontinued due to taking a permanent research position of IKERBASQUE.]
- Sep 2006-Jan 2007 Three-year Bolyai Research Scholarship of the Hungarian Academy of Sciences.
[Discontinued due to taking the Ramon y Cajal Fellowship.]
- Feb 2006 - Jan 2007 **Multi-partite entanglement in quantum optical systems.**
Three-year Postdoctoral Grant of the National Research Fund of Hungary OTKA, PF63908.
[Discontinued due to taking the Ramon y Cajal Fellowship.]
- Feb 2006 - 2010 **Quantum optical systems and applications in quantum informatics.**
Participant in the project of the National Research Fund of Hungary OTKA, T049234.
PI: J. Janszky, ca. 10-15 people.
- Feb 2006-Jan 2007 **Multi-partite entanglement in quantum optical systems.**
Marie Curie European Reintegration Grant of the European Union, MERG-CT-2005-029146.
PI: G. Tóth (Individual grant).
Employment of:
 - 3 Ph.D. students (Sep-Dec 2006, Sep-Dec 2006, Jan-Aug 2006),
 - 1 post-doctoral assistant (March-Aug 2006).
- Jan 2004-Dec 2005 **Entanglement Creation and Detection in Quantum Optical Systems.**
Marie Curie Intra-European Fellowship of the European Union, MEIF-CT-2003-500183.
PI: G. Tóth (Individual grant).

External funding of group members

2010	I. Urizar-Lanz, M.Sc. and Ph.D. Grant of the Basque Government (advisor G. Tóth, 4 years)
2012	P. Hyllus, Ikerbasque Research Fellowship (5 years)
2015	M. Kleinmann, Individual Grant of the German Research Foundation (DFG) (2 years), KL 2726/2-1
2015	G. Fagundes, Brazilian grant to visit our group as a Ph.D. student of M. Kleinmann (11 months).
2015	M. Kleinmann, FQXI Large Grant (2 years), FQXi-RFP-1608

Preprints

1. Z. Kádár, M. Keyl, R. Matjeschk, G. Tóth, and Z. Zimborás,
Simulating continuous quantum systems by mean field fluctuations,
arXiv:1211.2173.
2. L. Knips, C. Schwemmer, N. Klein, J. Reuter, G. Tóth, and H. Weinfurter,
How long does it take to obtain a physical density matrix?,
arxiv:1512.06866.
3. G. Tóth,
Lower bounds on the quantum Fisher information based on the variance and various types of entropies,
arxiv:1701.07461.

Refereed articles in journals

1. I. Apellaniz, M. Kleinmann, O. Gühne, and G. Tóth,
Optimal witnessing of the quantum Fisher information with few measurements,
Phys. Rev. A 95 032330 (2017), Editors' Suggestion; arXiv:1511.05203.
2. G. Vitagliano, I. Apellaniz, M. Kleinmann, B. Lücke, C. Klempt, and G. Tóth,
Entanglement and extreme spin squeezing of unpolarized states,
New J. Phys. 19, 013027 (2017); arXiv:1605.07202.
3. S. Altenburg, S. Wölk, G. Tóth, O. Gühne,
Optimized parameter estimation in the presence of collective phase noise,
Phys. Rev. A 94, 052306 (2016); arXiv:1607.05160
4. C. Budroni, G. Vitagliano, G. Colangelo, R. J. Sewell, O. Gühne, G. Tóth, and M. Mitchell,
Quantum non-demolition measurement enables macroscopic Leggett-Garg tests,
Phys. Rev. Lett. 115, 200403 (2015); arxiv:1503.08433
5. I. Apellaniz, B. Lücke, J. Peise, C. Klempt, and G. Tóth,
Verifying the metrological usefulness of Dicke states with collective measurements,
New J. Phys. 17, 083027 (2015); arXiv:1412.3426.
6. C. Eltschka, G. Tóth, and J. Siewert,
Partial transposition as a direct link between concurrence and negativity,
Phys. Rev. A 91, 032327 (2015); Editors' Suggestion; arxiv:1505.01833.
7. G. Tóth, T. Moroder, and O. Gühne,
Evaluating convex roof entanglement measures,
Phys. Rev. Lett. 114, 160501 (2015); arxiv:1409.3806.
8. G. Tóth and I. Apellaniz,
Quantum metrology from a quantum information science perspective,
J. Phys. A: Math. Theor. 47, 424006 (2014), special issue "50 years of Bell's theorem"; arxiv:1405.4878.

9. N. Behbood, F. Martin Ciurana, G. Colangelo, M. Napolitano, G. Tóth, R.J. Sewell, and M.W. Mitchell,
Generation of macroscopic singlet states in a cold atomic ensemble,
Phys. Rev. Lett. 113, 093601 (2014); Editors' Suggestion; arxiv:1403.1964.
10. C. Schwemmer, G. Tóth, A. Niggebaum, T. Moroder, D. Gross, O. Gühne, and H. Weinfurter,
Experimental Comparison of Efficient Tomography Schemes for a Six-Qubit State,
Phys. Rev. Lett. 113, 040503 (2014); arxiv:1401.7526.
11. B. Lücke, J. Peise, G. Vitagliano, J. Arlt, L. Santos, G. Tóth, and C. Klempt,
Detecting multiparticle entanglement of Dicke states,
Phys. Rev. Lett. 112, 155304 (2014), Editors' Suggestion, featured in physics.aps.org and in the Revista Española de Física; arxiv:1403.4542.
12. G. Vitagliano, I. Apellaniz, I.L. Egusquiza, and G. Tóth,
Spin squeezing and entanglement for arbitrary spin,
Phys. Rev. A 89, 032307 (2014); arxiv:1310.2269.
13. I. Urizar-Lanz, P. Hyllus, I.L. Egusquiza, M.W. Mitchell, and G. Tóth,
Macroscopic singlet states for gradient magnetometry,
Phys. Rev. A 88, 013626 (2013); arxiv:1203.3797.
14. G. Tóth and D. Petz,
Extremal properties of the variance and the quantum Fisher information,
Phys. Rev. A 87, 032324 (2013); arxiv:1109.2831.
15. T. Moroder, P. Hyllus, G. Tóth, C. Schwemmer, A. Niggebaum, S. Gaile, O. Gühne, and H. Weinfurter,
Permutationally invariant state reconstruction,
New J. Phys. 14, 105001 (2012), Focus issue on Quantum Tomography; arXiv:1205.4941.
16. P. Hyllus, L. Pezzé, A. Smerzi, and G. Tóth,
Entanglement and Extreme Spin Squeezing for a Fluctuating Number of Indistinguishable Particles,
Phys. Rev. A 86, 012337 (2012); arxiv:1204.5329.
17. G. Tóth,
Multipartite entanglement and high precision metrology,
Phys. Rev. A 85, 022322 (2012); arxiv:1006.4368.
18. G. Vitagliano, P. Hyllus, I.L. Egusquiza, and G. Tóth,
Spin squeezing inequalities for arbitrary spin,
Phys. Rev. Lett. 107, 240502 (2011); arxiv:1104.3147.
19. E. Alba, G. Tóth, and J.J. García-Ripoll,
Mapping the spatial distribution of entanglement in optical lattices,
Phys. Rev. A 82, 062321 (2010); arxiv:1007.0985.
20. G. Tóth, W. Wieczorek, D. Gross, R. Krischek, C. Schwemmer and H. Weinfurter,
Permutationally invariant quantum tomography,
Phys. Rev. Lett. 105, 250403 (2010); arxiv:1005.3313.
21. I. Urizar-Lanz and G. Tóth,
Number operator-annihilation operator uncertainty as an alternative of the number-phase uncertainty relation,
Phys. Rev. A 81, 052108 (2010); arxiv:0907.3147.
22. G. Tóth and M.W. Mitchell,
Generation of macroscopic singlet states in atomic ensembles,
New J. Phys. 12, 053007 (2010); arxiv:0901.4110.
23. G. Tóth and O. Gühne,
Separability criteria and entanglement witnesses for symmetric quantum states,
Appl. Phys. B 98, 617 (2010); arxiv:0908.3679.

[Special Issue: "Selected Papers Presented at the 2009 Spring Meeting of the Quantum Optics and Photonics Section of the German Physical Society", Guest Editor: M. Fleischhauer. The special issue presents papers based on the contributions selected by chairmen and chairwomen of various sessions.]

24. G. Tóth, W. Wieczorek, R. Krischek, N. Kiesel, P. Michelberger, and H. Weinfurter,
Practical methods for witnessing genuine multi-qubit entanglement in the vicinity of symmetric states,
New J. Phys. 11, 083002 (2009); arxiv:0903.3910.
25. W. Wieczorek, R. Krischek, N. Kiesel, P. Michelberger, G. Tóth, and H. Weinfurter,
Experimental entanglement of a six-photon symmetric Dicke state,
Phys. Rev. Lett. 103, 020504 (2009); arxiv:0903.2213.
26. O. Gühne and G. Tóth,
Entanglement detection (*review article*),
Phys. Rep. 474, 1 (2009); arxiv:0811.2803.
27. G. Tóth and O. Gühne,
Entanglement and permutational symmetry,
Phys. Rev. Lett. 102, 170503 (2009); arxiv:0812.4453.
28. G. Tóth, C. Knapp, O. Gühne, and H.J. Briegel,
Spin squeezing and entanglement,
Phys. Rev. A 79, 042334 (2009); arxiv:0806.1048.
29. G. Tóth,
QUBIT4MATLAB V3.0: A program package for quantum information science and quantum optics for MATLAB,
Comput. Phys. Comm. 179, 430 (2008); arxiv:0709.0948.
30. G. Tóth, C. Knapp, O. Gühne, and H.J. Briegel,
Optimal spin squeezing inequalities detect bound entanglement in spin models,
Phys. Rev. Lett. 99, 250405 (2007); quant-ph/0702219.
31. M.L. Almeida, S. Pironio, J. Barrett, G. Tóth, and A. Acín,
Noise robustness of the nonlocality of entangled quantum states,
Phys. Rev. Lett. 99, 040403 (2007); quant-ph/0703018.
32. G. Tóth and J.J. García-Ripoll,
Efficient algorithm for multi-qudit twirling,
Phys. Rev. A 75, 042311 (2007); quant-ph/0609052.
33. G. Tóth,
Detection of multipartite entanglement in the vicinity of Dicke states with many excitations,
J. Opt. Soc. Am. B 24, 275 (2007), Feature issue on *Optical quantum information science* (Eds. B. Sanders, Y. Yamamoto, and A. Zeilinger); quant-ph/0511237.
34. N. Kiesel, C. Schmid, G. Tóth, E. Solano, and H. Weinfurter,
Experimental Observation of Four-Photon Entangled Dicke State with High Fidelity,
Phys. Rev. Lett. 98, 063604 (2007); quant-ph/0606234.
35. G. Tóth and A. Acín,
Genuine three-partite entangled states with a local hidden variable model,
Phys. Rev. A 74, 030306(R) (2006); quant-ph/0512088.
36. O. Gühne, M. Mechler, G. Tóth, and P. Adam,
Entanglement criteria based on local uncertainty relations are strictly stronger than the computable cross norm criterion,
Phys. Rev. A 74, 010301(R) (2006); quant-ph/0604050.
37. O. Gühne and G. Tóth,
Energy and multipartite entanglement in multidimensional and frustrated spin models,
Phys. Rev. A 73, 052319 (2006); quant-ph/0510186.

38. G. Tóth, O. Gühne, and H.J. Briegel,
Two-setting Bell inequalities for graph states,
Phys. Rev. A 73, 022303 (2006); quant-ph/0510007.
39. G. Tóth and O. Gühne,
Detection of multipartite entanglement with two-body correlations,
Appl. Phys. B 82, 237 (2006); quant-ph/0602068.
[Special Issue: "Selected Papers Presented at the 2006 Spring Meeting of the Quantum Optics and Photonics Section of the German Physical Society", Guest Editors: Marciej Lewenstein and Cornelia Denz. The special issue presents papers based on the contributions selected by chairmen and chairwomen of various sessions.]
40. N. Kiesel, C. Schmid, U. Weber, G. Tóth, O. Gühne, R. Ursin, H. Weinfurter,
Experimental Analysis of a 4-Qubit Cluster State,
Phys. Rev. Lett. 95, 210502 (2005); quant-ph/0508128.
41. O. Gühne, G. Tóth, and H.J. Briegel,
Multipartite entanglement in spin chains,
New J. Phys. 7, 229 (2005); quant-ph/0502160.
42. O. Gühne, G. Tóth, P. Hyllus, and H.J. Briegel,
Bell Inequalities for Graph States,
Phys. Rev. Lett. 95, 120405 (2005); quant-ph/0410059.
43. G. Tóth and O. Gühne,
Detecting Multi-Party Entanglement in the Stabilizer Formalism,
Phys. Rev. A 72, 022340 (2005); quant-ph/0501020.
44. G. Tóth, O. Gühne, M. Seevinck, and J. Uffink,
Addendum to "Sufficient conditions for three-particle entanglement and their tests in recent experiments",
Phys. Rev. A 72, 014101 (2005); quant-ph/0505100.
45. G. Tóth and O. Gühne,
Detecting Genuine Multipartite Entanglement with Two Local Measurements,
Phys. Rev. Lett. 94, 060501 (2005); quant-ph/0405165.
46. G. Tóth,
Entanglement Witnesses in Spin Models,
Phys. Rev. A 71, 010301(R) (2005); quant-ph/0406061.
47. G. Tóth,
Entanglement Detection in Optical Lattices of Bosonic Atoms with Collective Measurements,
Phys. Rev. A 69, 052327 (2004); quant-ph/0310039.
48. G. Tóth, C. Simon and J.I. Cirac,
Entanglement Detection Based on Interference and Particle Counting,
Phys. Rev. A 68, 062310 (2003); quant-ph/0306086.
49. G. Tóth, C. Denniston and J.M. Yeomans,
Hydrodynamics of domain growth in nematic liquid crystals,
Phys. Rev. E 67, 051705 (2003); cond-mat/0207322.
50. G. Tóth, C. Denniston and J.M. Yeomans,
Hydrodynamics of topological defects in nematic liquid crystals,
Phys. Rev. Lett. 88, 105504 (2002); cond-mat/0201378.
51. G. Tóth, C. Denniston and J.M. Yeomans,
Modelling nematohydrodynamics in liquid crystal devices,
Comp. Phys. Communications Vol. 147/1-2, 7 (2002); cond-mat/0204318.

52. R.K. Kummamuru, J. Timler, G. Tóth, C.S. Lent, R. Ramasubramaniam, A.O. Orlov, G.H. Bernstein and G. Snider,
Power Gain in a Quantum-dot Cellular Automata Latch,
Appl. Phys. Lett. 81, 1332-1335 (2002).
53. C. Denniston, G. Tóth and J.M. Yeomans,
Domain motion in confined liquid crystals,
J. Stat. Phys. 107, 187 (2002); cond-mat/0108112.
54. G. Tóth and C.S. Lent,
The Role of Correlation in the Operation of Quantum-dot Cellular Automata,
J. Appl. Phys. 89, 7943 (2001); cond-mat/0104406.
55. G. Tóth and C.S. Lent,
Quantum Computing with Quantum-dot Cellular Automata,
Phys. Rev. A 63, 052315 (2001).
56. A.O. Orlov, R.K. Kummamuru, R. Ramasubramaniam, G. Tóth, C.S. Lent, G.H. Bernstein and G.L. Snider
Experimental Demonstration of a Latch in Clocked Quantum-dot Cellular Automata,
Appl. Phys. Lett. 78, 1625, (2001).
57. A. Orlov, I. Amlani, R.K. Kummamuru, R. Ramasubramaniam, G. Tóth, C.S. Lent, G.H. Bernstein and G.L. Snider,
Experimental Demonstration of the Clocked Single-Electron Switching in Quantum-dot Cellular Automata,
Appl. Phys. Lett. 77, 295 (2000).
58. G. Tóth, A. Orlov, I. Amlani, C.S. Lent, G.H. Bernstein and G.L. Snider,
Conductance Suppression due to Correlated Electron Transport in Coupled Double-dots,
Phys. Rev. B 60, 16906 (1999); cond-mat/9911173.
59. A. Orlov, I. Amlani, G. Tóth, C.S. Lent, G.H. Bernstein and G.L. Snider,
Experimental demonstration of a binary wire for quantum-dot cellular automata,
Appl. Phys. Lett. 74, 2875 (1999).
60. I. Amlani, A. Orlov, G. Tóth, G.H. Bernstein, C.S. Lent and G.L. Snider,
Digital Logic Gate Using Quantum-dot Cellular Automata,
Science 284, 289 (1999).
61. G. Tóth and C.S. Lent,
Quasiadiabatic switching for metal-island quantum-dot cellular automata,
J. Appl. Phys. 85, 2977 (1999); cond-mat/0004457.
62. A. G. Radványi, L. Gáspár, and G. Tóth,
CNNUM Architecture and 3D Template Design Techniques,
Int. J. of Circuit Theory and Application 27, 25 (1999).
63. A. Orlov, I. Amlani, G. Tóth, C.S. Lent, G.H. Bernstein, and G.L. Snider,
Correlated Electron Transport in Coupled Metal Double-dots,
Appl. Phys. Lett., 73, 2787 (1998).
64. G. Tóth, C.S. Lent, P.D. Tougaw, Y. Brazhnik, W. Weng, W. Porod, R.-W. Liu, and Y.-F. Huang,
Quantum Cellular Neural Networks,
Superlattices and Microstructures 20, 473 (1996); cond-mat/0005038.
65. L. Nemes, G. Tóth, T. Roska, and A. Radványi,
Analogic CNN algorithms for 3D interpolation-approximation and object rotation using controlled switched templates,
Int. J. Circuit Theory and Application 24, 409 (1996).

Book chapters

1. C. Schmid, N. Kiesel, W. Laskowski, E. Solano, G. Tóth, M. Zukowski, and H. Weinfurter, **The Entanglement of the Symmetric Four-Photon Dicke State**, chapter from page 113 in book: *Quantum communication and security*, M. Zukowski, S. Kilin, and J. Kowalik (Eds.), Proceedings of the NATO Advanced Research Workshop on Quantum Communication and Security, Gdansk, Poland, 10-13 Sept. 2006, IOS Press, Netherlands, 2007, ISBN 978-1-58603-749-9.
2. M. Koniarczyk and G. Tóth, **Introduction to quantum entanglement** (in Hungarian), chapter on pages 95-106 in book: *New results in quantum optics and quantum electronics*, Zs. Heiner and K. Osvey (Eds.), Department of Optics and Quantum Electronics, University of Szeged, Szeged, Hungary, 2006, ISBN 963-482-779-9.

Conference proceedings and research reports

1. N. Behbood, M. Napolitano, G. Colangelo, B. Dobust, S. Palacios lvarez, R. Sewell, G. Tóth, and M. W. Mitchell, **Generation of a macroscopic singlet state in an atomic ensemble, in Conference on Lasers and Electro-Optics 2012**, OSA Technical Digest (Optical Society of America, 2012), paper QF3E.3. doi:10.1364/QELS.2012.QF3E.3
2. N. Behbood, M. Napolitano, G. Colangelo, B. Dubost, S. Palacios lvarez, R. J. Sewell, G. Tth, and M. W. Mitchell, **Generation of a Macroscopic Singlet State in an Atomic Ensemble, in Research in Optical Sciences**, OSA Technical Digest (Optical Society of America, 2012), paper QM1B.2. doi:10.1364/QIM.2012.QM1B.2
3. C. Schwemmer, G. Tóth, W. Wieczorek, D. Gross, R. Krischek, and H. Weinfurter, **Permutationally invariant tomography of a four-qubit symmetric Dicke state**, Proceedings of the Conference on Lasers and Electro-Optics Europe (CLEO EUROPE/EQEC), 2011 Conference on and 12th European Quantum Electronics Conference, Munich, Germany, 22-26 May 2011. doi:0.1109/CLEOE.2011.5943393
4. N. Behbood, B. Dubost, M. Napolitano, M. Koschorreck, R. Sewell, G. Tóth, and M.W. Mitchell, **Generation of macroscopic singlet states in atomic ensembles**, Proceedings of the Conference on Lasers and Electro-Optics Europe (CLEO EUROPE/EQEC), 2011 Conference on and 12th European Quantum Electronics Conference Munich, Germany, 22-26 May 2011. doi:10.1109/CLEOE.2011.5942915
5. N. Behbood, B. Dubost, M. Napolitano, M. Koschorreck, R. Sewell, G. Tóth, and M.W. Mitchell, **Generation of macroscopic singlet states in atomic ensembles, Abstract for The 17th Central European Workshop on Quantum Optics (CEWQO)**, St. Andrews, Scotland, UK, on 6th-11th June, 2010. www.st-andrews.ac.uk/~cewqo10/submission/f5505.pdf
6. W. Wieczorek, R. Krischek, A. Ozawa, G. Tóth, N. Kiesel, P. Michelberger, T. Udem and H. Weinfurter, **Six-photon entangled Dicke state enabled by a UV enhancement cavity as novel SPDC photon source** (invited paper, keynote presentation), Proceedings of SPIE 7727, 77270L, 1-11 (2010). doi:10.1117/12.853599
7. G. Tóth, C. Knapp, O. Gühne, and H.J. Briegel, **Generalized spin squeezing criteria: Entanglement detection with collective observables**, Proceedings of The Ninth International Conference on Quantum Communication, Measurement and Computing (QCMC08), AIP Conf. Proc. 1110, 41 (2009). doi:10.1063/1.3131365

8. G. Tóth and O. Gühne,
Two measurement settings can suffice to verify multipartite entanglement,
Proceedings of The Seventh International Conference on Quantum Communication, Measurement and Computing (QCMC04), AIP Conf. Proc. 734, 234 (2004); quant-ph/0409132. doi:10.1063/1.1834423
9. R.K. Kummamuru, A.O. Orlov, G. Tóth, J. Timler, R. Ramasubramaniam, C.S. Lent, G.H. Bernstein and G.L. Snider,
Power Gain in a Quantum-dot Cellular Automata Latch,
Proceedings of the First IEEE Conference on Nanotechnology (IEEE-NANO 2001), Hawaii, USA, 28-30 October, 2001.
10. G. Tóth and C.S. Lent,
The Role of Correlation in the Operation of Quantum-dot Cellular Automata,
Proceedings of the European Conference on Circuit Theory and Design (ECCTD'01), Helsinki, August 2001.
11. C. Gerousis, X. Wang, G. Tóth, S.M. Goodnick, W. Porod, C.S. Lent and Á. Csurgay,
Modeling Nanoelectronic CNN Cells: CMOS, SETs and QCAs,
Proceedings of the IEEE International Symposium on Circuits and Systems (ISCAS'00), Geneva, May 2000.
12. C. Gerousis, S.M. Goodnick, X. Wang, W. Porod, Á. Csurgay, G. Tóth and C. Lent,
Modeling Nanoelectronic CNN Cells: CMOS, SETs and QCAs,
Proceedings of the European Conference on Circuit Theory and Design (ECCTD '99), Stresa, Italy, 1999.
13. G. Tóth, J. Timler and C.S. Lent,
Quantum Computing with Quantum-dot Cellular Automata using Coherence Vector Formalism,
Proceedings of the IEEE International Workshop on Computational Electronics (IWCE-6), Osaka, 1998.
14. W. Porod, C.S. Lent, G. Tóth, H. Luo, Á. Csurgay, Y.-F. Huang, and R.-W. Liu,
Quantum-dot Cellular Nonlinear Networks: Computing with Locally-Connected Quantum Dot Arrays,
Proceedings of the IEEE International Symposium on Circuits and Systems (ISCAS'97), 745-748, Hong Kong, 1997.
15. G. Tóth, C.S. Lent, P.D. Tougaw, Y. Brazhnik, W. Weng, W. Porod, R.-W. Liu and Y.-F. Huang,
Quantum Cellular Neural Networks,
Third International Symposium on Nanostructures and Mesoscopic Devices (NanoMES96), Santa Fe, 1996.
16. C.S. Lent, P.D. Tougaw, G. Tóth, W. Weng, Y. Brazhnik, and W. Porod,
Quantum Cellular Neural Networks,
Proceedings of the fourth Workshop on Physics and Computation (PhysComp96), Boston University, 22-24 November, 1996.
17. G. Tóth, P. Földesy, and T. Roska,
Distance preserving 1D Turing-wave models via CNN, implementation of complex-valued CNN, and solving a simple inverse pattern problem (detection),
Proceedings of the IEEE International Workshop on Cellular Neural Networks and their Applications (CNNA-96), 109-114, Seville, 1996.
18. G. Tóth, P. Földesy, and T. Roska,
Distance preserving 1D Turing-wave models via CNN, implementation of complex-valued CNN, and solving a simple inverse pattern problem (detection),
DNS-3-1996 (SzTAKI Research Report), Budapest, 1996.
19. B. Fehér, P. Szolgay, T. Roska, A. Radványi, T. Szirányi, M. Csapodi, G. Tóth, K. László, and I. Szatmári,
CNN-ACE: A Digital Floating Point CNN Emulator Engine,
Proceedings of the IEEE International Workshop on Cellular Neural Networks and their Applications (CNNA-96), 273-278, Seville, 1996.

20. G. Tóth, T. Roska and A. Radványi,
Analogic CNN Algorithm for 3D Interpolation-Approximation,
DNS-2-1995 (SzTAKI Research Report), Budapest, 1995.
21. M. Csapodi, L. Nemes, G. Tóth, T. Roska, and A. Radványi,
**Some novel analogic CNN algorithms for object rotation, 3D interpolation-approximation,
and a door-in-a-floor problem,**
Proceedings of the Third IEEE International Workshop on Cellular Neural Networks and their Applications
(CNNA-94), 435-439, Rome, 1994.

Invited conference talks

1. *Detecting metrologically useful multiparticle entanglement with few measurements: recent results*, Quantum metrology workshop, University of Hannover, Germany, 9-10 February 2017.
2. *Detecting metrologically useful multiparticle entanglement of Dicke states*, Recent Advances in Quantum Metrology (RAQM 2016), Warsaw, Poland, 2-4 March 2016.
3. *Detecting metrologically useful multiparticle entanglement of Dicke states*, 589. Wilhelm and Else Heraeus-Seminar Continuous Variable Entanglement in Atomic Systems: Fundamentals and Applications (organized by M. Oberthaler and P. Treutlein), Physikzentrum, Bad Honnef, Germany, 11-15 May 2015.
4. *Detecting multiparticle entanglement of Dicke states*, 7th Italian Quantum Information Science Conference (IQIS2014), Salerno, Palazzo Fruscione, September 15-19, 2014.
5. *Entanglement detection close to multi-qubit Dicke states in photonic experiments*, Workshop on the dynamics and asymptotics in the Dicke model and quantum networks, Mátraháza, Hungary, 3-7 May, 2012.
6. *Optimal spin squeezing inequalities for arbitrary spin*, Quantum Computing, Control and Communication Workshop 2011, Bernried (Munich), Germany, 8-11 October, 2011.
Permutationally invariant quantum tomography, Workshop on "New Trends in Quantum Dynamics and Entanglement", Abdus Salam ICTP (Trieste, Italy), 21 to 25 February 2011.
7. *Permutationally invariant quantum tomography*, International School and Conference on Quantum Information Processing and Applications (QIPA-2011), Harish-Chandra Research Institute (HRI), Allahabad, India, 14-20 February 2011.
8. *Generalized spin squeezing of unpolarized atomic ensembles and its modeling with Gaussian states*, 1st COQUIT Workshop, Hannover, Germany, 18-20 November, 2010. (1 hour talk)
9. *Multipartite entanglement and its experimental detection*, Summer School "Modern Results in Quantum Theory" of the Roland Eötvös Physical Society (Atomic physics-quantum electronics and Particle physics divisions), Tihany, Hungary, Aug. 30- Sept 3, 2010. (2 × 50 minute lecture)
10. *Multipartite entanglement and its experimental detection*, Quantum Information with Atoms, Photons and Solid State Systems, Grenoble, France, 17-19 June, 2010. (1 hour lecture)
11. *Entanglement and permutational symmetry*, Leuven Mathematical Physics Days (M. Fannes), Leuven, Belgium, 6-7 May, 2010.
12. *Entanglement detection using generalized spin squeezing inequalities*, Mini-Workshop on Quantum Statistics, Organizer: Dénes Petz, Rényi Institute of Mathematics, Budapest, Hungary, December 12, 2008.
13. *Generalized spin squeezing inequalities and metrological applications of entangled states*, Ringberg meeting of the Theory group of the Max Planck Institute for Quantum Optics, Germany, 11 December, 2007.
14. *Entanglement detection with the stabilizer formalism*, First International Workshop *Information and Quantum Physics*, Vienna, Austria, 31 October, 2004.

Contributed conference talks

How long does it take to obtain a physical density matrix?, New trends on complex quantum system dynamics, Cartagena, 8-12 May 2017. (tentative)

Witnessing metrologically useful multipartite entanglement, 11th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC2016), Berlin, 27-29 September 2016.

Witnessing metrologically useful multipartite entanglement, Frontiers of Matter Wave Optics (FOMO 2016), Arcachon, France, 10-17 September 2016.

Detecting metrologically useful multipartite entanglement of Dicke states, Entanglement Day 2, Wigner Research Centre for Physics, 24-25 September, 2015.

Detecting multipartite entanglement of Dicke states, 12th International Conference on Quantum Communication, Measurement and Computing (QCMC2014), Hefei, Anhui, China, November 2-6, 2014.

Entanglement witnesses, Entanglement Day (E-Day), Wigner Research Centre for Physics, Budapest, 4-5 September, 2014.

Quantum metrology from a quantum information science perspective, Entanglement Day (E-Day), Wigner Research Centre for Physics, Budapest, 4-5 September, 2014.

Detection of multipartite entanglement close to symmetric Dicke states, Conference of the German Physical Society, Berlin, Germany, 17-21 March 2014.

Quantum Fisher information as the convex roof of the variance and its relation to multipartite entanglement, 4th International Workshop on Quantum Entanglement and its Detection (QED4), Siegen, Germany, 23-27 September, 2013.

Spin-squeezing inequalities for entanglement detection in cold gases, Quantum Information Processing and Communication International Conference (QIPC2013), Florence, Italy, June 30-July 5, 2013.

Spin-squeezing inequalities for entanglement detection in cold gases, 13th International Conference on Squeezing and Uncertainty Relations (ICSSUR 2013), Nürnberg, Germany, 24-28 June, 2013.

Permutationally Invariant Quantum Tomography and State Reconstruction, Workshop Cartagena: New Trends in Complex Quantum System Dynamics, Cartagena, Spain, 8-12 April 2013.

Multipartite entanglement and high precision metrology, Conference of the German Physical Society, Hannover, Germany, 18-22 March 2013.

Extremal properties of the variance and the quantum Fisher information, Conference of the German Physical Society, Hannover, Germany, 18-22 March 2013.

Permutationally Invariant Quantum Tomography and State Reconstruction, Workshop on Mathematical Methods of Quantum Tomography, Fields Institute, Toronto, Canada, February 19-22, 2013.

Quantum Chromodynamics meets Quantum Information, 3rd Workshop on the QCD Structure of the Nucleon (QCD-N'12), Bilbao, Spain, 22-26 October, 2012.

Permutationally invariant quantum tomography, Workshop on Quantum Simulations, Bilbao, Spain, 22-25 October 2012.

My major research topics: Spin squeezing et al., Workshop Información Cuántica en España (ICE-0), Madrid, 17-19 September 2012.

Optimal generalized variance and quantum Fisher information, Conference of the German Physical Society,

Stuttgart, Germany, 12-16 March, 2012.

Mapping the spatial distribution of entanglement in optical lattices, Conference of the German Physical Society, Stuttgart, Germany, 12-16 March, 2012.

Detecting k -particle entanglement with spin squeezing inequalities, 2nd International Workshop on Quantum Entanglement and its Detection (QED2), University of Siegen, Germany, 19 September, 2011.

Permutationally invariant quantum tomography, Conference of the German Physical Society, Dresden, Germany, 13-18 March, 2011.

Permutationally invariant quantum tomography, International Conference on Quantum Information and Computation, Stockholm, Sweden, October 4-8, 2010. (30 minute talk)

Entanglement and permutational symmetry, 1st International Workshop on Quantum Entanglement and its Detection (QED2010), University of the Basque Country UPV/EHU, Leioa/Bilbao, Spain, 27-28 April, 2010.

Practical methods for witnessing genuine multi-qubit entanglement in the vicinity of symmetric states, Conference of the German Physical Society, Hannover, Germany, 8-12 March, 2010.

Generation of macroscopic singlet states in atomic ensembles, Conference of the German Physical Society, Hannover, Germany, 8-12 March, 2010.

Generation of macroscopic singlet states in atomic ensembles, 11th International Conference on Squeezed States and Uncertainty Relations (ICSSUR'09), Olomouc, Czech Republic, 22-26 June, 2009.

Entanglement and permutational symmetry, Conference of the German Physical Society, Hamburg, Germany, 2-6 March, 2009.

Spin squeezing and entanglement, 40th Symposium on Mathematical Physics, Toruń, Poland, 25-28 June, 2008.

Efficient algorithm for multi-qubit twirling for ensemble quantum computation, Spring Meeting of the German Physical Society, Düsseldorf, Germany, 19-23 March, 2007.

Detection of multipartite entanglement in the vicinity of symmetric Dicke states, 6th Joint Conference on Mathematics and Computer Science, Quantum Information Processing Workshop, University of Pécs, Pécs, Hungary, 13-15 June 2006.

Two-setting Bell inequalities for graph states, Spring Meeting of the German Physical Society, Frankfurt, 13-17 March, 2006.

Genuine three-partite entangled states with a local hidden variable model, Spring Meeting of the German Physical Society, Frankfurt, 13-17 March, 2006.

Entanglement detection in the stabilizer formalism, Quantum Physics Of Nature & 6th European QIPC Workshop, Vienna, Austria, 20-26 May, 2005.

Detecting Entanglement with the stabilizer formalism, 9th International Conference on Squeezed States and Uncertainty Relations, Besancon, France, 2-6 May, 2005.

Entanglement witnesses in spin models, Conference of the German Physical Society, Berlin, Germany, 4-9 March, 2005.

Detecting Entanglement with the stabilizer formalism, Conference of the German Physical Society, Berlin, Germany, 4-9 March, 2005.

Detecting genuine multi-qubit entanglement with two local measurement settings, Quantum Optics II, Cozumel, Mexico, 6-9 December, 2004.

Hydrodynamics of topological defects in liquid crystals, Liquid Crystal Colloid Meeting, Sheffield Hallam University, UK, April 2002.

The role of correlation in the operation of quantum-dot cellular automata, European conference on Circuit Theory and Design (ECCTD'01), Helsinki, August 2001.

The role of correlation in the operation of quantum-dot cellular automata, International Workshop and Seminar on Coherent Evolution in Noisy Environments, Max Planck Institute at Dresden, Germany, April 2001.

Domain motion in confined liquid crystals, conference of the British Liquid Crystal Society, Oxford, UK, March 2001.

Approximate Quantum Dynamics of Coupled Two-state Systems, APS March Meeting, Minneapolis, USA, March 2000.

Quantum Computing with Quantum-dot Cellular Automata, TMR Network School on Quantum Computation and Quantum Information Theory, Villa Gualino, Torino, Italy, 12-23 July, 1999.

Quantum Computing with Quantum-dot Cellular Automata, APS Centennial Meeting, Atlanta, USA, March 1999.

Quantum Computing with Quantum-dot Cellular Automata using Coherence Vector Formalism, IEEE International Workshop on Computational Electronics (IWCE-6), Osaka, Japan, June 1998.

Talks

How long does it take to obtain a physical density matrix?, Wigner Research Centre for Physics, Budapest, Hungary, 26 January 2017.

Witnessing metrologically useful multipartite entanglement, ICFO, Barcelona, 12:00, 7 June 2016.

[invited] *Detecting metrologically useful multiparticle entanglement of Dicke states*, Colloquium at the Graduate College of the the Research Training Group 1729, Institute for Quantum Optics (group of C. Klempt) at the University of Hannover, Germany, 2 June, 2016; visit between 31 May-3 June, 2016.

G. Tóth, *Detecting metrologically useful multiparticle entanglement of Dicke states*, University of Firenze and LENS, Italy, 7-11 December 2015.

G. Tóth, *Detecting metrologically useful multiparticle entanglement of Dicke states*, Center for Quantum Dynamics Colloquium at the Kirchoff-Institute, University of Heidelberg, Germany, 27-30 October 2015.

[invited] *Detecting metrologically useful multiparticle entanglement of Dicke states*, Department of Theoretical Physics, Budapest University of Technology, 28 September 2015.

Introduction to entanglement theory & Detection of multipartite entanglement close to symmetric Dicke states, Donostia International Physics Center (DIPC), San Sebastian, Spain, 10 February 2015.

Introduction to entanglement theory & Detection of multipartite entanglement close to symmetric Dicke states, Basque Center for Applied Mathematics (BCAM), Bilbao, Spain, 27 January 2015.

[invited] *Spin-squeezing inequalities for entanglement detection in cold gases*, Institute of Theoretical Physics, University of Ulm, Germany, 13 November, 2013.

Spin-squeezing inequalities for entanglement detection in cold gases, Wigner Research Centre for Physics, Budapest, Hungary, 29 July, 2013.

Efficient algorithm for multi-qudit twirling for ensemble quantum computation, Wigner Research Centre for Physics, Budapest, Hungary, 25 July, 2013.

[invited] *Spin-squeezing inequalities for entanglement detection in cold gases*, Group of Theoretical Physics: Quantum Information and Quantum Phenomena of the Universitat Autònoma de Barcelona (J. Calsamiglia), Barcelona, 11 June, 2013.

[invited] *Spin-squeezing inequalities for entanglement detection in cold gases*, Colloquium at the Graduate College of the the Research Training Group 1729, Theoretical Quantum Optics Group (L. Santos) at the University of Hannover, Germany, May 21, 2013; visit between 20-23 May, 2013.

[invited] *Permutationally invariant tomography*, Institute for Experimental Physics, University of Innsbruck, Innsbruck, Austria, 30 May, 2011.

Multipartite entanglement and high precision metrology, Department of Mathematics, Budapest University of Technology and Economics, Budapest, Hungary, 25 August, 2010.

[invited lecture in a lecture series] *Quantum entanglement and its detection with few measurements*, Grupo de Información y Computación Cuánticas, Departamento de Física Teórica I, Facultad de Ciencias Físicas, Universidad Complutense, Madrid, Spain, 3 December, 2009. (2 × 45 minute lecture)

Separability of symmetric states, talk on one of the von Neumann Seminars organized by D. Petz, Department of Mathematics, Budapest University of Technology and Economics, Budapest, Hungary, 25 August, 2009.

Generation of macroscopic singlet states in atomic ensembles, Center for Quantum Optics, Niels Bohr Institute, Copenhagen, Denmark, 16 June, 2009.

Entanglement and Permutational Symmetry, Quantum Information Theory group, ICFO-The Institute of Photonic Sciences, Barcelona, Spain, 28 May, 2009.

Generation of macroscopic singlet states in atomic ensembles, Theory group at the Max Planck Institute for Quantum Optics, Munich, Germany, 16 December, 2008.

[invited] *Spin squeezing and entanglement*, Centre for Quantum Optics and Quantum Information, Innsbruck, Austria, 7 May, 2008.

Optimal spin squeezing inequalities detect bound entanglement in spin models, Autonomous University of Barcelona (Universidad Autònoma de Barcelona), Barcelona, Spain, 15 April, 2008.

Optimal spin squeezing inequalities detect bound entanglement in spin models, Quantum Information and Computation Group, University of Barcelona, Barcelona, Spain, 4 April, 2008.

[invited] *Optimal spin squeezing inequalities detect bound entanglement in spin models*, Theoretical Physics Laboratory, IRSAMC, CNRS, Paul Sabatier University, Toulouse, France, 5 February, 2008.

Efficient algorithm for multi-qudit twirling, talk on one of the von Neumann Seminars organized by D. Petz, Department of Mathematics, Budapest University of Technology and Economics, Budapest, Hungary, 19 December, 2007.

[invited lecture in a lecture series] *Entanglement and its experimental detection*, Quantum Information and Computation Group, Theoretical Physics Department 1, Faculty of Science, Universidad Complutense, Madrid, Spain, 21 November, 2007.

Experimental detection of quantum entanglement, Research Institute for Solid State Physics and Optics, Hungarian Academy of Sciences, Budapest, Hungary, 23 August, 2007.

Optimal spin squeezing inequalities detect entanglement in spin models, Theory Division, Max Planck Institute for Quantum Optics, Garching bei München, Germany, 21 May, 2007.

Entanglement Detection with Witness Operators, talk on one of the von Neumann Seminars organized by D. Petz, Department of Mathematics, Budapest University of Technology and Economics, Budapest, Hungary, 9

October, 2006.

[invited] *Genuine three-partite state with a local hidden variable model and multi-qudit twirling*, Centre for Quantum Optics and Quantum Information, Innsbruck, Austria, 28 September, 2006.

[invited] *Entanglement detection in the stabilizer formalism*, Institute of Photonic Sciences (ICFO), Barcelona, 26 October, 2005.

[invited] *Entanglement Detection with Witness Operators*, Department of Physics of Complex Systems, Eötvös University (ELTE), Budapest, 4 October, 2005.

[invited] *Entanglement and quantum optical systems*, Research Institute for Solid State Physics and Optics, Budapest, 21 June, 2005.

[invited] *The role of entanglement in quantum information*, Institute for Nanoelectronics, Technical University of Munich, Germany, 2 June, 2005.

[invited] *Entanglement detection in spin chains and optical lattices of two-state atoms*, Research Center for Quantum Information, Bratislava, Slovakia, 19 October, 2004.

[invited] *Detecting Genuine Multipartite Entanglement with Two Local Measurements*, Centre for Quantum Optics and Quantum Information, Innsbruck, Austria, 23 June, 2004.

Many-qubit Entanglement Witnesses based on Simple Measurements, Department of Nonlinear and Quantum Optics, Research Institute for Solid State Physics and Optics, Budapest, 15 June, 2004.

[invited] *Witnessing Many-Qubit Entanglement with Very Few Local Measurements*, Institut für Experimentalphysik, Universität Wien, Austria, 29 March, 2004.

Muti-party entanglement detection with simple measurements, Department of Theoretical Physics, Szeged University, Hungary, 18 December, 2003.

[invited] *Muti-party entanglement detection in spin chains and optical lattices of bosonic atoms with collective measurements*, Theoretical Quantum Optics Group at the University of Hannover, Germany, 10 December, 2003.

Removing the redundancy from the density matrix and the state vector: alternative quantum state descriptions based on the hierarchy of correlations, Centre for Quantum Computation, Oxford, UK, 5 December, 2001.

The role of correlation in the operation of quantum-dot cellular automata, Centre for Quantum Optics and Quantum Information, Innsbruck, Austria, 14 November, 2001.

The role of correlation in the operation of quantum-dot cellular automata, T-6 (W. H. Zurek), Los Alamos, USA, 26 October, 2001.

Liquid crystal hydrodynamics with the Lattice Boltzmann method, Workshop on Multiscale Algorithms for the Simulation of Materials and Fluids, Department of Mathematics, Imperial College, London, UK, 2 April, 2001.

Quantum-dot Cellular Automata, Semiconductor Physics Group, Cavendish Laboratory, Cambridge, UK, 1 February, 1999.

Posters

TBA, Conference and Working Group meeting of COST CA15220 QTSpace, Malta, 26-31 March, 2017.

Spin squeezing and entanglement, The Ninth International Conference on Quantum Communication, Measurement and Computing (QCMC), University of Calgary, Canada, 19-24 August, 2008.

Optimal spin squeezing inequalities for entanglement detection with collective measurements, Solvay Workshop on "Bits, Quanta and Complex Systems: modern approaches to photonic information processing", Belgium, 30 April-3 May, 2008.

Optimal spin squeezing inequalities for entanglement detection with collective measurements, EuroQUAM Inauguration Conference (Cold gases), Barcelona, Spain, 7-9 April, 2008.

Optimal spin squeezing inequalities detect bound entanglement in spin models, QIPC 2007 International Conference on Quantum Information Processing and Communication, Barcelona, Spain, 15-19 October, 2007.

Optimal spin squeezing inequalities detect bound entanglement in spin models, Symposium on the Foundations of Modern Physics, Vienna, Austria, 7-10 June 2007.

Entanglement detection based on an upper bound on variances of collective observables for separable states, Workshop on Quantum - Classical Transition and Quantum Information, Benasque, Spain, 18-23 June, 2006.

Entanglement detection based on an upper bound on variances of collective observables for separable states, Gordon Research Conference on Quantum Information, Il Ciocco, Barga, Italy, 7-12 May, 2006.

Detecting Genuine Multipartite Entanglement with Only Two Measurement Settings, Workshop on Entanglement and Transfer of Quantum Information, Isaac Newton Institute, Cambridge, UK, 26-30 September, 2004.

Entanglement Witnesses with Simple Local Decomposition, The Seventh International Conference on Quantum Communication, Measurement and Computing (QCMC2004), Glasgow, Scotland, 25-28 July, 2004.

Entanglement Witnesses with Simple Local Decomposition, Conference of the German Physical Society, Munich, Germany, 22-26 March, 2004.

Entanglement Witnesses with Simple Local Decomposition, Gordon Research Conference on Quantum Information, Ventura, California, USA, 22-27 February, 2004.

Entanglement detection in continuous variable systems, Euro Summer School on Quantum Gases in Low Dimensions, Les Houches, France, 15-25 April, 2003.

Hydrodynamics of topological defects in liquid crystals, 19th International Liquid Crystal Conference, Edinburgh, UK, 30 June-5 July, 2002.

Hydrodynamics of topological defects in nematic liquid crystals, Europhysics conference on discrete simulation of fluid dynamics, Cargese, Corsica, France, July 2001.

Research Group

- Employing Research Fellows

- 2011-2012: Dr. Philipp Hyllus (grant with G. Tóth as PI)
- 2012-2014: Dr. Zoltán Zimborás (grant with G. Tóth as PI)
- 2014: Dr. Iñigo Urizar-Lanz (grant with G. Tóth as PI)
- 2014: Dr. Charlotte van Hulse (grant with G. Tóth as PI)
- 2014-: Dr. Matthias Kleinmann (grant with G. Tóth as PI, 1 Oct 2014-31 May 2015; individual grant of M.K. of the German Research Society (DFG) from 1 June 2015.)
- 2015-: Dr. Giuseppe Vitagliano (grant with G. Tóth as PI)
- 2016-: Dr. Gael Sentís (grant with G. Tóth as PI)

- Advising and employing Ph.D. students

- 2010-2014: Iñigo Urizar-Lanz (Ph.D. grant of the Basque Government; 2014: grant with G. Tóth as PI). Ph.D. thesis: "Quantum Metrology with Unpolarized Atomic Ensembles", 2014 (Theoretical Physics, UPV/EHU). Result: Sobresaliente cum laude.
- 2011-2015: Giuseppe Vitagliano (grant with G. Tóth as PI). Visited Prof. P. Calabrese, Department of Physics, University of Pisa, Italy, 3 months in 2013. International Ph.D. thesis: "Spin squeezing, macrorealism and the Heisenberg uncertainty principle", 2015 (Theoretical Physics, UPV/EHU). Result: Sobresaliente cum laude.
- 2013-: Iagoba Apellaniz (grant with G. Tóth as PI). Visiting the group of Prof. O. Gühne, University of Siegen, Siegen, Germany, 2 months in 2014, visiting the group of Prof. A. Smerzi, University of Florence, Italy, 1 month in 2016. International Ph.D. is expected in May 2017 (Theoretical Physics, UPV/EHU).

- Advising Master's students

- 2009-2010: Iñigo Urizar-Lanz (M.Sc. and Ph.D. grant of the Basque Government). Thesis: "Number operator-annihilation operator uncertainty as an alternative for the number-phase uncertainty relation", 2010 (Theoretical Physics, UPV/EHU).

- Master's students advised by Research Fellows of the group

- 2011-2012: Iagoba Apellaniz. Thesis: "Quantum Limits on the Measurement Precision of a Magnetic Field Gradient", 2012. Advisor: P. Hyllus.

- Short term employment from a one-year Marie Curie Reintegration Grant

- March-Aug 2006: Attila Kárpáti (Ph.D. student)
- Sep-Dec 2006: Zoltán Kurucz (Ph.D. student)
- Jun-Dec 2006: Aurél Gábris (Ph.D. student)
- Jan-Aug 2006: Dr. Máttyás Koniorczyk (postdoctoral research fellow)

- Scientists visiting our group

- Sanah Altenburg (Ph.D. student of O. Gühne at the U. of Siegen), 4 months, 2015.
- Gabriel Fagundes (Ph.D. student of M. Kleinmann), 11 months in 2015-2016.

Conference organization (international)

1. Organized together with M. Koniorczyk and P. Adam, Quantum Information Processing Workshop at the 6th Joint Conference on Mathematics and Computer Science (MaCS), University of Pécs, Pécs, Hungary, 13-15 June 2006. 22 talks, 25 invited participants:

- Austria: J. Asbóth, O. Gühne.
- Czech Republic: J. Bouda, I. Jex, H. Lavička, M. Stefanak, T. Tyc.
- Germany: J.J. García-Ripoll, G. Giedke, P. Hyllus, N. Kiesel, C. Schmid, N. Schuh.
- Hungary: P. Ádám, M. Benedict, P. Domokos, P. Földi, A. Gábris, J. Janszky, A. Kárpáti, T. Kiss, M. Koniorczyk, Z. Kurucz, D. Nagy, D. Petz, S. Varró.

2. Organizers: G. Tóth, O. Gühne, and E. Solano, 1st International Workshop on Quantum Entanglement and its Detection (QED2010), University of the Basque Country UPV/EHU, Leioa/Bilbao, Spain, 27-28 April, 2010. 7 invited talks:

- IQOQI, Austria: O. Gühne, B. Jungnisch, S. Niekamp,
- Bilbao: J. Siewert, G. Tóth, I. Urizar-Lanz,
- Belgium: T. Bastin.

10-15 participants.

3. Organizers: O. Gühne and G. Tóth, 2nd International Workshop on Quantum Entanglement and its Detection (QED2), University of Siegen, Germany, 23-26 September 2011. 8 invited talks:

- Austria: Julio de Vicente (Innsbruck).
- Belgium: Thierry Bastin (Liege), Jean-Daniel Bancal (Genf).
- Switzerland: David Gross (Zürich).
- France: Daniel Braun (Toulouse).
- Germany: Christian Schwemmer (München), Hermann Kampermann (Düsseldorf), M. Johanning (Siegen).
- Spain: Jens Siewert (Bilbao), Remigiusz Augusiak (Barcelona).

About 20-25 participants, C. Eltschka (Regensburg) together with the group members from Siegen (O. Gühne) and Bilbao (G. Tóth).

4. Organizers: G. Tóth and O. Gühne, 3rd International Workshop on Quantum Entanglement and its Detection (QED3), University of the Basque Country UPV/EHU, Leioa/Bilbao, Spain, 7-12 September 2012. With the support of Journal of Physics A. 10 contributed talks, 8 invited talks:

- Germany: Andreas Osterloh (Duisburg), David Gross (Freiburg), Christian Schwemmer (München).
- Poland: Paweł Hordecki (Gdansk).
- Spain: Lucas Lamata (Bilbao), Jens Siewert (Bilbao), Morgan W. Mitchell (Barcelona).
- Great-Britain: Miguel Navascues (Bristol).

About 25-30 participants, C. Eltschka (Regensburg) together with the group members from Siegen (O. Gühne) and Bilbao (G. Tóth). Local organizers: G. Tóth and I.L. Egusquiza.

5. Organizers: O. Gühne and G. Tóth, 4th International Workshop on Quantum Entanglement and its Detection (QED4), University of Siegen, Germany, 23-26 September 2014. With the support of Journal of Physics A. 17 contributed talks, 8 invited talks:

- Austria: Oleg Gittsovich (Innsbruck, Waterloo - Canada).
- Slovakia: Mário Ziman (Bratislava).
- Germany: Marcus Cramer (Ulm), Christian Schwemmer (München).
- Poland: Rafal Demkowicz-Dobrzanski (Warsaw).

- Spain: Jens Siewert (Bilbao), Marcus Huber (Barcelona), Remigiusz Augusiak (Barcelona).

Altogether > 40 participants, mostly from the group of D. Bruß (Düsseldorf), O. Gühne (Siegen), and G. Tóth (Bilbao).

- Organizers: G. Tóth, O. Gühne, and M. Cramer, International Conference on Entanglement Detection and Quantification, Bilbao, 10-13 March, 2014. Place: Sala Garate of the University of Deusto. Local organizers: G. Tóth, I.L. Egusquiza, C. Van Hulse, S. Nistal, G. Schnell.
 - 16 invited talks: A. Acín (ICFO Barcelona), D. Bruß (U. Düsseldorf), M. Cheneau (Institut d'Optique, Paris), F. Illuminati (U. Salerno), F. Jelezko (U. Ulm), B. Kraus (U. Innsbruck), C. Klempt (U. Hannover), S. Kuhr (U. Strathclyde), M.W. Mitchell (ICFO Barcelona), M. Oberthaler (U. Heidelberg), P. Richerme (Uni Maryland & NIST), A. Sanpera (UAB Barcelona), R. Schmied (U. Basel), A. Smerzi (CNR-INO & LENS Florence), H. Weinfurter (LMU Munich), C. Wunderlich (U. Siegen).
 - 18 contributed talks: R. Sewell (ICFO Barcelona), C. Budroni (U. Siegen), J. Dunningham (U. Sussex), A. Gábris (Czech Technical University), M. Gessner (U. Freiburg), S.M. Giampaolo (U. Wien), M. Huber (UAB, Barcelona), H. Kampermann (U. Düsseldorf), N. Killoran (U. Ulm), Y.-C. Liang (ETH Zürich), O. Marty (U. Ulm), T. Moroder (U. Siegen), A. Osterloh (U. Duisburg-Essen), M. Ziman (Slovak Academy of Sciences), M. Sanz (UPV/EHU, Bilbao), J. Siewert (UPV/EHU, Bilbao), A. Stefanov (U. Bern), L. Tagliacozzo (ICFO Barcelona).
 - Around 30 posters, altogether 70-80 participants.
- Local Organizing Committee: (co-chairs) L. Lamata, I. Egusquiza, (local organizers) M. Pons, M. Modugno, J. Siewert, G. Tóth, M. Kleinmann, G. Giedke, E. Solano, Workshop "Información Cuántica, España (ICE-2)" June 1-3, 2015. Annual quantum information conference for all Spain.
- Organizers: G. Tóth, G. Vitagliano, I. Apellaniz, International Workshop on Cold Gases in Quantum Information (CGQI), University of the Basque Country UPV/EHU, Leioa (Bilbao), 30 June-1 July, 2015.
 - 10 invited speakers: J. Asbóth (Wigner, Budapest), J. Calsamiglia (UAB, Barcelona), T. Grass (ICFO, Barcelona), P. Sinkovicz (Wigner, Budapest), D. Spehner (Grenoble), Sz. Szalay (Wigner, Budapest), E. Szirmai (Wigner, Budapest), G. Szirmai (Wigner, Budapest), L. Tagliacozzo (ICFO, Barcelona), P. Venkatesh (IQOQI, Innsbruck).
 - 8 contributed talks from UPV/EHU: I. Apellaniz, I.L. Egusquiza, U. Las Heras, M. Modugno, G. Muga, E. Rico, M. Sanz, G. Vitagliano.

Conference organization (national)

- Organizers: J. Asbóth, G. Tóth, Sz. Szalay, and I. Kovács, Entanglement Day, Wigner Research Centre for Physics, Budapest, 4-5 September, 2014; 14 talks, 43 participants. Talks by Sz. Szalay, P. Vrana, G. Tóth, P. Vecsernyés, L. Diósi, A. Szállás, Z. Zimborás, V. Eisler, I. Kovács, Ö. Legeza, J. Asbóth, M. Kormos, P. Dömötör, T. Kiss.
- Organizers: J. Asbóth, Sz. Szalay, G. Tóth, Entanglement Day, Wigner Research Centre for Physics, Budapest, 24-25 September, 2015; 11 talks, 19 participants. Talks by Sz. Szalay, P. Vrana, G. Tóth, Z. Zimborás, V. Eisler, Ö. Legeza, J. Asbóth, Á. Gali, G. Barcza, I. Hagymási, P. Lévy.

Referee for Ph.D. theses and Habilitation theses

1. President in the committee for the Ph.D. defense of G. Colangelo (advisor M. W. Mitchell and R. Sewell), ICFO-The Institute of Photonic Sciences, Barcelona, Spain, 16 December, 2016.
2. External referee for the Ph.D. thesis of I. Kruse (advisor C. Klempt), University of Hannover, Germany, 2015.
3. In the committee for the Ph.D. defense of N. Behbood (advisor M. W. Mitchell), ICFO-The Institute of Photonic Sciences, Barcelona, Spain, 17 April, 2015.
4. External referee for the habilitation thesis of Dr. rer. nat. H. Kampermann, University of Düsseldorf (group of D. Bruß), Germany, 2014.
5. Vocal in the tribunal for the M.Sc. defense of I. Apellaniz (advisor P. Hyllus), University of the Basque Country UPV/EHU, Bilbao, Spain, 27 September 2012.
6. External referee for the Ph.D. thesis of B. Jungnitsch (advisor O. Gühne), University of Siegen, Germany, 2012.
7. In the committee for the Ph.D. defense of M. K. Kubasik (advisor M. W. Mitchell and J. M. Peña), ICFO-The Institute of Photonic Sciences, Barcelona, Spain, May 15, 2009.

Popular science

1. C. Moskowitz,
Quantum Entanglement Creates New State of Matter,
Scientific American,
<http://www.scientificamerican.com/article/quantum-entanglement-creates-new-state-of-matter1/>
Popular explanation of the results of Behbood *et al.*, Phys. Rev. Lett. (2014).
2. M. Schriber,
Measuring Entanglement Among Many Particles,
Synopsis in physics.aps.org,
<http://physics.aps.org/synopsis-for/10.1103/PhysRevLett.112.155304>
Popular explanation of the results of Lücke *et al.*, Phys. Rev. Lett. (2014).
3. **Puntos de interés** (in Spanish),
Revista Española de Física 28(2), 31 (2014).
Popular explanation of the results of Lücke *et al.*, Phys. Rev. Lett. 112, 155304 (2014).
4. T. Braun,
A couple-of-minute interview: Géza Tóth (in Hungarian),
Élet és Tudomány ("Life and Science") 19, 598-599 (2010).

Recent classes

1. 2016-2017/2nd trimester. Quantum information (G. Tóth, 20 hours; L.A. Wu, 20 hours). Graduate course in the Master's program in Quantum Science and Technology at UPV/EHU.
2. 2015-2016/2nd trimester. Quantum information (G. Tóth, 20 hours; L.A. Wu, 20 hours). Graduate course in the Master's program in Quantum Science and Technology at UPV/EHU.
3. Introduction to quantum information science and quantum computation (4×50 minute lectures) within the class Temas de Física (J. M. M. Senovilla), University of the Basque Country UPV/EHU, February-March, 2014.
4. 2014-2015/2nd trimester. Quantum information (G. Tóth, 20 hours; L.A. Wu, 20 hours). Graduate course in the Master's program in Quantum Science and Technology at UPV/EHU. (tentative)
5. Introduction to quantum information science and quantum computation (2×50 minute lectures in Spanish) within the class Temas de Física (J. M. M. Senovilla), University of the Basque Country UPV/EHU, 5-6 May, 2014.
6. 2012-2013/2nd trimester. Quantum information (G. Tóth, 12 hours; Z. Zimborás, 8 hours; L.A. Wu, 20 hours). Graduate course in the Master's program in Quantum Science and Technology at UPV/EHU.
7. 2011-2012/2nd trimester. Quantum information (G. Tóth, 10 hours; P. Hyllus, 10 hours; L.A. Wu, 20 hours). Graduate course in the Master's program in Quantum Science and Technology at UPV/EHU.
8. (invited lecture in a lecture series) *Quantum entanglement and its detection with few measurements*, Grupo de Información y Computación Cuánticas, Departamento de Física Teórica I, Facultad de Ciencias Físicas, Universidad Complutense, Madrid, Spain, 3 December, 2009. (2×45 minute lecture)

Refereeing/Board membership:

1. Invited to be in the Editorial Advisory Board of De Gruyter Open's Books Series program in Quantum Information, 2014.
2. Referee for: Nature, Nat. Commun., Phys. Rev. Lett. (> 40), Phys Rev. A, Phys. Rev. X, New J. Phys., Europhys. Lett., J. Phys. A, Quantum Inf. and Comp., Int. J. Quantum Inf., Circ. Theor. Appl., etc.
3. Swiss National Science Foundation, 2016.
4. German Research Foundation (DFG), 2016.
5. Austrian Science Fund (FWF), 2016.
6. In the panel evaluating the proposal for the Transregional Collaborative Research Center 183 ("Entangled States of Matter") of the German Research Foundation (DFG), Colone, Germany, 2016.
7. National Science Centre (Narodowe Centrum Nauki), Poland, 2016, 2015, 2013.
8. Doctoral Fellowship Programme of the Austrian Academy of Sciences, 2015.
9. European Research Council (ERC) Starting Grant, 2014.
10. START grant, Austrian Science Fund (FWF), 2012.
11. NSERC (Natural Sciences and Engineering Research Council of Canada), 2011.
12. Expert reviewer for a Feodor Lynen Research Fellowship, 2010.
13. FONDECYT (Chilean government), 2010, 2008.
14. OTKA (National Research Fund of Hungary), 2009, 2008.

Languages

1. English (fluent, official intermediate level examination in Hungary, Ph.D. studies in the United States)
2. German (good, official intermediate level examination in Hungary)
3. Spanish (good, project proposal and letter writing)
4. Hungarian (mother tongue)