

# CARLOS PALAZUELOS

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February 2016

## EDUCATION

**Feb 2009 PhD in Mathematics**, Facultad de CC. Matemáticas, *UCM* (Madrid).

- **Thesis:** *Tensor Products and Applications to Quantum Information Theory*.
- **Advisors:** David Pérez-García and Ignacio Villanueva Díez.
- **Distinctions:** *Doctorado Europeo* and *Premio Extraordinario de Doctorado* (2008/2009).

**June 2004 Degree in Mathematics**, Facultad de CC. Matemáticas, *UCM* (Madrid).

## RESEARCH INTERESTS

Functional Analysis and Quantum Information Theory.

## POSITIONS

- **2014-** Ramón y Cajal position at the Department of Mathematical Analysis of the UCM.
- **2011-2013** Juan de la Cierva position at ICMAT (CSIC).
- **2010-2011** Visiting Assistant Professor at the Department of Mathematics of the University of Illinois at Urbana-Champaign (USA).
- **2009-2010** Postdoctoral position at the Department of Mathematical Analysis of the UCM
- **2005-2009** PhD Fellowship-Contract at the Department of Mathematical Analysis of the UCM.

## PUBLICATIONS

- Hahn-Banach extension of multilinear forms and summability. H. Jarchow, C. Palazuelos, D. Pérez-García, and I. Villanueva. *Journal of Mathematical Analysis and Applications* 336 (2), 1161-1177 (2007).
- Orthogonally additive polynomials on  $C^*$ -Algebras. C. Palazuelos, A. M. Peralta and I. Villanueva. *The Quarterly Journal of Mathematics* 59, 363-374 (2008).
- Unbounded violation of tripartite Bell inequalities. D. Pérez-García, M.M. Wolf, C. Palazuelos, I. Villanueva and M. Junge. *Communications in Mathematical Physics* 279 (2) 455-486 (2008).
- The natural rearrangement invariant structure on tensor products. C. Fernández-González, C. Palazuelos and D. Pérez-García. *Journal of Mathematical Analysis and Applications* 343, 40-47 (2008).
- Factorizing multilinear operators on Banach spaces,  $C^*$ -algebras and  $JB^*$ -triples. C. Palazuelos, A. M. Peralta and I. Villanueva. *Studia Mathematica* 192 (2), 129-146 (2009).
- Operator Space theory: a natural framework for Bell inequalities. M. Junge, C. Palazuelos, D. Pérez-García, I. Villanueva and M.M. Wolf. *Physical Review Letters* 104, 170405 (2010).
- Unbounded violations of bipartite Bell Inequalities via Operator Space theory. M. Junge, C. Palazuelos, D. Pérez-García, I. Villanueva and M.M. Wolf. *Communications in Mathematical Physics* 300 (3), 715-739 (2010).
- Connes' embedding problem and Tsirelson's problem. M. Junge, M. Navascues, C. Palazuelos, D. Pérez-García, V. B. Scholz and R. F. Werner. *Journal of Mathematical Physics* 52, 012102 (2011).
- Large violation of Bell inequalities with low entanglement. M. Junge and C. Palazuelos. *Communications in Mathematical Physics* 306 (3), 695-746 (2011) (*Contributed talk in QIP 2011*).
- Maurey-Rosenthal factorization for  $p$ -summing operators and Dodds-Fremlin domination. C. Palazuelos, E. A. Sánchez-Pérez and P. Tradacete. *Journal of Operator Theory* 68 (1), 205-222 (2012).
- Superactivation of quantum nonlocality. C. Palazuelos. *Physical Review Letters* 109, 190401 (2012) (*Featured in Physics* 5, 124 (2012)), (*Featured in Real Sociedad Española de Física*), (*Contributed talk in QIP 2013*).

- On the largest Bell violation attainable by a quantum state. C. Palazuelos. *Journal of Functional Analysis* 267, 1959-1985 (2014).
- Rank-one Quantum Games. T. Cooney, M. Junge, C. Palazuelos and D. Pérez-García. *Computational Complexity* 24, 133-196 (2015) (*Contributed talk in QIP 2013*).
- Channel capacities via  $p$ -summing norms. M. Junge and C. Palazuelos. *Advances in Mathematics* 272, 350-398 (2015).
- Hypercontractivity in finite-dimensional matrix algebras. M. Junge, C. Palazuelos, J. Parcet, M. Perrin. *Journal of Mathematical Physics* 56, 023505 (2015).
- Hypercontractivity for free products. M. Junge, C. Palazuelos, J. Parcet, M. Perrin, E. Ricard. *Annales Scientifiques de l'École Normale Supérieure* 48 (4) 861-889 (2015).
- Large bipartite Bell violations with dichotomic measurements. C. Palazuelos, Z. Yin. *Physical Review A* 92, 052313 (2015).
- CB-norm estimates for maps between noncommutative  $L_p$ -spaces and quantum channel theory. M. Junge, C. Palazuelos. To appear in *International Mathematics Research Notices*. Available in: arXiv:1407.7684.
- Survey on Nonlocal Games and Operator Space Theory. C. Palazuelos, T. Vidick. *Journal of Mathematical Physics* 57, 015220 (2016)(Special Issue: Operator Algebras and Quantum Information Theory).
- Hypercontractivity in group von Neumann algebras. M. Junge, C. Palazuelos, J. Parcet, M. Perrin. To appear in *Memoirs of American Mathematical Society*. Available in: arXiv:1304.5789.
- Sampling quantum nonlocal correlations with high probability. C. González-Guillén, C. H. Jiménez, C. Palazuelos, I. Villanueva. To appear in *Communications in Mathematical Physics*. (*Talk in TQC 2015*). Available in arXiv:1412.4010.

### Preprints and works in progress:

- Euclidean distance between gaussian and orthogonal matrices. C. González-Guillén, C. Palazuelos, I. Villanueva. Submitted. Available in : arXiv:1412.3743.
- Random constructions in Bell inequalities: A survey. C. Palazuelos. Submitted. Available in: arXiv:1502.02175.
- Reducing the number of inputs in nonlocal games. M. Junge, T. Oikhberg, C. Palazuelos. In preparation.

### TALKS, SEMINARS AND COURSES

- **Talks**
  - (2015) Universidad de Murcia. Congreso de jóvenes investigadores RSME. Murcia (Spain). Talk: *Canales Cuánticos: De la teleportación a los espacios  $L_p$  no conmutativos*.
  - (2014) National Centre of Competence in Research. The Greatest Inspiration is Surely Non-locality. Riederalp (Switzerland). Talk: *Sampling quantum nonlocal correlations with high probability*.
  - (2014) Universidad del País Vasco. First joint international meeting of the Italian and Spanish mathematical societies -RSME-SCM-SEMA-SIMAI-UMI. Bilbao (Spain). Talk: *Bell inequalities from a mathematical point of view*.
  - (2013) Universidad de Sevilla. Congreso de jóvenes investigadores RSME. Sevilla (Spain). Talk: *Hipercontractividad no conmutativa*.
  - (2013) Instituto de Ciencias Matemáticas. School and workshop: Topics in Operator Algebras and Applications. Madrid (Spain). Talk: *Operator algebras and quantum channels*.
  - (2013) Tsinghua University. 16th Workshop on Quantum Information Processing (QIP 2013). Beijing (China). Talk: *Superactivation of quantum nonlocality*.
  - (2012) University of Wuhan. Operator Spaces, Quantum Probability and Applications, Wuhan (China). Talk: *How nonlocal can a quantum state be?*
  - (2012) Banff International Research Station (BIRS). Operator structures in quantum information theory, Banff (Canada). Talk: *Studying Quantum Games with Operator Spaces*.

- (2011) RSME. Congreso de jóvenes investigadores RSME. Soria (Spain). Talk: *Quantum channel capacities and  $p$ -summing maps*.
- (2011) La Manga del Mar Menor. Integration, Vector Measures and Related Topics IV (Dedicated to Joe Diestel). Murcia (Spain). Talk: *On some subspaces of  $L_1(\ell_\infty^n)$  and applications to Quantum Information Theory*.
- (2011) The Capella Sentosa. 14th Workshop on Quantum information Processing (QIP 2011). Singapore (Singapore). Talk: *Large violation of Bell inequalities with low entanglement*.
- (2010) Banff International Research Station (BIRS). Workshop on Noncommutative  $L_p$  spaces, Operator spaces and Applications, Banff (Canada). Talk: *Violation of Bell inequalities via operator spaces*.
- (2009) Fields Institute. Workshop on Operator Structures in Quantum Information, Toronto (Canada). Talk: *Operator Spaces: A natural language for Bell Inequalities*.
- (2009) Centro de Estudios Superiores Felipe II. Modern Functional Analysis. Conference to honor Fernando Bombal on his 65th birthday, Aranjuez (Spain). Talk: *Functional Analysis and Quantum Information*.
- (2008) Fundación Ramón Areces. International Workshop on the Mathematical Foundations of Quantum Control and Quantum Information Theory, Madrid (Spain). Talk: *Unbounded Violation of Tripartite Bell Inequalities*.
- (2008) IV Encuentro de Análisis Funcional y Aplicaciones, Salobrea (Spain). Talk: *La Estructura Natural de Espacio Invariante por Reordenamiento sobre el Producto Tensorial*.

#### • Seminars

- (2013) ICMAT, Madrid (Spain). Seminario de Álgebra y Combinatoria. Talk: *Hypercontractivity for free products*.
- (2013) Department of Applied Mathematics and Theoretical Physics of Cambridge University, Cambridge (United Kingdom), Talk: *Some recent results in quantum nonlocality*.
- (2012) ICMAT, Madrid (Spain). Club de Matemáticas y Física. Talk: *Quantum nonlocality from different perspectives*.
- (2012) Departamento de Matemáticas de la Universidad Carlos III de Madrid, Madrid (Spain), Talk: *The role of Grothendieck's Theorem in quantum games*.
- (2012) F. C. Matemáticas de la Universidad de Murcia, Murcia (Spain), Talk: *On some topics in Quantum Information Theory from a mathematical point of view*.
- (2011) F. C. Matemáticas de la UCM, Quantum Information Seminar, Madrid (Spain), Talk: *On some classical aspects on quantum channels from a mathematical point of view*.
- (2011) ICMAT, Madrid (Spain). Seminario de Análisis y Aplicaciones. Talk: *Introducción a las desigualdades de Bell y su papel en la Teoría de Información Cuántica*.
- (2010) Institut Mittag- Leffler, Stockholm (Sweden). Talk: *Quantum nonlocality from a mathematical point of view*.
- (2010) F. C. Matemáticas de la UCM, Madrid (Spain). Talk: *Subespacios bonitos de  $L_1(\ell_\infty^k)$* .
- (2009) Departamento de Matemáticas de la UAM, Madrid (Spain). Seminario de Análisis y Aplicaciones. Talk: *Análisis matemático y teoría de información cuántica*.

#### • Courses

- (2013) Instituto de Ciencias Matemáticas (ICMAT), Cursos de Análisis y Aplicaciones, Madrid (Spain). Course: *Introduction to Quantum Information theory*.
- (2010) Centro Internacional de Encuentros Matemáticos (CIEM), Workshop on Advanced topics of analysis applied to Quantum Information problems, Castro Urdiales (Spain). Course: *Operator Spaces and Bell Inequalities*.

## GRANTS

- **June 2013-** *Ramón y Cajal* Post-Doctoral Contract/Fellowship (Institution: Ministerio de Economía y Competitividad, Spain).

- **Dec. 2010- 2013** *Juan de la Cierva* Post-Doctoral Contract/Fellowship (Institution: Ministerio de Ciencia e Innovación, Spain).
- **Dec. 2009- Dec. 2010** Post-Doctoral position at the University of Illinois at Urbana-Champaign associated to NSF grant DMS-0901457.
- **Oct. 2010- Nov. 2010** Post-Doctoral fellowship at Institute Mittag-Leffer.
- **May 2009- Dec. 2009** Post-Doctoral fellowship associated to I- MATH project (subproject FUT-C4-0182) .
- **2005-2009** PhD Fellowship (Institution: Universidad Complutense de Madrid, Spain).

## TEACHING

- **Spring 2016** *Espacios de Banach*, Máster en Matemáticas Avanzadas. Facultad de Matemáticas, UCM.
- **Spring 2016** *Métodos Matemáticos de la Ingeniería*, Grado en Ingeniería Informática. Facultad de Informática, UCM.
- **Spring 2015** *Métodos Matemáticos de la Ingeniería*, Grado en Ingeniería Informática. Facultad de Informática, UCM.
- **Spring 2014** *Cálculo Integral*, Doble grado: Matemáticas-Física y Matemáticas-Informática. Facultad de CC. Matemáticas, UCM.
- **Spring 2013** *Introduction to quantum information theory*, Curso de doctorado UCM, ICMAT-Facultad de CC. Matemáticas de la UCM.
- **Fall 2011** *Matemáticas I*, Ingeniería Química, Facultad de Ciencias, Universidad Autónoma de Madrid.
- **Spring 2010** *MATH 231: Calculus II*, University of Illinois at Urbana-Champaign.
- **Course 2007- 2008** *Análisis de Variable Real*, Facultad de CC. Matemáticas, UCM.
- **Related Information:**
  - CAP: Pedagogical Course for secondary school.
  - National Evaluation (ANECA) for “Profesor Contratado Doctor”.

## ACTIVITIES ORGANIZATION

- Research Term on Operator Algebra Methods in Harmonic Analysis and Quantum Information, Instituto de Ciencias Matemáticas (May-June-July 2013): <http://www.icmat.es/NTHA/RT-OAM/index.html>), Organizing Committee.
- Jornadas sobre Teoría de Información Cuántica, Instituto de Ciencias Matemáticas (Dec. 2011- Feb. 2012), Organizing Committee (<http://193.144.183.228/mathematica/files/File/actividades/FUT-CEXT-0481/Informe>)
- Quantum Information seminar at UCM (2014-). Organizer (<http://www.mat.ucm.es/imi/QI/people.htm>).

## CURRENT RESEARCH PROJETS

- Quantum Information Technologies Madrid +(QUITEMAD) (S2013/ICE-2801), Director: M. A. Martín Delgado.
- Las matemáticas del entrelazamiento cuántico (MTM2014-54240-P), Director: David Pérez-García.