# Research Report ই



# RANDOM MATRIX TEHNIQUES IN QUANTUM INFORMATION THEORY (RMTQIT)

## Goal of the project

The field of Quantum Information Theory (QIT) attracted lately the interest of scientific community due to the its ambitious goals meant to create new technologic systems (quantum computers) and new more secured methods to transmit the information. Nowadays, QIT is a multi-faceted field, with large connections in the subfields of Mathematics, such as Functional Analysis, Operator Theory, Linear Algebra, Probability Theory. The project RMTQIT purposes to give answers to open questions from QIT, using techniques from random matrix theory.

#### Short description of the project

The project RMTQIT focuses on a systematic exploration of theoretical questions in QIT about random quantum states and random quantum channels. These problems have attracted the attention lately in a very naturally connection to fundamental issues of QIT theory, such as entanglement theory and classical (or quantum) capacities for channels.

#### Project implemented by

- 1. The Department of Mathematics, Politehnica University of Timişoara.
- 2. Laboratoire de Physique Théorique de Toulouse, Université Paul Sabatier Toulouse III, France.

#### Implementation period

01.03.2013 - 29.02.2016

#### Main activities

In the last year within the project RMTQIT it took place interesting activities meant to complete the scientific tasks purposed as well as to extend and attract new collaborators.

- First of all, it would like to mention that we welcomed at Timisoara for short visits some of our collaborators: Dr Ion Nechita, Dr. David Reeb, from Zentrum Mathematik, Technische Universität München, Dr. Kim Dang, from Department of Mathematics Yale University and Prof. Dr. Antonino Messina, from University Palermo, Italy.
- Dr. David Reeb presented the research seminar "Extending Quantum Channels", on 16 July 2014 at Department of Mathematics, UPT.
- The results of our research activity were presented to scientific community with several occasions:
- in May at University of Munchen, where dr M.A. Jivulescu presented the talk "On the reduction criterion for random quantum states", at the 25th edition of the Conference on Operator Theory, Timişoara, where dr. Nicolae Lupa presented the talk "Eigenvalue distribution of the reduced Wishart matrices and applications in quantum information theory".

#### Results

- Maria Anastasia Jivulescu, Nicolae Lupa, Ion Nechita On the reduction criterion for random quantum states - JOURNAL OF MATHEMATICAL PHYSICS, Volume: 55, Issue: 11, Article Number: 112203-1-27, NOV 2014, (arXiv:1402.4292)
- António J. G. Bento, Nicolae Lupa, Mihail Megan, César M. Silva - Integral conditions for nonuniform μ-dichotomy arXiv:1405.2946
- Maria Anastasia Jivulescu, Nicolae Lupa, Ion Nechita, David Reeb - Positive reduction from spectra -LINEAR ALGEBRA and its APPLICATIONS, Volume 469, NOV 2014, Pag. 276–304, doi:10.1016/j.laa.2014.11.031 (arXiv:1406.1277)
- Motohisa Fukuda, Ion Nechita, Michael M. Wolf Quantum channels with polytopic images and image additivity arXiv:1408.2340
- 5. Motohisa Fukuda, Ion Nechita Additivity rates and PPT property for random quantum channels arXiv:1411.6881
- 6. M.R. Abdollahpour, A. Najati, P. Gavruta Multipliers of pg-Bessel sequences in Banach spaces arXiv:1501.01146v1

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#### **Research Team**

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