

Mathematical Physics at IJCLab

Definition: *Mathematical Physics involves: i) applications of Mathematics to (understand/solve) problems in Physics as well as ii) developments of new Mathematics inspired by Physics.*

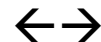
(definition borrowed from Journal of Mathematical Physics)

Examples:

- i) Math. \rightarrow Phys.: (*standard!*) Group Theory \rightarrow Symmetries,..., Fiber bundles \rightarrow Gauge Theories,...
- ii) Phys. \rightarrow Math.: (*not so standard*) "Particular" Gauge models \rightarrow Differential Invariants of manifolds, Quantum Gravity approaches \rightarrow new algebraic structures,...

Summary:

Algebra, Topology, Differential Geometry, Functional Analysis,... *almost all MCS items*



Field Theory, High Energy Physics, Quantum Gravity,...

Mathematical Physics at IJCLab: People

Michel DUBOIS-VIOLETTE

Samuel FRIOT

Vincent RIVASSEAU

Jean-Christophe WALLET

Robin ZEGERS

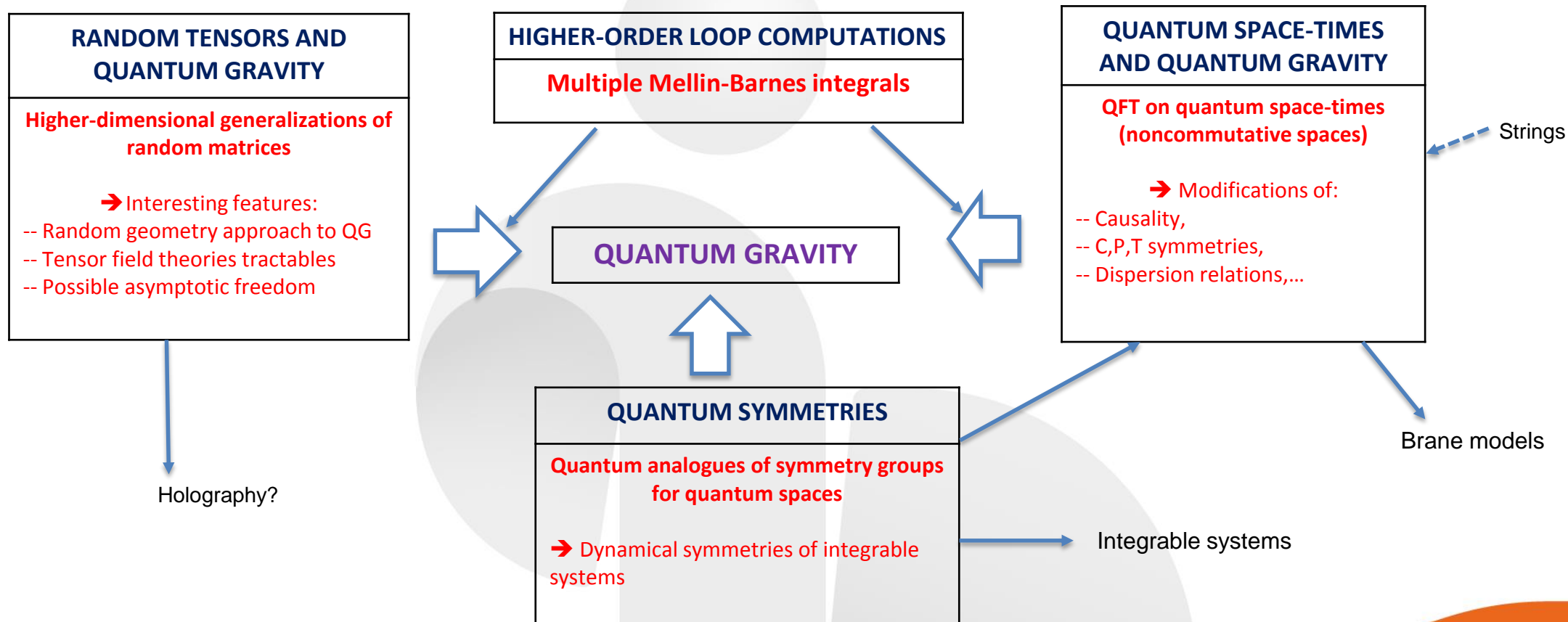
Léonard FERDINAND

Kilian HERSENT

Elie MOUNZER

Mohamed OUERFELLI

Mathematical Physics at IJCLab: Topics



Mathematical Physics at IJCLab: Recent results

Quantum symmetries: → **Classification of the irreducible representations of quantum toroidal algebras**
(lowest rank) long-standing problem in representation theory

Field theories:

→ **Construction of the first physically suitable gauge theory on κ -Minkowski space-time**

Solves a 20 years old problem in the area of field theories on quantum spaces

→ **First steps toward the construction of a renormalizable Tensor Field Theory**

Some evidence of non-perturbative asymptotic freedom

Mathematical methods:

→ **First systematic series expansion of multiple Mellin-Barnes integrals**

Series representations of multivariable hypergeometric functions



Mathematical Physics at IJCLab: Networks

High visibility

Interactions/Collaborations:

→ Dept. of Maths:

Univ. of Almeria (Spain), IHES (France), Institut for Geometry and Physics Trieste (Italy), univ. of Notre Dame Indiana (USA), univ. of Genova (Italy),...

→ Dept. of Physics:

CPhT X, CPT Marseille (France), univ. of Napoli (Italy), univ. Of Roma Sapienza (Italy), Univ. of Brussel (Belgie), Jagelonian univ. Krakow (Poland),...

EU Programs:

→ Program CA18108 “Quantum Gravity phenomenology in the multi-messenger approach”

*(Investigate possible signatures predicted by quantum gravity models in the observation of different cosmic messengers, by creating the conditions for a **close collaboration between theorists and the various experimental communities** involved in the detection of such cosmic messengers)*

28 countries, ~150 scientists

→ ...