Contribution ID: **21** Type: **Oral contribution**

Foundations of Relational Quantum Field Theory

Wednesday 9 July 2025 10:20 (20 minutes)

Starting from operationally motivated principles, we derive a relational theory of observables in Minkowski spacetime from which the notion of scalar quantum fields naturally emerges. We expand on quantum reference frames in spacetime and demonstrate that most properties of quantum fields arise as direct consequences of constraints on quantum reference frames – that is, quantum fields should be understood as what observers "see" using an imperfect measurement setup. We show that such quantum fields satisfy the usual axioms of constructive quantum field theory, including notions of covariance and causality conditions, provided natural assumptions at the level of the quantum reference frames. We indeed highlight that analogous objects to the textbook Wightman quantum fields show up in certain classes of quantum reference frames in spacetime.

Working Group

WG3 - Low-energy gravitational effects in quantum systems

Author: FEDIDA, Samuel (CQIF, DAMTP, University of Cambridge)

Co-author: Mr GLOWACKI, Jan (Institute for Quantum Optics and Quantum Information, Vienna, Austria)

Presenter: FEDIDA, Samuel (CQIF, DAMTP, University of Cambridge)

Session Classification: WG3 Low-energy Gravitational Effects in Quantum Systems 2