MP 17: Quantum Information and QFT

Time: Thursday 15:20–16:00 Location: H-HS VII

MP 17.1 Thu 15:20 H-HS VII

Relative entropy approach to quantum phenomena — •Tobi Haas and Stefan Flörchinger — ITP Heidelberg

Our main goal is to get a better understanding of entanglement entropies in Quantum Field Theories. Unfortunately Von Neumann's entanglement entropy is UV divergent for a finite subvolume V in any Quantum Field Theory due to entanglement across the boundary. We believe that relative entropy is capable of circumventing this well-known problem. Besides the fact, that relative entropy is more universal in a mathematical sense, it may in general be a more natural approach to think in terms of distinguishability rather than in terms of missing information.

We begin with quantum statistical mechanics and show how to reformulate the maximum entropy principle. Then we present the deep connection between the key property of relative entropy, namely its monotonicity under CPTP-maps, and the second law of thermodynamics. We furthermore propose an extension to a local second law-like inequality in terms of relativistic fluids.

Additionally we investigate entropic uncertainty relations and how to understand them in terms of relative entropy. We discuss the discrete variable case for a spin system and the continuous variable case for a quantum harmonic oscillator. At last we present a proof for a relative entropic uncertainty relation based on monotonicity of relative entropy under CPTP-maps.

MP 17.2 Thu 15:40 H-HS VII

Entanglement in a non-relativistic QFT — •Natalia Sánchez-Kuntz — Institut für Theoretische Physik Universität Heidelberg

This presentation gives a quick overview of the mathematical methods used to calculate entanglement entropy for Gaussian states, and takes this formalism to the particular case of fields which follow a Bogoliubov dispersion relation, concentrating on the vacuum state. The main objective of this contribution is to show the difficulties encountered when approaching this problem, regarding both, divergencies and the expression of the theory in an adequate set of basis functions.