Contribution ID: **13** Type: **not specified**

Causality in QFT measurements: the scattering paradigm and beyond

Monday 15 April 2024 17:15 (45 minutes)

The formulation of local measurement theory for QFT has recently been an active area of research. In contrast to the asymptotic measurement framework that was enshrined in QED the new proposals aim to supply a measurement framework for measurement in local spacetime regions. In the history of QFT, in parallel to the establishment of the asymptotic scattering paradigm, there is a series of attempts to model local measurements in QFT that we will briefly review in the first part of this talk (based on [1]). Considerations of relativistic causality played an important role in these developments. Causality issues, such as impossible measurements, today have been addressed for local QFT measurements that are formulated as local scattering maps. I will focus on the analysis of causality in the detector model approach to QFT measurements, where the local scattering maps are induced by non-relativistic probes coupled to the field. Finally, I will discuss causality beyond the scattering paradigm, for histories-based approaches to QFT measurements (based on [2]).

[1] https://link.springer.com/article/10.1140/epjh/s13129-023-00064-1
[2] https://philsci-archive.pitt.edu/22887/

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Session Classification: Talks