

Plenary Talk

PV I Mon 9:00 Audimax

Measurement theory for quantum fields — ●CHRISTOPHER FEWSTER — Department of Mathematics, University of York, Heslington, York YO10 5DD. United Kingdom

Great emphasis is placed on the problem of measurement in quantum mechanics. However, a parallel discussion for quantum field theory (QFT) is much less well-developed, despite its foundational importance and the conceptual interest arising from the inclusion of relativity.

This talk will describe how the measurement chain can be described in QFT. Measurements of a quantum system are made by temporarily coupling it to a probe (itself a quantum system). Once the coupling is removed, the probe is measured and the results are interpreted as the measurement of a system observable. This arrangement is called a

measurement scheme for the latter observable; although measurement schemes have been studied extensively in quantum mechanics, they have rarely been discussed in the context of quantum fields and still less on curved spacetimes.

I will describe how measurement schemes may be formulated for quantum fields on curved spacetime within the general setting of algebraic QFT. This allows the discussion of the localisation and properties of the system observable induced by a probe measurement, and the way in which a system state can be updated thereafter. The framework is local and fully covariant, allowing the consistent description of measurements made in spacelike separated regions. In particular, it sheds light on an old problem due to Sorkin concerning “impossible measurements” in which measurement apparently conflicts with causality.