



Department of  
Theoretical Physics

# THE QUANTUM SPACETIME SEMINAR SERIES

## What can be measured asymptotically?

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**Time:** 9 AM IST

Zoom link shall be shared  
separately



In this talk, we consider asymptotic observables in quantum field theories in which the S-matrix makes sense. We argue that in addition to scattering amplitudes, a whole compendium of inclusive observables exists where the time ordering is relaxed. These include expectation values of electromagnetic or gravitational radiation fields as well as out-of-time-order amplitudes. We explain how to calculate them in different ways: by relating them to amplitudes and products of amplitudes and by using a generalization of the LSZ reduction formula. Finally, we discuss how to relate them to one another through new versions of crossing symmetry. As an application, we discuss one-loop contributions to gravitational radiation in the post-Minkowski expansion, emphasizing the role of classical cut contributions and highlighting the infrared physics of in-in observables.