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## An intrinsic cosmological observer

*Thursday 6 February 2025 10:15 (1 hour)*

There has been much recent interest in the necessity to include an observer degree of freedom in the description of local algebras in semiclassical gravity. In this talk, I will describe an example where the observer can be constructed intrinsically from the quantum fields. This construction involves the slow-roll inflation example recently analyzed by Chen and Penington, in which the gauge-invariant gravitational algebra arises from averaging over modular flow in a local patch. I will relate this procedure to the Connes-Takesaki theory of the flow of weights for type III von Neumann algebras, and further show that the resulting gravitational algebra can naturally be presented as a crossed product. This leads to a decomposition of the gravitational algebra into quantum field and observer degrees of freedom, with different choice of observer being related to changes in frame for the algebra. I will also connect this example to other constructions of type II algebras in semiclassical gravity, and argue they all share the common feature of being the result of gauging modular flow.

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