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## Relational Quantum Dynamics for Toy Models of Time Travel

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The “problem of time” that approaches to quantum gravity have to either tackle or circumvent should, naturally, also occur in models of time travel trying to move beyond (semi-)classical gravity. From a viewpoint of canonical gravity a first hurdle to time travel is that the underlying quantization procedure relies on global hyperbolicity of the space-time to be quantized. As with any new theory, it is to be expected that expectations of earlier theories (like in this case, global hyperbolicity) would have to be tempered, changed, or let go in the successor theory. Recent advances in the understanding of relational dynamics in quantum theory have greatly propelled the field of time in quantum theories forward. In this talk we will present our recent efforts to combine such relational quantum dynamics and periodic clocks in the service of toy models for time travel. The goal will be to build a collection of toy models of varying degrees of complexity that should provide a view of quantum gravity beyond global hyperbolic space-times, and thus potentially new arguments against time travel.

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