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Gravity from optimized computation

A new principle in quantum gravity, dubbed spacetime complexity, states that gravitational physics emerges from spacetime seeking to optimize the computational cost of its quantum dynamics. Thus far, this principle has been realized at the linearized level, in holographic theories with Einstein gravity duals, assuming the so-called 'Complexity-Volume' (CV) proposal. We expand on this proof in two significant directions. First, we derive higher-derivative gravitational equations by including appropriate corrections to the CV dictionary. Second, we show semi-classical equations arise by considering the leading bulk quantum corrections to CV. Our proof is valid for two-dimensional dilaton gravities, where the problem of semi-classical backreaction can be solved exactly.

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