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(G*) Dynamics and entanglement in quantum and quantum-classical systems: lessons for gravity

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Motivated by quantum gravity, semiclassical theory, and quantum theory on curved spacetimes, we study the system of an oscillator coupled to two spin-1/2 particles. This model provides a prototype for comparing three types of dynamics: the full quantum theory, the classical oscillator with spin backreaction, and spins propagating on a fixed oscillator background. From calculations of oscillator and entanglement entropy evolution, we find that the three systems give equivalent dynamics for sufficiently weak oscillator-spin couplings but deviate significantly for intermediate couplings. These results suggest that semiclassical dynamics with backreaction does not provide a suitable intermediate regime between quantum gravity and quantum theory on curved spacetime.

Keyword-1

Quantum gravity

Keyword-2

Semiclassical gravity

Keyword-3

Entanglement

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