

Decoherence in gravitating and gravity-exposed quantum systems

Initiative: Freigeist-Fellowships

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Laufzeit: 5 Jahre

Projekt-Website: <https://www.physik.uni-jena.de/GravitatingQuantumSystems>

Quantum experiments are being conducted with larger and larger systems of higher and higher masses. Gravitational effects could soon become relevant in these experiments. This creates the opportunity for an experimental evaluation of our concepts of space, time, and matter, and can pave the way to the yet unknown theory uniting general relativity and quantum mechanics. If we ask how a quantum superposition state sources the gravitational field, there are two possible answers: the gravitational field itself being in a superposition or the geometrical concept of classical space-time remaining valid even at small scales. One focus of this project will be on a systematic evaluation as to which decoherence effects can be expected as the result of either possibility, i.e. gravitational fluctuations of classical compared to such of quantum origin. The latter possibility of a co-existence of quantum matter and classical gravity has triggered the idea that gravity may also cause an objective collapse of the wave-function, thereby resolving the measurement problem of quantum mechanics. Exploring this idea with a detailed study of the combined dynamics of gravity and decoherence is the second major objective of the project.

Projektbeteiligte

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[Acceleration noise constraints on gravity-induced entanglement](#)

[Dephasing and inhibition of spin interference from semi-classical self-gravitation](#)

[Three little paradoxes: making sense of semiclassical gravity](#)

