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Newtonian Semiclassical Gravity in the Ghirardi–Rimini–Weber theory with Matter Density Ontology

We present a Newtonian semiclassical gravity theory based on the GRW collapse theory with matter density ontology (GRWm), which we term GRWmN. The theory is proposed because, as we show from previous arguments in the literature, the standard theory of Newtonian semiclassical gravity based on the Schrödinger–Newton equations does not have a consistent Born rule interpretation for gravitationally self-interacting particles and implies gravitational cat states for macroscopic mass superpositions.
By contrast, we show that GRWmN has a consistent statistical description of gravitationally self-interacting particles and adequately suppresses the cat states for macroscopic superpositions. Two possible routes to experimentally testing GRWmN are also considered. We conclude with a discussion of possible variants of GRWmN, what a general relativistic extension would entail, and various objections that might be raised against semiclassical gravity theories like GRWmN.
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