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Why and how collapse models make sure that quantum measurements have definite outcomes (and with the correct probabilities)

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Abstract

Collapse models are phenomenological modifications of the Schrödinger equation devised to solve the quantum measurement problem. Nonlinear and stochastic terms are added to the usual evolution of the wave function. These new terms have negligible effects on the dynamics of microscopic quantum systems, hence their quantum properties are left almost unaltered. On the other hand, when atoms and molecules glue together to form macroscopic objects, the noise rapidly localized the wave function in space. Here we will show in detail why and how, during a measurement process, the wave function collapses in space as expected, and it does so with the correct quantum probabilities. We will also discuss how it is possible to detect the collapse effects induced by the noise.