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Bounding the Minimum Time of a Quantum Measurement

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Measurements take a singular role in quantum theory. While they are often idealized as an instantaneous process, this is in conflict with all other physical processes in nature. Here, we adopt a standpoint where the interaction with an environment is a crucial ingredient for the occurrence of a measurement. Within this framework, we derive a general lower bound on the time needed for a measurement to occur with minimal assumptions and without specifying any physical model.
We evaluate our bound in two examples where the environment is modeled by harmonic oscillators and the measurement apparatus is modeled by spins or bosons. We further discuss possible experimental implementations of the dynamics of a measurement induced by complex environment.

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