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Optimizing Protective Quantum Measurements

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Measurement is at the heart of quantum mechanics. Conventional projective measurements yield full information about an observable while maximally changing ("disturbing") the quantum state. By contrast, so-called protective quantum measurements enable one to measure expectation values on single quantum systems with an arbitrarily low probability of disturbing the quantum state. Protective measurement provides an interesting alternative to conventional ensemble state tomography and broadens our understanding of measurement in quantum mechanics. In this talk, I will describe how a careful choice of the coupling between system and apparatus allows one to reduce the unwanted disturbance of the quantum state by many orders of magnitude compared to previous proposals. This makes protective measurements much more powerful and may get us a step closer to their experimental implementation.