

## Noninvasive measurement of dynamic correlation functions

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Dynamic (2-time) correlation functions of quantum systems are complex quantities, and their experimental accessibility is complicated by measurement backaction. We prove that the real part of dynamical correlation functions is not affected by backaction, and hence can be obtained by projective measurements. To measure the imaginary part of dynamic correlation functions we introduce a protocol based on noninvasive measurements, which are achieved by weak ancilla-system couplings, thus reducing disturbances due to the early time measurements to a minimum. The deviation of the measured correlation functions from the theoretical, unitarily-evolved ones is quantified, and this allows us to optimize the parameters of the weak measurement protocol. Through these results, experimental measurement of dynamic correlations in nonequilibrium quantum systems becomes feasible. Implementations of the protocol in trapped ions and other experimental platforms are discussed. An outlook will be given on the measurement of out-of-time-ordered correlation functions.