

## Measuring 2-time correlation functions in many-body quantum systems

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Dynamic (2-time) correlation functions have widespread applications in theoretical statistical physics, both in and out of equilibrium. In quantum systems these correlation functions are complex-valued quantities, and their experimental accessibility is complicated by measurement backaction. To facilitate measurements of 2-time quantum correlations we introduce a protocol based on weak ancilla–system couplings, which reduces disturbances due to the early-time measurements to a minimum. Different choices of the coupling operator give access to the real and imaginary parts of the dynamic correlation function. For spin-1/2 models and single-site observables we prove that measurement backaction can be avoided altogether, allowing for the use of ancilla-free protocols. Through these results, experimental measurement of dynamic correlations in nonequilibrium quantum systems becomes feasible, and may be used for the detection of ageing in quantum glasses and other statistical physics applications. 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. (Preprint available at arXiv:1611.08123.)