Abstract Submitted
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Weak values are universal in von Neumann measurements[1] JUSTIN DRESSEL, ANDREW JORDAN, University of Rochester — We refute the widely held belief that the quantum weak value necessarily pertains to weak measurements. To accomplish this, we use the transverse position of a free particle as the detector for the conditioned von Neumann measurement of a system observable. For any coupling strength, any initial states, and any choice of conditioning, the averages of the detector position and momentum are completely described by the real parts of three generalized weak values in the joint Hilbert space. Higher-order detector moments also have similar weak value expansions. Using the Wigner distribution of the initial detector state, we find compact expressions for these weak values within the reduced system Hilbert space, demonstrating that the effective preselection for a measured system weak value is decohered by the detector. As an optical application of the approach, we consider an arbitrary Hermite-Gauss mode for a paraxial beam-like detector. For non-Gaussian modes the momentum shift involves the imaginary part of the system weak value plus an additional weak-value-like correction.

[1]arXiv:1206.4714

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