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Some Statistical Measures and Analytical Results of Quantum Walks under Weak Measurement and Weak Values Regime DEBABRATA GHOSHAL, George Mason University, MARCO LANZAGORTA, ITT Corporation, SALVADOR VENEGAS-ANDRACA, Tecnológico de Monterrey Campus Estado de México (ITESM-CEM) — Motivated by experimental results on quantum weak measurements and weak values as well as by the need to develop new insights for quantum algorithm development, we study the behavior of quantum walks under the regime of quantum weak measurements and weak values of pre- and post-selected measurements (QWWM hereinafter). In particular, we investigate the limiting position probability distribution and several statistical measures (such as standard deviation) of a QWWM on an infinite line, and compare such results with corresponding classical and quantum walks position probability distributions and statistical measures, stressing the differences provided by weak measurements and weak values with respect to results computed by using canonical observables. We start by producing a concise introduction to quantum weak values and quantum weak measurements. We then introduce definitions as well as both analytical and numerical results for a QWWM under Hadamard evolution and extend our analysis to quantum evolution ruled by general unitary operators. Moreover, we define a 2-walker QWWM on an infinite 2D lattice and explore its behavior on limiting probability distribution, standard deviation and degree of entanglement between walkers.

Debabrata Ghoshal
George Mason University

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