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Experimental test of non-local realism using a fiber-based source of polarization-entangled photon pairs MATTHEW EISAMAN, ELIZABETH GOLDSCHMIDT, JINGYUN FAN, ALAN MIGDALL, National Institute of Standards and Technology, Gaithersburg, MD — We describe a bright, wavelength-tunable source of polarization-entangled photon pairs that uses a single-mode microstructure fiber in a Sagnac interferometer at room temperature [1]. We create all four Bell states with a two-photon coincidence rate of 7 kHz/nm over wavelengths spanning more than 20 nm, and measure the fidelity of each Bell state to be greater than 95% using quantum-state tomography [2]. We compare our measurements of two-photon polarization correlations to the predictions of quantum mechanics, and to the predictions of local realistic and non-local realistic theories. Our measurements are consistent with quantum-mechanical predictions, violating Bell's inequality in the CHSH form by 15 standard deviations (excluding local hidden-variable theories) and violating a Leggett-type non-local hidden-variable inequality by 3 standard deviations (excluding a certain class of non-local hidden-variable theories) [3]. Refs. [1] J. Fan, M. D. Eisaman, and A. Migdall, PRA 76, 043836 (2007). [2] J. Fan, M. D. Eisaman, and A. Migdall, Opt. Express 15, 18339 (2007). [3] M. D. Eisaman, E. A. Goldschmidt, J. Chen, J. Fan, and A. Migdall, "Experimental test of non-local realism using a fiber-based source of polarization-entangled photon pairs," PRA (in press).

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