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High-fidelity linear optical quantum computing with polarization encoding FEDERICO SPEDALIERI, Jet Propulsion Laboratory, HWANG LEE, Lousiana State University, JONATHAN DOWLING, Louisiana State University — We show that the KLM scheme [Knill, Laflamme and Milburn, Nature **409**, 46] can be implemented using polarization encoding, thus reducing the number of path modes required by half. One of the main advantages of this new implementation is that it naturally incorporates a loss detection mechanism that makes the probability of a gate introducing a non-detected error, when non-ideal detectors are considered, dependent only on the detector dark-count rate and independent of its efficiency. Since very low dark-count rate detectors are currently available, a high-fidelity gate (probability of error of order 10^{-6} conditional on the gate being successful) can be implemented using polarization encoding. The detector efficiency determines the overall success probability of the gate but does not affect its fidelity. This can be applied to the efficient construction of optical cluster states with very high fidelity for quantum computing.

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