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QNIX: A Linear Optical Architecture for Quantum Computing MERCEDES GIMENO-SEGOVIA, PETER J. SHADBOLT, TERRY G. RUDOLPH, Department of Physics, Imperial College London, SW7 2AZ, UK, DAN E. BROWNE, Department of Physics and Astronomy, University College London, WC1E 6BT, UK, GABRIEL MENDOZA, NICHOLAS J. RUSSELL, JOSHUA W. SILVERSTONE, ALBERTO SANTAMATO, JACQUES CAROLAN, JEREMY O'BRIEN, Centre for Quantum Photonics, H.H. Wills Physics Laboratory & Department of Electrical and Electronic Engineering, University of Bristol, BS8 1UB, UK — There is currently a great deal of effort to develop a large-scale quantum computer, and one of the most promising platforms to do so is integrated linear optics. We present a proposal for a dynamical scheme for an integrated linear optics implementation of a one-way quantum computer. We go beyond the purely theoretical work and address practical issues in order to create a physically realistic design. We describe every step of cluster state construction and processing, showing the outstanding issues left to be addressed and our contributions to the different stages of the dynamical process. These include optimised interferometers for the generation of GHZ states, a universal and scalable architecture which requires entangled sources of no more than 3 photons with no active feed-forward, and loss-tolerant and fault-tolerant strategies specifically tailored to our proposed architecture. Our work demonstrates that building a linear optical quantum computer need be less challenging than previously thought, and brings large-scale switch-free linear optical architectures for quantum computing much closer to experimental realisation.

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