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Creation of resilient entangled states and a resource for measurement-based quantum computation with optical superlattices ANDREAS NUNNENKAMP, Departments of Physics and Applied Physics, Yale University, PO Box 208120, New Haven, CT 06520, USA , BENOIT VAUCHER, DIETER JAKSCH, Clarendon Laboratory, University of Oxford, Parks Road, Oxford OX1 3PU, UK — We investigate how to create entangled states with ultracold bosonic atoms trapped in optical lattices by dynamical manipulation of the shape of the lattice potential. We consider a period-two superlattice that allows both the splitting of each site into a double-well potential and also the variation of the height of the potential barrier between the sites. We show how to use this array of double-well potentials to entangle neighboring qubits encoded on the Zeeman levels of the atoms, without using the different vibrational states of the atoms. Finally, we present a method of realizing a Bell-pair encoded cluster state, a resource for measurement-based quantum computing which remains resilient to collective dephasing noise throughout the computation [NJP 10, 023005 (2008)].

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