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Layered materials as platforms for quantum technologies CARMEN PALACIOS-BERRAQUERO, DHIREN M. KARA, ALEJANDRO R.-P. MONTBLANCH, MATTEO BARBONE, University of Cambridge, PAWEL LATAWIEC, Harvard University, DUHEE YOON, ANNA K. OTT, University of Cambridge, MARKO LONCAR, Harvard University, ANDREA C. FERRARI, METE ATATURE, University of Cambridge — Quantum emitters (QEs) recently seen in tungsten diselenide (WSe_2), member of the 2-dimensional transition metal dichalcogenides (2d-TMDs), present potential for quantum information technology (QIT) hosted in a silicon-compatible platform. QEs in 2d-TMDs until now have appeared randomly and with unstable emission properties. We demonstrate a method to deterministically create large-scale QE arrays in LMs. We present results showing QE arrays of tens of microns square and more than 100 QEs, in both WSe_2 and WS_2. We do this through strain-engineering at the nanoscale, placing monolayers onto nanopatterned substrates. The quality of the QEs is equal or superior to those appearing randomly. We present results on the susceptibility of the deterministic QEs to pillar height, TMD material source and fabrication method. We study their excitonic and optical properties through micro-resolved photoluminescence and charge-controlled experiments for creating optically active spin qubits using hybrid and 2d-heterostructure devices. This work places layered materials as potential key players in QIT – enabling a more efficient study of these QEs and advancing towards real quantum circuit architectures.

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