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Metasurface route to quantum state engineering PANKAJ JHA, NIR SHITRIT, JEONGMIN KIM, XUEXIN REN, YUAN WANG, XIANG ZHANG, UC Berkeley — Quantum state engineering aims at meticulous preparation, control and manipulation of the quantum states of an atom, photon, etc. It has emerged as a key tool for quantum technology including sensing and metrology. Here we propose and theoretically demonstrate a novel platform for on-chip quantum state engineering by harnessing the exceptional light-manipulation capabilities of a metasurface. We demonstrate robust generation of entanglement between two qubits by engineering their coherent and dissipative interactions via a judiciously designed metasurface. Our proposal opens a new paradigm for quantum technology by integrating high-end custom-designed ultrathin optical elements in atom chips. Furthermore, it may also enable optical control of quantum many-body correlations.

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