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Deterministic and on-demand solid-state generation of photon Fock states KEYU XIA, JASON TWAMLEY, GAVIN BRENNEN, Centre for Engineered Quantum Systems, Department of Physics and Astronomy, Macquarie University, North Ryde, NSW 2109, Australia, DEMOSTHENES ELLINAS, Technical University of Crete Department of Sciences MØQ Research Unit GR-731 00 Chania Crete Greece — Pure highly non-classical photon states are an essential component for quantum technologies such as quantum communication and cryptography, quantum enhanced metrology and quantum computing. To generate such pure states of light researchers have developed methods involving trapped ions, trapped atoms, quantum dots, cavity-QED, four-wave mixing and parametric down conversion but almost all of these methods are probabilistic/heralded. We present a method to deterministically and on-demand, generate pure photon Fock states of light with high photon occupation via a quantum walk like protocol in a solid-state cavity-QED setup using a high-Q toroidal cavity coupled to a single nitrogen-vacancy defect in a nanodiamond. Through a sequence of microwave, magnetic field and laser pulses we show that starting from the vacuum this system can produce high quality bright photon Fock states on demand and quantify how robust our protocol is to timing errors.

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