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Photonic engineering of defect qubit systems in silicon carbide[1]

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The recent discovery of electronic states in silicon carbide (SiC) exhibiting properties similar to the negatively charged nitrogen vacancy center in diamond has opened up the possibility of scalable integration of defect qubits into solid state devices that can be fabricated on the wafer scale [1,2]. One form of SiC termed "3C" grows as a high quality thin film on silicon making it a promising platform for incorporating these defect systems into three dimensional device architectures such as photonics and micro- and nano-mechanical devices. We present the results of our recent progress towards incorporating optically active defects states in 3C SiC into high Q, small mode volume planar photonic crystal optical cavities. We demonstrate an optimized process for producing modified H1 and L3 cavities with Q's as high as 2700. Additionally, we utilize a combination of resonant scattering spectroscopy techniques and FDTD simulations to study the coupling of defect optical transitions to cavity modes and intrinsic cavity properties.

[1] W. F. Koehl et al., Nature 479, 84-87 (2011)
[2] A. L. Falk et al., Nat. Commun. 4, 1819 (2013)

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