Photonic systems are the leading candidates for deterministic quantum sources, quantum repeaters, and other key devices for quantum information processing. Scalability of this technology depends on the stability, homogeneity and coherence properties of quantum emitters, which makes color centers in wide band gap semiconductors a highly desirable platform for applications. Silicon carbide, in particular, has been an attractive commercial host of color centers featuring fiber-compatible single photon emission, long spin-coherence times and nonlinear optical properties. Integration of color centers with nanophotonic devices has been a challenging task, but significant progress has been made with demonstrations up to 120-fold resonant emission enhancement of emitters embedded in photonic crystal cavities. A novel direction in overcoming the integration challenge has been the development of triangular photonic devices, recently shown to preserve millisecond-scale spin-coherence in silicon carbide defects. Triangular photonics has promising applications in quantum networks, integrated quantum circuits, and quantum simulation. Here, open quantum system modeling provides insights into polaritonic physics achievable with realistic device parameters through evaluation of cavity-protection, localization and phase transition effects. Mapping of this dynamics to gate-based quantum circuits opens door for quantum advantage in understanding cavity quantum electrodynamical (QED) effects using commercial Noisy Intermediate-Scale Quantum (NISQ) hardware.

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Friday, May 26th, 2023 at 1:00 PM
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