Abstract Submitted
for the NWS14 Meeting of
The American Physical Society

Hybrid GaP/diamond waveguide-integrated resonators for quantum information processing applications[1] NICOLE THOMAS, RUSSELL BARBOUR, University of Washington, YUNCHENG SONG, MINJOO LARRY LEE, Yale University, KAI-MEI C. FU, University of Washington — Nitrogen-vacancy (NV) centers are considered a promising qubit system for on-chip entanglement generation in future quantum information processing (QIP) platforms. Optical networks for creating entanglement between NV centers require efficient collection and enhancement of the NV emission, photon routing along the diamond surface and entanglement generation via measurement-based schemes. As a first building block for such a network, we present gallium phosphide (GaP) waveguide-integrated disk resonators on a diamond substrate, and demonstrate coupling between 1 μm diameter resonators and waveguides with loaded quality factors of 3,800. The devices were fabricated from single-crystalline GaP transferred onto the diamond using an epitaxial lift-off process. A hybrid GaP/diamond system is ideal in that the GaP device layer provides both a high-index material for efficient waveguiding and the potential for the integration of active optical switches due to its linear electro-optic properties. Our devices show quality factors and coupling characteristics that are extremely promising for a future integration with near-surface NV centers in diamond, with the efficiency of on-chip photon collection in bus waveguides being several magnitudes higher than in comparable platforms utilizing free-space collection.

[1]This work was supported by the NSF under Grant No. 1343902. N. Thomas acknowledges financial support from Intel Corp.

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Date submitted: 21 Mar 2014 Electronic form version 1.4