Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Efficient Photon Collection from a Nitrogen Vacancy Center in a Circular Bullseye Grating in Diamond[1] EDWARD CHEN, LUOZHOU LI, Massachusetts Inst of Tech-MIT, JIABAO ZHENG, Columbia University, SARA MOURADIAN, FLORIAN DOLDE, TIM SCHRODER, SINAN KARAVELI, Massachusetts Inst of Tech-MIT, MATTHEW MARKHAM, DANIEL TWITCHEN, Element 6, DIRK ENGLUND, Massachusetts Inst of Tech-MIT — Efficient collection of the broadband fluorescence from the diamond nitrogen vacancy (NV) center is essential for a range of applications in sensing and quantum information processing. Here, we introduce a circular 'bullseye' diamond grating which enables a collected photon rate of 2.7±0.9 x 10^6 counts per second from a single NV with a spin coherence time of 1.7±0.1 ms. Back-focal-plane studies indicate efficient redistribution of the NV photoluminescence into low-NA modes by the gratings. Compared to other geometries with high collection efficiencies, the planar structure of the bullseye grating allows for direct transfer onto different substrates for device integration with other optical components, such as electrically-gated on-chip photon detectors and optical fiber facets. For narrow-band applications ($\Delta\lambda/\lambda<0.03$) the collection efficiency can be optimized to as high as 90% of the total dipole emission power within an NA=1.5. This makes the bullseye geometry particularly useful for collection of the zero-phonon line, e.g. for spin-photon entanglement.[2]

[1]L. Li*, E. H. Chen* et al. Nano Letters ASAP. (2015) *equal contributors
[2]Pfaff, W., et al. Science 345.6196 (2014).

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Date submitted: 09 Mar 2015 Electronic form version 1.4