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Quantum interference of single photons from two remote nitrogen-vacancy centers in diamond MICHAEL GOLDMAN, ALP SIPAHIGIL, EMRE TOGAN, YIWEN CHU, Harvard University, Department of Physics, MARK MARKHAM, DANIEL TWITCHEN, Element Six Ltd, ALEXANDER ZIBROV, ALEXANDER KUBANEK, MIKHAIL LUKIN, Harvard University, Department of Physics — The interference of two identical photons impinging on a beam splitter leads to perfect photon coalescence where both photons leave through the same output port. This effect, known as Hong-Ou-Mandel (HOM) interference, can be used to characterize the properties of quantum emitters with high accuracy. This is a particularly useful tool for quantum emitters embedded in a solid state matrix because their internal properties, unlike those of atoms in free space, differ substantially from emitter to emitter due to strong interactions with the environment. HOM interference can also be used to generate optically mediated entanglement between two remote quantum emitters, a crucial step toward the development of long-distance quantum communication and scalable quantum computation architectures. Here, we demonstrate this interference effect with single photons emitted from two single Nitrogen-Vacancy (NV) centers in diamond samples that are spatially separated by 2 meters [1]. The detuning of the photons can be tuned by applying a DC electric field to one NV center. We discuss current efforts toward optical entanglement of the two NV centers.

[1] A. Sipahigil, M. L. Goldman, E. Togan, Y. Chu, M. Markham, D. J. Twitchen, A. S. Zibrov, A. Kubanek, and M. D. Lukin, arXiv:1112.3975v1.

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