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3D diamond photonics enabled by femtosecond laser inscription

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Abstract

Diamond's nitrogen-vacancy (NV) centers show great promise in sensing applications and quantum computing due to their long electron spin coherence time and their ability to be located, manipulated and read out using light. The electrons of the NV center, largely localized at the vacancy site, combine to form a spin triplet, which can be polarized with 532-nm laser light, even at room temperature. The NV's states are isolated from environmental perturbations making their spin coherence comparable to trapped ions. An important breakthrough would be in connecting, using waveguides, multiple diamond NVs together optically. However, the inertness of diamond is a significant hurdle for the fabrication of integrated optics similar to those that revolutionized silicon photonics. In this work we show the first demonstration of buried 3D waveguide fabrication in diamond, enabled by focused femtosecond high repetition rate laser pulses. The properties of NV centers are preserved in the waveguides, making them promising for diamond-based magnetometers or quantum information systems.

The speaker

Shane Eaton received the B.A.Sc. degree in engineering physics (electrical engineering option) from the University of British Columbia, Vancouver, BC, Canada, in 2002, and the Ph.D. degree in electrical engineering from the University of Toronto, Toronto, ON, Canada, in 2008. He is currently a postdoc in the Department of Physics and has three funded projects related to diamond photonics, worth approximately €1 million over the next 2 years.