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Diamond in tellurite glass

An emerging hybrid material for quantum devices

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Sala Wataghin, Dipartimento di Fisica, via P. Giuria 1, Torino

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Abstract

Colour centres in diamond, especially the nitrogen-vacancy colour centre, promise a new era for quantum technologies. But despite the success of diamond colour centres in laboratory settings, they have had little impact in technology. One critical issue impeding the development of diamond technologies is the difficulty of integrating diamond centres with existing photonic platforms. Here we outline some of our work that attempts to address this concern. We have combined fluorescent nanodiamonds with tellurite glass. To date we have shown single photon emission, coupling of NV emission to microspheres, and primitive magnetic field sensing.

This work is based on the following papers:

- M. R. Henderson, B. C. Gibson, H. Ebendorff-Heidepriem, K. Kuan, S. Afshar V., J. O. Orwa, I. Aharonovich, S. Tomljenovic-Hanic, A. D. Greentree, S. Praver, and T. M. Monro, *Diamond in Tellurite Glass: a New Medium for Quantum Information*, *Advanced Materials* 23, 2806 (2011)
- H. Ebendorff-Heidepriem, Y. L. Ruan, H. Ji, A. D. Greentree, B. C. Gibson, T. M. Monro, *Nanodiamond in tellurite glass Part I: origin of loss in nanodiamond-doped glass*, *Optical Materials Express* 4, 2608 (2014).
- Y. L. Ruan, H. Ji, B. C. Johnson, T. Ohshima, A. D. Greentree, B. C. Gibson, T. M. Monro, H. Ebendorff-Heidepriem, *Nanodiamond in tellurite glass Part II: practical nanodiamond-doped fibers*, *Optical Materials Express* 5, 73 (2015).
- Y. Ruan, B. C. Gibson, D. W. M. Lau, A. D. Greentree, H. Ji, H. Ebendorff-Heidepriem, B. C. Johnson, T. Ohshima and T. M. Monro, *Atom–Photon Coupling from Nitrogen-vacancy Centres Embedded in Tellurite Microspheres*, *Scientific Reports* 5, 11486 (2015)
- Y. L. Ruan, D. A. Simpson, J. Jeske, H. Ebendorff-Heidepriem, D. W. M. Lau, H. Ji, B. C. Johnson, T. Ohshima, S. Afshar V., L. Hollenberg, A. D. Greentree, T. M. Monro, B. C. Gibson, *Remote Nanodiamond Magnetometry*, arXiv:1602.06611

The speaker



Andy Greentree is an Australian Research Council Future Fellow, Professor of Quantum Physics at RMIT University, and Chief Investigator in the Australian Research Council Centre of Excellence for Nanoscale BioPhotonics. He is a theorist whose interests range widely, including Quantum Optics, Quantum Information, Diamond, Photoacoustics, imaging, and bees. Andy was a QEII Fellow at the University of Melbourne, and has postdoctoral experience at the University of Melbourne, University of New South Wales and the Open University. He completed his PhD under the supervision of Neil Manson at the Australian National University, and his undergraduate degrees at the University of Adelaide.