PURDUE INNOVATES | Office of Technology Commercialization

Hybrid Sensing of Electric Field with Quantum Spin Defects Coupled to Nanomagnets

Nanomagnet-coupled spin defects dramatically enhance electric field sensitivity for quantum devices.

Researchers at Purdue University have developed a new method for hybrid sensing of electric fields using quantum spin defects (QSD). Currently, electric sensing for small electric field sensitivity (about 1000 V cm^-1) are possible, but dynamic range remains uncertain. The new highly sensitive technique created by Purdue researchers can detect small changes in electric fields by optimizing coupling excitations in nanomagnets with QSD, including those of nitrogen-vacancy centers found in nanodiamonds offering measurable signals that orders of magnitude higher in resolution. This can be implemented in quantum spintronics devices, single spin probes of multiferroic order, and NV-sensing of electric fields.

Advantages:

-Enhanced Dynamic Range

-Improved Electric Field Sensing

-Highly Sensitive

Potential Applications:

-Quantum Spintronics

-Nitrogen-Vacancy Sensing of Electric Fields

-Single Spin Probes of Multiferroic Order

Technology Validation: The ferroelectric polarization changes nitrogen-vacancy spin relaxation rates by 400%, improving the patterning of the ferromagnetics by three orders of magnitude.

Technology ID

2021-SHAL-69281

Category

Computing/Quantum Technologies

Materials Science & Nanotechnology/Nanomaterials & Nanostructures

Materials Science & Nanotechnology/Composites & Hybrid Materials

Further information

Will Buchanan

wdbuchanan@prf.org

View online

Recent Publication:

"Quantum-Classical Spin Hybrids: Leveraging Spintronic Tools for Information Processing Applications"

SPIE Nanoscience + Engineering

â€‹DOI: 10.1117/12.2567795

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2020-11-30, United States

Utility-Gov. Funding, 2021-11-30, United States

CON-Gov. Funding, 2023-10-13, United States

Keywords: Advanced Sensing, Diamond, Electric Fields, Electrical Engineering, Electromagnetics, Magnetics, Materials and Manufacturing, Micro & Nanotechnologies, Nano-electronics, Nanocrystals, Nanoelectronics, Nanomaterial, Nanomaterials, Nanoscale, Nanotechnology, Nitrogen, quantum electronics, Sensing, spintronic devices, Spintronics