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## Precision measurement and spectroscopy with diamond NV centers

### ABSTRACT

Color centers in wide-bandgap semiconductors have emerged as a leading platform in the field of quantum sensing, broadly defined as the use of qubits to measure environmental parameters. In my lab at the University of New Mexico, we are using Nitrogen-Vacancy (NV) centers in diamond to image magnetic phenomena in condensed-matter and biological systems over a broad range of length scales. At the nanometer scale, we are building super-resolution magnetic microscopes to image magnetic nanoparticles with 50-100 nm resolution [1]. At the micrometer scale, we embed diamond sensors inside microfluidic chips to perform nuclear magnetic resonance spectroscopy at the scale of single cells [2]. At the millimeter scale, we are developing femtotesla-level magnetometers [3], with potential applications in medical imaging, navigation, and even dark matter detection. I will provide an introduction to the field, discuss recent results and ongoing challenges, and outline future directions.

### BIO

Victor Acosta is an Associate Professor in the Dept of Physics and Astronomy and a member of the Center for High Technology Materials at the University of New Mexico. In addition to his research efforts, he also directs the Quantum Undergraduate Research Experience at CHTM (QU-REACH) and the Quantum Photonics and Quantum Technology (QPAQT) graduate research training programs at UNM.

[1] N. Mosavian, F. Hubert, J. Smits, P. Kehayias, Y. Silani, B. A. Richards, V. M. Acosta, "Super-resolution diamond magnetic microscopy of superparamagnetic nanoparticles." ACS Nano 18, 8, 6523 (2024).

[2] J. Smits\*, J. Damron\*, P. Kehayias, A. F. McDowell, N. Mosavian, N. Ristoff, I. Fescenko. A. Laraoui, A. Jarmola, V. M. Acosta, "Two-dimensional nuclear magnetic resonance spectroscopy with a microfluidic diamond quantum sensor." Science Advances 5 eaaw7895 (2019).

[3] Y. Silani, J. Smits, I. Fescenko, M. W. Malone, A. F. McDowell, A. Jarmola, P. Kehayias, B. A. Richards, N. Mosavian, N. Ristoff, V. M. Acosta, "Nuclear quadrupole resonance spectroscopy with a femtotesla diamond magnetometer." Science Advances 9 : eadh3189 (2023).