Dr. Kapildeb Ambal

Contact information.

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Education

- **Ph.D., Physics – University of Utah,** Nov, 2015 Salt Lake City, UT, USA.
  Advisor: Dr. Christoph Boehme and Dr. Clayton C. Williams
  Dissertation: *Imaging and spectroscopy of individual paramagnetic electronic states.*
- **M.S., Physics – University of Utah,** Salt Lake City, UT, USA.
  Advisor: Dr. Christoph Boehme.
- **M.Sc., Physics – Indian Institute of Technology Madras,** 2006, Chennai, India.
  Advisor: Dr. V.R.K Murty.
  Thesis: *Measurement of dielectric constant of different organic liquid and liquid blend in microwave frequency using network analyzer (S-parameter).*
- **B.Sc., Physics (Honors) – University of Calcutta,** 2004, Kolkata, India.

Research Interest

My research interest focuses on measurements of charge and spin dynamics using spin resonance at nanoscale. The broader goal is to measure mesoscale interactions such as spin-orbit interaction, and nuclear hyperfine interaction that control charge and spin transport in many condensed matter systems. The comprehensive information about these mescoscale physical interactions will lead to build efficient light emitting diodes (LEDs), to harvest more electricity from solar energy, and to build an emerging class of storage devices.

Expertise

- Electron Spin Resonance
  - Electron parmagnetic resonance.
  - Electrically detected magnetic resonance (EDMR).
  - Optically detected magnetic resonance (ODMR).
  - Magnetic resonance using coplanar micro–resonator.
- Scanning Probe Microscopy
  - Non-contact-AFM, STM, c-AFM
  - Single Electron Tunneling Microscopy and Spectroscopy.

Employments

- Postdoctoral Research Associate, Center for Nanoscale Science and Technology, NIST, Gaithersburg, Maryland, US; Nov, 2016 – present
  Advisor: Dr. Robert McMichael.
  - Magnetization dynamics of nanomagnets using custom built AFM.
  - Nano-magnetometry using nitrogen vacancy centers in diamond.
  - Co-mentoring summer undergraduate student.
- Postdoctoral Research Associate, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah, US; Nov, 2015 – Nov, 2016.
  Advisor: Dr. Clayton C. Williams.
  - Electrically detected single spin resonance.
  - Barrier height spectroscopy of individual defect states.
  - Trained and supported undergraduate and graduate students.
- Research Assistant, Ph.D Student, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah, US; Aug, 2010 – Nov, 2015.
  - Imaging and spectroscopy of individual paramagnetic states.
  - Development of a spin-selection rule based single–spin resonance microscopy.
  - Investigation of the spin relaxation dynamics of thin silicon dioxide layer with high E′ center densities.
  - Robust absolute magnetometry using electrically detected magnetic resonance(EDMR).
  - Spin counting in the fatty acid of inner core of blood vessel and the fatty acid in the heart tissue for diabetes-2 disease using cw-EPR.
- Teaching Assistant Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah, US; Aug, 2008 – Aug, 2010.

  Served as a teaching assistant for following classes.
  - Fall, 2008 : PHYS 2015, PHYS 2225.
  - Spring, 2009 : PHYS 2025, PHYS 2225.
  - Summer, 2009 : PHYS 3719.
  - Fall, 2009 : PHYS 2215.
- Software Engineer, Infosys Technologies Ltd.(www.infosys.com), India, Jun, 2006 – Aug, 2008.
  - Computer programming.
  - Technical support and client management.
  - Team building and training.

Professional services

- DLA (Division Level Approval) division reader/reviewer at NIST.
- Secondary division judge at Salt Lake Valley Science & Engineering Fair, 2012 & 2014.

Awards and Honors

- J. Irvin and Norma K. Swigart Graduate Student Scholarship, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah, US, 2012.
- Merit scholarship, Indian Institute of Technology Madras (IITM), India, 2004 – 2006.

Publications

[9] **K. Ambal**, and R. D. McMichael. Real-time data processing and frequnecy locking for magnetometry using NV center in diamond. *arXiv:1808.05580*.

[8] **K. Ambal** Imaging and spectroscopy of individual paramagnetic electronic states on the atomic scale (Ph.D. Thesis). *The University of Utah*, (2016)

[7] **K. Ambal**, C. C. Williams, and C. Boehme. In situ absolute magnetometry in an UHV scanning probe microscope using conducting polymer-thin film. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films* **35**, 021602 (2017).

[6] G. Joshi, R. Miller III, L. Ogden, S. Jamali, M. Kavand, **K. Ambal**, H. Malissa, J.M. Lupton, and C. Boehme. Separating hyperfine from spin-orbit interactions in organic semiconductors by multi-octave magnetic resonance using coplanar waveguide microresonators. *Appl. Phys. Lett.* **109**, 103303 (2016).

[5] **K. Ambal**, P. Rahe, A. Payne, J. Slinkman, C. C. Williams, and C. Boehme. Electrical coupling to individual pairs of phosphorous donor atoms and silicon dangling bonds. *Sci. Rep.* **6**, 18531 (2016).

[4] **K. Ambal**, A. Payne, D. P. Waters, C. C. Williams, and C. Boehme. Spin-relaxation dynamics of $E^{'}$ centers at high density in sio_2 thin films for single-spin tunneling force microscopy. *Phys. Rev. Applied* **4**, 024008 (2015).

[3] A Payne, **K. Ambal**, C Boehme, and C. C. Williams. An atomic resolution, single-spin magnetic resonance detection concept based on tunneling force microscopy. *Phys. Rev. B* **91**, 195433 (2015).

[2] W.J. Baker, **K. Ambal**, D. P. Waters, R. Baarda, H. Morishita, K. van Schooten, D.R. McCamey, J. M. Lupton, and C. Boehme. Robust absolute magnetometry with organic thin-film devices. *Nat. Commun.* **3**, 898 (2012).

[1] Quan-Jiang Zhang, William L. Holland, Lloyd Wilson, Jason M. Tanner, Devin Kearns, Judd M Cahoon, Dix Pettey, Jason Losee, Bradlee Duncan, Derrick Gale, Christopher A. Kowalski, Nicholas Deeter, Alexandrea Nichols, Michole Deesing, Colton Arrant, Christoph Boehme, Dane R. McCamey, **Kapil Ambal**, Janvida Rou, Krishna K. Narra, Scott A. Summers, E. Dale Abel, J. David Symons. Ceramide mediates vascular dysfunction in diet-induced obesity by pp2a-mediated dephosphorylation of the enos-akt complex. *Diabetes* **61**, 1848 (2012).

Oral presentations

[10] **K. Ambal** et al., *Locking and tracking magnetic reonance spectra of NV- center for real-time magnetometry* at Rocky Mountain Conference on magnetic resonance 2018.

[9] R.D. McMichael, **K. Ambal** and J. Liu, *Measuring thermal field noise from magnetic nanostructure using NV centers in diamond* at Magnetism and Magnetic Materials, 2017.

[8] Lars Tatum, **Kapildeb Ambal** and Robert McMichael, *Towards a Scanned Probe Diamond NV Center Nanoscale Magnetometer* at NIST SURF Student Colloquium, 2017.

[7] R. D. McMichael and **K. Ambal**, *Opportunities in magnetic metrology using nitrogen-vacancy defects in diamond* at Frontiers of Metrology Techniques for Magnetic Nanodevices Workshop, Oregon State University, Corvallis, OR, 2017.

[6] **K. Ambal** et al., *Electrical detection and imaging of individual phosphorus and silicon-dangling bonds states at the crystalline silicon to silicon dioxide interface* at APS March Meeting 2016.

[5] **K. Ambal** et al., *Imaging and Spectroscopy of Individual Paramagnetic Electronic States on the Atomic Scale*, Condensed Matter Seminar, Department of Physics and Astronomy, University of Utah, UT, November 17, 2015.

[4] **K. Ambal** et al., *Development of a Spin-Selection Rule based Single-Electron Spin Resonance Microscope* at Rocky Mountain Conference on magnetic resonance 2015.

[3] **K. Ambal** et al., *Ångstrom resolved imaging of charge percolation through the interface between phosphorous doped SiO_2/c-Si* at APS March Meeting 2014.

[2] **K. Ambal** et al., *Synthesis and Physical Characterization of Thin a-SiO2 Layer with High Density E' Centers* at APS March Meeting 2013.

[1] C. C. Williams, A. Payne, **K. Ambal**, C. Boehme *Towards force detected single electron spin resonance at room temperature* at APS March Meeting 2013.

Poster presentations

[5] K. Ambal et al., *Magnetic microscopy and spectroscopy using nitrogen vacancy center in diamond* at Gordon Research Conferences on Defects in Semiconductor, 2018.

[4] Bob McMichael, Jason Liu and Kapildeb Ambal, *A new NIST facility for nanoscale magnetic field and temperature measurements* at Workshop on Imaging for Precision Medicine, NIST, 2017.

[3] K. Ambal et al., *Imaging and Spectroscopy of Individual Paramagnetic Electronic States on the Atomic Scale* at National Institute of Standard Technology, Sigma-Xi poster presentation, 2017.

[2] K. Ambal et al., *Imaging and Spectroscopy of Individual Paramagnetic Electronic States on the Atomic Scale* at Gordon Research Conferences on Defects in Semiconductor, 2016.

[1] K. Ambal et al., *Synthesis and physical characterization of thin silicon dioxide films with very high densities of E centers* - poster presentation at Rocky Mountain Conference on magnetic resonance, 2012.

Letter of references

The letter of reference will be provided by following writers upon request.

[1] Dr. Christoph Boehme
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[2] Dr. Clayton C. William
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[3] Dr. Robert McMichael
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