

Dr. Ram Shanker Patel

Associate Professor, Department of Physics,
Birla Institute of Technology and Science Pilani - K K Birla Goa Campus,
Zuarinagar – 403726, GOA.
Phone: + 91 832 2580 294.
Email: rsp@goa.bits-pilani.ac.in, ramspatel@gmail.com

EDUCATION / PROFESSIONAL EXPERIENCE

- Ph. D. in Physics (1998 – 2005) Department of Physics, Indian Institute of Technology Kanpur, India.
Thesis: Transport and magnetic properties of ion beam sputtered Fe-Cr GMR multilayers.
Supervisor: Prof. A. K. Majumdar
- 2006 – 2007, Post-doctoral fellow at Max-Planck Institute of Microstructure Physics, Halle, Germany.
Project: (e, 2e) correlation electron spectroscopy
Supervisor: Prof. J. Kirschner
- 2007 – 2009, Post-doctoral Scientist at Nanoelectronics group, *MESA*⁺ Institute of Nanotechnology, University of Twente, the Netherlands.
Project: Ferromagnet-semiconductor hetero-structures for spin injection
Supervisor: Prof. R. Jansen
- 2009 - 2018, Assistant Professor, Birla Institute of Technology and Science Pilani - K K Birla Goa Campus.
- 2018 - present, Associate Professor, Birla Institute of Technology and Science Pilani - K K Birla Goa Campus.

RESEARCH INTERESTS

- Electrical and thermal transport studies in Transition Metal Dichalcogenides.
- Spin injection and manipulation studies of ferromagnet-semiconductor heterostructures.
- Magnetic properties of low-dimensional materials.
- Magnetic thin films and multilayers: preparation and characterization by transport and magnetization studies.

EXPERIMENTAL SKILLS

- Thin films deposition – MBE, Sputtering.
- Nanofabrication- Clean room experience, Lithography, Ion beam and chemical patterning, Oxidation.
- Electrical measurements- Magneto-transport measurements
- Magnetic measurements- SQUID, VSM
- Computer interfacing: Laboratory automation of various measuring instruments using serial (RS-232) and parallel (GPIB-IEEE) standards with LabVIEW program.
- Software knowledge- Maple, Origin, FORTRAN, Pascal

TEACHING EXPERIENCE

Taught several multidisciplinary and physics courses at undergraduate level (B. E. / M. Sc. students). Promoted class-room demonstration experiments for the courses.

Multidisciplinary courses:

- Mechanics, oscillations and waves
(Textbook: An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow)
- Electronic devices
(Textbook: Solid State Electronic Devices by Ben J. Streetman)
- Thermodynamics
(Textbook: Fundamentals of Thermodynamics by Claus Borgnakke and Richard E. Sonntag)
- Electromagnetic theory
(Foundations of Electromagnetic Theory by John R. Reitz, Frederick J. Milford, and Robert W. Christy)
- Mechanics, oscillations and waves Lab

Physics department courses:

- Solid State Physics
(Textbook: Introduction to Solid State Physics by Charles Kittel)
- Physics of Semiconductor Devices
(Textbook: Physics of Semiconductor Devices by J.-P. Colinge and C.A. Colinge)
- Atomic and molecular physics
(Textbook: Physics of Atoms and Molecules by B.H. Bransden, and C. J. Joachain)
- Electricity and Magnetism Lab
- Modern Physics Lab
- Advanced Physics Lab

RESEARCH PROJECTS

Executed/Executing following research projects; Promoted in-house developed experimental set-ups as they bridge teaching and research:

- Spin Seebeck Effect in novel heterostructures
Principal Investigator: Dr. Ram Shanker Patel
Co-investigator: Dr. Pratap Kumar Sahoo and Dr. Kartik Senapati (NISER Bhubaneswar)
Funding Agency: Department of Science and Technology, Govt. of India, under Science and Engineering Research Board programs
Funding amount: Rs 51 Lakh
Project Duration: 2017 - 2020 (36 months)
- Magneto-transport in magnetic tunnel junctions.
Principal Investigator: Dr. Ram Shanker Patel
Co-investigator: None

Funding Agency: Department of Science and Technology, Govt. of India, under Nanomission program

Funding amount: Rs 52.65 Lakh

Project Duration: 2012 - 2016 (48 months)

- Development of low temperature magnetization measurements set-up.
Principal Investigator: Dr. Ram Shanker Patel
Co-investigator: Dr. Teny John, Dr. Halan Prakash
Funding Agency: Council of Scientific and Industrial Research. Govt. of India.
Funding amount: Rs 13.85 Lakh
Project Duration: 2012 - 2014 (24 months)

Ph D Thesis Guided

- Dr. Dhavala Suri (2018), Postdoctoral scientist at Massachusetts Institute of Technology.

INSTITUTIONAL RESPONSIBILITIES

- Faculty in-charge, Central Sophisticated Instrumentation Facility (July 2018 -).
- Member, Departmental Research Committee (Nov 2017 - Oct 2019).
- Member, Departmental Committee on Academics (Nov 2016 - Sept 2018).
- Organizer, Workshop on effective teaching and learning, July 18-20, 2015, BITS Pilani - K K Birla Goa Campus, Goa.
- Member, Quality Assurance & Assessment imperative team (April 2014 - Nov 2015, under university's Mission 2015 | Vision 2020 project).
- Member, University Research Board (Aug 2013 - Dec 2015).
- Member, Departmental Research Committee (May 2011 - July 2013).

INFRASTRUCTURE DEVELOPMENT

- Coordinator for setting-up and manual preparation for Physics Laboratory I (Re-designed compulsory lab course for all 1st year students; Later became the 1st Instructor-in-charge of the course in 2nd Semester 2011-12).
- Coordinator for setting-up and manual preparation for Advanced Physics Laboratory (Compulsory lab course for M. Sc. (Physics) 3rd year students; later became 1st Instructor-in-charge of the course in 2nd Semester 2013-14).
- Coordinator for establishing a Central Liquid Nitrogen Facility (Plant is operational since Nov. 2013).

PUBLICATIONS

1. A study of electron and thermal transport in layered Titanium Disulphide single crystals
Dhavala Suri, S. Vantari, S. Joshi, K. Senapati, P. K. Sahoo, S. Varma and R. S. Patel
Journal of Physics: Condensed Matter **29**, 485708 (2017).
2. Electron and thermal transport transport via variable range hopping in MoSe₂ single crystals
Dhavala Suri and R. S. Patel
Appl. Phys. Lett. **110**, 233108 (2017).
3. Spin polarized tunneling through chemical vapor deposited multilayer Molybdenum disulfide
Andre Dankert, M. Venkata Kamalakar, R. S. Patel, S. P. Dash et al
ACS Nano **11**, 6389 (2017).
4. Tunnel magnetoresistance with atomically thin two- dimensional hexagonal boron nitride barriers
Andre Dankert, M. Venkata Kamalakar, Abdul Wajid, **R. S. Patel**, and Saroj P. Dash.
Nanoresearch (Springer) **8**, 1357 (2015).
5. Temperature dependence of the giant magnetoresistance in Fe–Cr multilayers - Intralayer and interlayer exchange energies.
R. S. Patel and A. K. Majumdar.
J. Magn. Magn. Mater. **323**, 646 (2011).
6. Electrical creation of spin polarization in silicon at room temperature.
Saroj P. Dash, Sandeep Sharma, **Ram S. Patel**, Michel P. de Jong, and Ron Jansen.
Nature **462**, 491 (2009).
7. Magnetic tunnel contacts to silicon with low-work-function ytterbium nanolayers.
R. S. Patel, S. P. Dash, M. P. de Jong, and R. Jansen.
J. Appl. Phys. **106**, 016107 (2009).
8. Electron pair emission from a W (001) surface: photon versus electron excitation.
M. Muñoz-Navia, C. Winkler, **R. S. Patel**, M. Birke, F. O. Schumann, and J. Kirschner.
J. Phys.: Condens. Matter **21**, 355003 (2009).
9. Relaxation of thermo-remanent magnetization in Fe-Cr GMR multilayers.
R. S. Patel, A. K. Majumdar, and A. K. Nigam.
J. Magn. Magn. Mater. **309**, 256 (2007).
10. Role of heterostructure and multiple magnetic phases in the low-field magnetization of Fe-Cr GMR multilayers.
R. S. Patel, A. K. Majumdar, A. K. Nigam, D. Temple, and C. Pace.
J. Appl. Phys. **100**, 123914 (2006).
11. Swift heavy ion induced mixing in Fe/Ni multilayer.
S. K. Srivastava, R. Kumar, A. Gupta, **R. S. Patel**, A. K. Majumdar, and D. K. Avasthi.
Nucl. Instrum. Methods Phys. Res., Sect. B **243**, 304 (2006).
12. Evidence of spin-wave demagnetization in Fe-Cr GMR multilayers.
R. S. Patel, A. K. Majumdar, A. F. Hebard, and D. Temple.
J. Appl. Phys. **97**, 033910 (2005).

13. Magnetic scattering in Fe-Cr multilayers in the ferromagnetic state at low temperatures.
R. S. Patel, A. K. Majumdar, A. F. Hebard, and D. Temple.
J. Appl. Phys. **93**, 7684 (2003).
14. Thermoremanent magnetization in Mn-rich $\text{Cu}_{100-x}\text{Mn}_x$ ($x=73, 76, \text{ and } 83$) binary alloys
R. S. Patel, D. Kumar, and A. K. Majumdar.
Phys. Rev. B **66**, 054408 (2002).

CONFERENCE / WORKSHOP CONTRIBUTIONS:

1. Electron and thermal transport studies in large MoSe_2 single crystals
Dhavala Suri and R. S. Patel
SpinTECH IX International School and Conference, June 4-8, Fukuoka, Japan.
2. Thermal hysteresis in Seebeck coefficient of MoTe_2 crystals.
Dhavala Suri, S. P. Dash, and R. S. Patel.
5th International Chalcogen Conference, 19-21 December 2016, Goa.
3. Electron-electron scattering dominance in MoTe_2 crystals at low temperatures.
Dhavala Suri, S. P. Dash, and R. S. Patel.
61st Annual conference on Magnetism and Magnetic Materials, New Orleans, Louisiana, October 31 - November 4, 2016.
4. [**Invited Speaker**] Tunneling Magnetoresistance with Thin Hexagonal Boron Nitride Barriers.
A cluster of topical meetings on Current Trends in Condensed Matter Physics, National Institute of Science Education and Research (NISER), Bhubaneswar. February 19 – 22, 2015
5. Spin Hall Effect measurement techniques.
Dhavala Suri, and **R. S. Patel**
ICTP Workshop on Current Trends in Frustrated Magnetism, Jawaharlal Nehru University, New Delhi, India. February 9 – 13, 2015.
6. Spin-transport in Silicon using multi-terminal lateral devices.
S. P. Dash, **R. S. Patel**, M. P. de Jong, and R. Jansen.
5th International School and Conference on Spintronics and Quantum Information Technology, Kraków (Cracow), Poland. July 7 – 11, 2009.
7. Spin-tunnel contacts to silicon using low-work-function CoGd alloys.
R. S. Patel, S. P. Dash, M. P. de Jong, R. Jansen.
Institute of Electrical and Electronics Engineers (IEEE) international magnetic conference, Sacramento, California, USA, May 4 - 8, 2009.
8. Electric field control of spins in a silicon two-dimensional electron gas.
R. Jansen, B.-C. Min, S. P. Dash, **R. S. Patel**, and M. P. de Jong. 2009
American Physical Society (APS) March Meeting (Focus Session on Spins in Group IV semiconductors), Pittsburgh, Pennsylvania, USA, March 16 - 20, 2009.
9. Engineering spin-tunnel junctions to Si using interfacial Yb nanolayers.
R. S. Patel, S. P. Dash, M. P. de Jong, R. Jansen.
NanoNed NanoSpintronics Workshop, Eindhoven, the Netherlands, June 26 - 27, 2008.

10. Tunnel spin-polarization of low-work-function ferromagnets.
R. S. Patel, B.-C. Min, S. P. Dash, M. P. de Jong, R. Jansen.
Institute of Electrical and Electronics Engineers (IEEE) international magnetic conference, Madrid, Spain, May 4 - 8, 2008.
11. Tunnel magnetoresistance of spin tunnel contacts to silicon.
R. Jansen, B.-C. Min, **R. S. Patel**, S. P. Dash, and M. P. de Jong.
American Physical Society (APS) March Meeting (Focus Session on Spin Injection in Si), New Orleans, Louisiana, USA, March 10 - 14, 2008.
12. Probing correlated electron-pair emission from a W(001) surface.
M. Muñoz-Navia, C. Winkler, M. Birke, **R. S. Patel**, F. O. Schumann, and J. Kirschner.
72th Annual Meeting of the Deutsche Physikalische Gesellschaft (DPG) and DPG Spring Meeting of the Condensed Matter Division, Berlin, Germany, February 25 - 29, 2008.
13. Low-field magnetization in Fe-Cr GMR multilayers.
R. S. Patel and A. K. Majumdar.
Condensed Matter Physics (CMP) Workshop, Department of Physics, IIT Kanpur, February 04 - 06, 2005.
14. Magnetic scattering in Fe-Cr multilayers in the ferromagnetic state at low temperatures.
R. S. Patel, A. K. Majumdar, A. F. Hebard, and D. Temple.
47th Annual Conference on Magnetism and Magnetic Materials at Tampa, Florida, USA, November 11 - 15, 2002.