

Prof. Bhagwati Prasad

Materials Engineering Department
Indian Institute of Science, Bangalore, KA, 560012

Email: bpjoshi@iisc.ac.in

Research and Teaching Experience: 15+ Years [6+ years of Industrial R&D experience (US and India) & 9+ years of Academic research/teaching experience (India, UK, Germany, and US)]

Research interests:

- Electronic, Magnetic, Energy, 2D and Quantum Materials
- Thin-film deposition, and Functional coating
- Spintronics, Iontronics, Ferroelectrics and Magnetoelectrics
- Nanoelectronic, AI and IoT Hardware devices, Neuromorphic and Quantum computing
- Non-volatile memory and Storage
- 3D sensors for Virtual and Augmented realities
- On-chip Energy storage and Battery devices
- Materials for 6G-7G wireless technology

Technology developed:

- Nonvolatile memory devices (MRAM, FeFET, RRAM, and FTJ devices) for AI and IoT (WD, USA) (**TRL 3/5**)
- Ultralow power emerging magnetoelectric memory devices (University of California, Berkeley) (**TRL-3/4**)
- Brain-inspired patterned liquid-based computing chips (MPI, Germany) (**TRL-2/3**)
- Highly efficient magnetic memory devices for advanced computation (University of Cambridge, UK) (**TRL-3/4**)
- Building-integrated photovoltaic solar cell (Tata Steel, India) (**TRL-3/4**)
- Low-cost arsenic removal water filter system (Tata Steel, India) (**TRL-7/8**)

Research Group: *Disruptive Electronic Materials And Nanoelectronic Devices (DEMAND) Group, IISc, India*

- **Team (13):** Postdoc: 2; RA: 1; Ph.D. student: 5; Masters: 2; Undergraduate: 1; Intern: 2
- **Funding secured so far:** ~ \$650 k (5.35 CR)
- **Experimental facilities in the lab:** Pulsed Laser Deposition, Ultra-high Vacuum DC and RF Sputtering cluster tool; Cryogenic based Magnetic and transport with 7T magnetic field; Probe Station with Hall Measurement set-up
- **Central experimental facilities in the institute:** Clean room with cutting-edge device fabrication and measurement facility; HR-TEM, XRD, VSM, ALD, Sputtering units; RIE-etcher, Dry etching tool, etc.

EDUCATION

<u>2011-2015</u>	Ph.D. (Materials Science and Metallurgy) University of Cambridge, UK
<u>2006-2008</u>	M.Tech. (Materials Science), Departmental Rank-1 (1st in Class) Indian Institute of Technology Kanpur, India
<u>2002-2004</u>	M.Sc. (Physics), Gold Medalist (1st in University) H. N. B. Garhwal University, India

WORK EXPERIENCE

<u>2021 -Present</u>	Assistant Professor; Materials Engineering department, Indian Institute of Science, Bangalore, KA, India
<u>2018 – 2021</u>	Principal Research Scientist; Non-volatile Memory Research Group, Western Digital (erstwhile IBM Research), San Jose, CA, USA Thrust research area leader: Ferroelectric memories Research area: <i>Non-volatile memories for AI and IoT devices</i>
<u>2016 – 2018</u>	Senior Postdoctoral Researcher; University of California Berkeley, USA Research area: <i>Magnetoelectric spin-orbit logic and memory devices</i>
<u>2015 – 2016</u>	Scientist; Max Planck Institute for Solid State Research, Stuttgart, Germany Research area: <i>Oxide electronics, Electrolyte-gated field effect transistors</i>
<u>2008- 2011</u>	Scientist (Sr. Manager); R&D Division, Tata Steel Limited, Jamshedpur, India Research area: <i>Photovoltaic coating and water purification</i>

TEACHING EXPERIENCE

2022

MTE 211: Magnetism, magnetic materials, and devices: August – December 2022; Materials Engineering Department, Indian Institute of Science, Bengaluru (Developed a new course in the Institute)

2019-2021

Tutorial on Ferroelectric Memory Technology at Western Digital, USA

2011-2015

X-Ray Diffraction (XRD) and crystallography: M.Phil (Nanotechnology), University of Cambridge

Instructor: Focused Ion Beam (FIB), Device Fabrication (Photolithography, Ion milling), Low-Temperature Transport and Magnetic Measurement (Cryo-freedom system), and Pulsed Laser Deposition (PLD)

2007-2008

Teaching Assistant (TA): Indian Institute of Technology Kanpur, India

Introduction to Nanomaterial and Nanotechnology- Helped the course instructor in conducting and evaluating the examination papers.

SCIENTIFIC CONTRIBUTIONS

- **Publications (33) (Published and Communicated):** Research papers published in reputed refereed journals (*Nature-3, Nature Materials, Advanced Materials-4, Nano Letters-2, Nature Communications-3, Science Advances-2, Applied Physics Letters-2*, etc.)
- **Patents (Granted and Filed) – 40+:** 36+ US Patents and 4 Indian Patent
- **Number of citations:** 1700+; h-index - 17
- **Editorial Services:**
 - Principal Editor - MRS Advances
 - Member of Editorial Board - Nature Scientific Reports,
 - Guest Editor-APL Materials (Topic: Materials Challenges for Nonvolatile Memory),
 - Guest Editor-Electronics (Topic: Recent Advanced Applications of Magnetic materials and Quantum Material)
- **Conferences and Presentations:**
 - Research data presentations at 29 international conferences – **Invited** (13), Oral (12) and Posters (4) Presentations
 - 20+ Invited and organization level talks – at *Western Digital, San Jose (Invited); IBM Research – Almaden (Invited-Colloquium); MIT, US (Invited); Lawrence Berkeley National Lab, US (Invited); Max Planck Institute, Stuttgart, Germany (Invited); University of Cambridge, UK; University of California, Berkeley; Tata Steel, IIT Delhi and IIT Kanpur*
- **Article Reviewed:** 35+ (*Nature publishing group journals, Wiley journals, American Institute of Physics journals, Elsevier journals, Taylor and Francis Ltd. Journals, and MDPI journals*)
- **Memberships:** Indian Institute of Metal (Lifetime), IEEE, IEEE magnetics society, Materials Research Society (MRS), American Ceramic Society (ACS), St John's College, University of Cambridge (Lifetime), Indian Physics Association (Lifetime), Cambridge Philosophical Society (1012-2015) and Institute of Physics (2012-2016).
- **Scientific Community Services (Conference/Seminar):**
 - Symposium Organizer: Materials Research Society – Fall Meeting, International Conference, **Nov 26 – December 1, 2023, Boston, MA, USA**
 - Symposium Organizer and Session chair: Platinum Jubilee Conference on, “Perspectives in Materials Research”, **21-23 December 2022, IISc Bengaluru**
 - Symposium Organizer and session chair: Materials Research Society – Fall Meeting, International Conference, **Nov 27 – December 2, 2022, Boston, MA, USA**
 - Vice Chair Programme at IEEE-Magnetic Society; Santa Clara Valley Section: Jan 2021- Jan 2022 **Organized several talks and seminars.**
 - Member of the organizing committee of an international conference on Interstitial Free Steel - Manufacturing and Application (**IFSTEEL 2010**) at Jamshedpur, India (2010)
- **Mentorship and co-supervision:** - 3 Postdocs (*IISc Bengaluru, and Western Digital*); 6 PhDs (*IISc Bangalore, Western Digital, U C Berkeley and MPI*), 4 Masters (*IISc Bangalore, U C Berkeley and Tata Steel*) and 5 Undergraduates (*U C Berkeley and Cambridge University*)

AWARDS

- 2011-2014** ❖ **Nehru Trust for Cambridge University Fellowship:** Funding for graduate studies
- ❖ **St John's College, Cambridge University:** Bursary for graduate studies
- 2007-2008** ❖ **Academic Excellence Award:** M.Tech. programme at Indian Institute of Technology Kanpur, India
- 2006-2008** ❖ **Ministry of Human Resource Development (MHRD) Fellowship:** Graduate Aptitude Test in Engineering (GATE) [Physics]; All India Rank-61
- ❖ **National Eligibility Test (NET) - Junior Research Fellowship (JRF)**

LEADERSHIP AND MANAGEMENT EXPERIENCE

- ❖ **Group Leader and PI, Disruptive Electronic Materials And Nanoelectronic Devices (DEMAND) Group,** Materials Engineering department, IISc, India (2021-present)
- ❖ **Thrust research area (Ferroelectric Memories) Leader** (2018-2020)
- ❖ Member of a **technology roadmap team** at Western Digital (2018-2020)
- ❖ **Tool manager** of thin film deposition facility at Western Digital R&D, San Jose, CA USA (2018-2020)
- ❖ **Managed several laboratory facilities**, e.g., pulsed laser deposition, focused ion beam nanomachining, He Liquefier, magnetic measurement (SQUID), cryo-freedom (magnetic & transport) set-ups, photolithography and clean room facilities, over last seven years at several places (2011-2018)
- ❖ Coordinated with several colleagues to successfully conduct **Cambridge Science Festival** in Materials Science Department at University of Cambridge, UK (2012)
- ❖ **Developed an Advanced Nanomaterials Laboratory** equipped with several thin film deposition and characterization facility at R&D division, Tata Steel, India (2009-2011)
- ❖ Member of Human Assets Development (HADC), Infrastructure Development Committees, and Worldwide Tata Steel's R&D Innovation Team at the R&D Division, Tata Steel, India (2009-2011)
- ❖ Led a subgroup of 10 people to scale the Dharwa Peak (13,500 ft) in an expedition organized by the Tata Steel Adventure Foundation, India (2009)
- ❖ **Departmental Placement Coordinator** in the Career Services and **Athletics Coordinator** in a sport festival, Sangharsh at IIT Kanpur India (2007-2008)

PUBLICATIONS AND PATENTS

Selected Publication

31. **Bhagwati Prasad**, Stuart Parkin, Themis Prodromakis, Chang-Beom Eom, Jordi Sort, JL MacManus-Driscoll, "Material Challenges for Nonvolatile Memory", **APL Mater.** 10, 090401 (2022).
30. Julia A. Mundy, Colin A. Heikes, Bastien F. Grosso, Dan Ferenc Segedin, Zhe Wang, Berit H. Goodge, Quintin N. Meier, Christopher T. Nelson, **Bhagwati Prasad**, Lena F. Kourkoutis, William D. Ratcliff, Nicola A. Spaldin, Ramamoorthy Ramesh, Darrell G. Schlom, "Liberating a hidden antiferroelectric phase with interfacial electrostatic engineering", **Science Advances**, **8**, eabg5860 (2022).
29. Diogo C Vaz, Chia-Ching Lin, John Plombon, Won Young Choi, Inge Groen, Isabel Arango, Dmitri E Nikonov, Hai Li, Punyashloka Debashis, Scott B Clendenning, Tanay A Gosavi, Vincent Garcia, Stephane Fusil, Manuel Bibes, Yen-Lin Huang, **Bhagwati Prasad**, Ramamoorthy Ramesh, Fèlix Casanova, Ian A Young, "Functional Demonstration of a Fully Integrated Magneto-Electric Spin-Orbit Device", **IEEE International Electron Devices Meeting (IEDM)** (2022).
28. **Bhagwati Prasad***, Vishal Thakare, Alan Kalitsov, Zimeng Zhang, Bruce Terris and Ramamoorthy Ramesh, "Large tunnel electroresistance with ultrathin $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ ferroelectric tunnel barriers", **Advanced Electrotonic Materials** **7**, 2001074 (2021).
27. P. B. Meisenheimer, R. A. Steinhart, S. H. Sung, L. D. Williams, S. Zhuang, M. E. Nowakowski, S. Novakov, M. M. Torunbalci, **B. Prasad**, C. J. Zollner, Z. Wang, N. M. Dawley, J. Schubert, A. H. Hunter, S. Manipatruni, D. E. Nikonov, I. A. Young, L. Q. Chen, J. Bokor, S. A. Bhavé, R. Ramesh, J.-M. Hu, E. Kioupakis, R. Hovden, D. G. Schlom, J. T. Heron "Engineering new limits to magnetostriction through metastability in iron-gallium alloys", **Nature Communication** **12**, 1 (2021).
26. Sujit Das, Zijian Hong, VA Stoica, MAP Gonçalves, Yu-Tsun Shao, Eric Parsonnet, Eric J Marks, Sahar Saremi, MR McCarter, A Reynoso, Christian J Long, Aaron M Hagerstrom, D Meyers, V Ravi, **B. Prasad**, H Zhou, Z Zhang, H Wen, F Gómez-Ortiz, P García-Fernández, J Bokor, Jorge Íñiguez, JW Freeland, Nathan D Orloff, J Junquera, Long-Qing Chen, Sayeef Salahuddin, David A Muller, LW Martin, R Ramesh, "Local negative permittivity and topological phase transition in polar skyrmions", **Nature Materials** **20**, 194 (2021).

25. **Bhagwati Prasad***, Yen-Lin Huang, Rajesh V Chopdekar, Zuhuang Chen, James Steffes, Sujit Das, Qian Li, Mengmeng Yang, Chia-Ching Lin, Tanay Gosavi, Dmitri E Nikonov, Zi Qiang Qiu, Lane W Martin, Bryan D Huey, Ian Young, Jorge Íñiguez, Sasikanth Manipatruni, Ramamoorthy Ramesh, “*Ultralow Voltage Manipulation of Ferromagnetism*”, **Advanced Materials** **32**, 2001943 (2020).
24. Yen-Lin Huang, Dmitri Nikonov, Christopher Addiego, Rajesh V Chopdekar, **Bhagwati Prasad**, Lei Zhang, Jyotirmoy Chatterjee, Heng-Jui Liu, Alan Farhan, Ying-Hao Chu, Mengmeng Yang, Maya Ramesh, Zi Qiang Qiu, Bryan D Huey, Chia-Ching Lin, Tanay Gosavi, Jorge Íñiguez, Jeffrey Bokor, Xiaoping Pan, Ian Young, Lane W Martin, Ramamoorthy Ramesh, “*Manipulating magnetoelectric energy landscape in multiferroics*”, **Nature Communication** **11**, 2836 (2020).
23. Petrucio Barrozo, Didrik René Småbråten, Yun-Long Tang, **Bhagwati Prasad**, Sahar Saremi, Rustem Ozgur, Vishal Thakare, Rachel A. Steinhardt, Megan E. Holtz, Vladimir Alexandru Stoica, Lane W. Martin, Darrel G. Schlom, Sverre Magnus Selbach, Ramamoorthy Ramesh, “*Defect-Enhanced Polarization Switching in the Improper Ferroelectric LuFeO_3* ”, **Advanced Materials** **32**, 2000508 (2020).
22. Humaira Taz*, **Bhagwati Prasad***, Yen-Lin Huang, Zuhuang Chen, Shang-Lin Hsu, Ruijuan Xu, Vishal Thakare, Tamil Selvan Sakthivel, Chenze Liu, Mark Hettick, Rupam Mukherjee, Sudipta Seal, Lane W Martin, Ali Javey, Gerd Duscher, Ramamoorthy Ramesh, Ramki Kalyanaraman, “*Integration of amorphous ferromagnetic oxides with multiferroic materials for room temperature magnetoelectric spintronics*”, **Nature Scientific Reports** **10** 3583 (2020). (*Equal contribution)
21. Chia-Ching Lin, Tanay Gosavi, Dmitri Nikonov, Yen-Lin Huang, **Bhagwati Prasad**, WonYoung Choi, Inge Groen, Jun-Yang Chen, DC Mahendra, Huichu Liu, Kaan Oguz, Emily S Walker, John Plombon, Benjamin Buford, Carl H Naylor, Jian-Ping Wang, Felix Casanova, Ramamoorthy Ramesh, Ian A Young, “*Experimental demonstration of integrated magneto-electric and spin-orbit building blocks implementing energy-efficient logic*”, **2019 IEEE International Electron Devices Meeting (IEDM)** (2020).
20. Sasikanth Manipatruni, Dmitri E. Nikonov, Chia-Ching Lin, Tanay Gosavi, Huichu Li, **Bhagwati Prasad**, Yen Lin Huang, Ramamoorthy Ramesh, Ian A. Young, “*Scalable Energy-Efficient Magnetoelectric Spin-Orbit Charge Logic*”, **Nature** **565**, 35 (2019).
19. Ajay K. Yadav, Kayla X. Nguyen, Zijian Hong, Pablo García-Fernández, Pablo Aguado-Puente, Christopher T. Nelson, Sujit Das, **Bhagwati Prasad**, Daewoong Kwon, Suraj Cheema, Asif Khan, Jorge Íñiguez, Javier Junquera, Long-Qing Chen, David A. Muller, Ramamoorthy Ramesh, Sayeef Salahuddin, “*Spatially Resolved Steady State Negative Capacitance*”, **Nature** **565**, 468 (2019).
18. S. Das, Y. L. Tang, Z. Hong, M. A. P. Gonçalves, M. R. McCarter, F. Gómez-Ortiz, S.-L. Hsu, C. Klewe, P. Shafer, E. Arenholz, V. A. Stoica, C. Ophus, J. F. Liu, C. T. Nelson, S. Saremi, **B. Prasad**, A. B. Mei, D. G. Schlom, J. Íñiguez, P. García- Fernández, L. Q. Chen, J. Junquera, L. W. Martin and R. Ramesh, “*Observation of room-temperature polar skyrmions*”, **Nature** **568**, 368 (2019).
17. **Bhagwati. Prasad**, G. Pfanzelt, E. F.-Tsirakis, M.J. Zachman, L.F. Fitting Kourkoutis, J. Mannhart “*Integrated circuits comprising functional liquids*”, **Advanced Materials** **30**, 1802598 (2018).
16. Zuhuang Chen, Zhanghui Chen, Chang-Yang Kuo, Yunlong Tang, Liv R. Dedon, Qian Li, Lei Zhang, Christoph Klewe, Yen-Lin Huang, **Bhagwati Prasad**, Alan Farhan, Mengmeng Yang, James D. Clarkson, Sujit Das, Sasikanth Manipatruni, A. Tanaka, Padraic Shafer, Elke Arenholz, Andreas Scholl, Ying-Hao Chu, Z. Q. Qiu, Zhiwei Hu, Liu-Hao Tjeng, Ramamoorthy Ramesh, Lin-Wang Wang & Lane W. Martin, “*Complex Strain Evolution of Polar and Magnetic Order and Control of Spin Orientation in Multiferroic BiFeO_3 Thin Films*”, **Nature Communications** **9**, 3764 (2018).
15. Sasikanth Manipatruni, Dmitri E. Nikonov, Chia-Ching Lin, **Bhagwati Prasad**, Yen Lin Huang, Anoop R. Damodaran, Zuhuang Chen, Ramamoorthy Ramesh and Ian A. Young, “*Voltage Control of Unidirectional Anisotropy in Ferromagnet-Multiferroic System*”, **Science Advances** **4**, eaat4229 (2018).
14. H. S. Alagoz, **B. Prasad**, J. Jeon, M. G. Blamire, K. H. Chow and J. Jung, “*Phase shift of oscillatory magnetoresistance in a double-cross thin film structure of $\text{La}_{0.3}\text{Pr}_{0.4}\text{Ca}_{0.3}\text{MnO}_3$ via strain-engineered elongation of electronic domains*”, **Physical Review B**, **97**, 085129 (2018).
13. **Bhagwati Prasad*** and M. G. Blamire, “*Fully magnetic manganite spin filter tunnel junctions*”, **Appl. Phys. Lett.** **109**, 132407 (2016).
12. S Mesoraca, J E Kleibeuker, **B Prasad**, J L MacManus-Driscoll and M G Blamire, “*Lithium outdiffusion in LiTi_2O_4 thin films grown by pulsed laser deposition*”, **J. Crystal Growth** **454**, 124 (2016).
11. Ady Suwardi, **Bhagwati Prasad**, Shinbuhm Lee, Eun-Mi Choi, Ping Lu, Wenrui Zhang, Leigang Li, Mark Blamire, Quanxi Jia, Haiyan Wang, Kui Yao and Judith L. MacManus-Driscoll; “*Turning antiferromagnetic $\text{Sm}_{0.34}\text{Sr}_{0.66}\text{MnO}_3$ into a 140 K ferromagnet using a nanocomposite strain tuning approach*”, **Nanoscale** **8**, 8083 (2016).

10. **Bhagwati Prasad***, W. Zhang, J. Jian, H. Wang and M. G. Blamire; “*Strongly bias-dependent tunnel magnetoresistance in manganite spin filter tunnel junctions*”, **Advanced Materials** 27, 3079 (2015).
9. S.K. Soni, Pavan Kumar Bijalwan, Abhijeet Sangle, **Bhagwati Prasad**, Monojit Dutta, R.O. Dusane, “*Development of a-Si:H single junction n-i-p solar cell on steel substrates by HWCVD process*”, **Tata Search** 2, 199 (2016).
8. **Bhagwati Prasad***, M. Egilmez, F. Schoofs, T. Fix, M. E. Vickers, W. Zhang, J. Jian, H. Wang and M. G. Blamire; “*Nanopillar spin filter tunnel junctions with manganite barriers*”, **Nano Letters** 14, 2789 (2014).
7. T. Fix, E.-M. Choi, J. W. A. Robinson, S. B. Lee, A. Chen, **Bhagwati Prasad**, H. Wang, M. G. Blamire, and J. L. MacManus-Driscoll; “*Electric-field control of ferromagnetism in a nanocomposite via a ZnO phase*”, **Nano Letters** 13, 5886 (2013).
6. H. S. Alagoz, J. Jeon, S. T. Mahmud, M. M. Saber, **B. Prasad**, M. Egilmez, K. H. Chow, and J. Jung; “*Recovery of oscillatory magneto-resistance in phase separated $\text{La}_{0.3}\text{Pr}_{0.4}\text{Ca}_{0.3}\text{MnO}_3$ epitaxial thin films*”, **Applied Physics Letters** 103, 232402 (2013).
5. S. Thota, K. Singh, **B. Prasad**, J. Kumar, Ch. Simon, and W. Prellier; “*Formation mechanism, optical and magneto-dielectric studies of new cubic spinel MgMnO_3* ”, **AIP ADVANCES** 2, 032140 (2012).
4. **Bhagwati Prasad***, C. Ghosh, A. Chakraborty, N. Bandyopadhyay and R. K. Ray; “*Adsorption of arsenite (As^{3+}) on nano-sized Fe_2O_3 waste powder from the steel industry*”, **Desalination** 274, 105 (2011).
3. M. S. Seehra, V. Singh, S. Thota, **B. Prasad**, and J. Kumar; “*Synthesis and magnetic properties of nanocrystals of cubic defect spinel MgMnO_3* ”, **Applied Physics Letters** 97, 112507 (2010).
2. **Bhagwati Prasad***, C Ghosh and N Bandyopadhyay; “*Removal of arsenic from arsenic contaminated water using integrated steel industry CRM Fines*”, **Tata Search** 1, 1 (2010).
1. S. Thota, **Bhagwati Prasad**, J. Kumar; “*Formation and magnetic behaviour of manganese oxide nanoparticles*”, **Materials Science and Engineering: B** 167, 153 (2010).

Selected Patents

34. **Bhagwati Prasad**, Rahul Sharangpani, “*Antiferroelectric memory devices and methods of making the same*” US Patent: US011502104B2 (Nov 2022) **Granted**
33. Bhagwati Prasad, Derek Stewart, Matt Carey, Tiffany Santos, “*Spinel containing magnetic tunnel junction and method of making the same*” US Patent: US011443790B2 (Sept 2022) **Granted**
32. Alan Kalitsov, **Bhagwati Prasad**, Derek Stewart, “*Magnetic tunnel junction memory devices employing resonant tunneling and methods of manufacturing the same*”, US Patent: US011411170B2 (August 2022) **Granted**
31. Alan Kalitsov, **Bhagwati Prasad**, Derek Stewart, “*Magnetic tunnel junction memory devices employing resonant tunneling and methods of manufacturing the same*”, US Patent: US011417379B2 (August 2022) **Granted**
30. **Bhagwati Prasad**, Rahul Sharangpani, “*Antiferroelectric memory devices and methods of making the same*” Filed US Patent, Application no.” 17/081,147 (2020). US Patent: US011430813B2 (August 2022) **Granted**
29. Bhagwati Prasad, “*Magnetoresistive memory device including a magnesium containing dust layer*”, US Patent: US011404193B2 (August 2022) **Granted**
28. **Bhagwati Prasad**, “*Magnetoresistive memory device including a magnesium containing dust layer*”, US Patent: US011404632B2 (August 2022) **Granted**
27. Goran Mihajlović, Wonjoon Jung, Bhagwati Prasad, “*Magnetoresistive memory device including a reference layer side dielectric spacer layer*”, US Patent: US011361805B2 (June 2022) **Granted**
26. Alan Kalitsov, **Bhagwati Prasad**, Derek Stewart, “*Magnetic tunnel junction memory devices employing resonant tunneling and methods of manufacturing the same*”, US Patent : US 20220131068A1 (April 2022) **Granted**
25. **Bhagwati Prasad**, Alan Kalitsov and Neil Smith, “*Multiferroic-assisted voltage controlled magnetic anisotropy memory device and methods of manufacturing the same – Part B*”, US Patent: US 11,276,446 B1 (March, 2022) **Granted**
24. **Bhagwati Prasad**, Alan Kalitsov and Neil Smith, “*Multiferroic-assisted voltage controlled magnetic anisotropy memory device and methods of manufacturing the same – Part A*”, US Patent: US 11,264,562 B1 (March, 2022) **Granted**.
23. **Bhagwati Prasad**, Derek Stewart and Bruce Terris “*Spinel containing magnetic tunnel junction and method of making the same – Part B*”, US Patent, US 11,217,289 B1 (Jan, 2022) **Granted**
22. **Bhagwati Prasad** and Alan Kalitsov, “*Magnetic device including multiferroic regions and methods of forming the same*”, US Patent: US 11222920 B2 (Jan, 2022) **Granted**
21. **Bhagwati Prasad** and Alan Kalitsov, “*Tunneling metamagnetic resistance memory device and methods of operating the same – Part B*”, US Patent: US 11200934 B2 (Dec, 2021) **Granted**
20. **Bhagwati Prasad**, Derek Stewart and Bruce Terris “*Spinel containing magnetic tunnel junction and method of making the same – Part A*”, US Patent: US11176981B1 (Nov, 2021) **Granted**
19. **Bhagwati Prasad** and Alan Kalitsov, “*Tunneling metamagnetic resistance memory device and methods of operating the same – Part A*”, US Patent:US11152048B1 (Oct, 2021) (**Granted**)

18. Alan Kalitsov, Kumar Srinivasan and **Bhagwati Prasad**, “Data storage device with Voltage-assisted Magnetic Recording (VAMR) for high density magnetic recording”, US Patent: US11087791B1 (Aug, 2021) **Granted**
17. **Bhagwati Prasad** and Alan Kalitsov, “Electric field controllable spin filter tunnel junction magnetoresistive memory devices and methods of making the same – Part B”, US Patent: US 11069741B2 (July, 2021) **Granted**
16. **Bhagwati Prasad**, Alan Kalitsov, Matt Carey and Bruce Terris “Magnetoresistive memory device including a high dielectric constant capping layer and methods of making the same- Part C” US Patent: US 11056640 B2 (July, 2021) **Granted**
15. Alan Kalitsov and **Bhagwati Prasad**, “Voltage-controlled interlayer exchange coupling magnetoresistive memory device and method of operating thereof” US Patent: US 11049538 B2 (June, 2021) (**Granted**).
14. **Bhagwati Prasad**, Alan Kalitsov, Matt Carey and Bruce Terris “Magnetoresistive memory device including a high dielectric constant capping layer and methods of making the same – Part B”, US Patent: US11005034B1 (May, 2021) **Granted**
13. **Bhagwati Prasad**, Alan Kalitsov, Matt Carey and Bruce Terris “Magnetoresistive memory device including a high dielectric constant capping layer and methods of making the same – Part A” US Patent: US10991407B1 (April, 2021) **Granted**
12. **Bhagwati Prasad** and Alan Kalitsov, “Ferroelectric device with multiple polarization states and method of making the same”, US Patent, US10957711B2 (March, 2021) **Granted**
11. **Bhagwati Prasad** and Alan Kalitsov, “Electric field controllable spin filter tunnel junction magnetoresistive memory devices and methods of making the same- Part A”, US Patent: US10964748B1 (March, 2021) **Granted**.
12. **Bhagwati Prasad**, Chiradeep Ghosh, Manish Kumar Bhadu and Anindita Chakraborty; “A water filter candle system for removal of arsenic including associated impurities from arsenic contaminated group water and a method of manufacturing a water filter candle”, Indian Patent, Application no. 1453/KOL/2010. **Granted**
9. **Bhagwati Prasad**, Chiradeep Ghosh and Nikhiles Bandyopadhyay; “Multilayer bed filtering system for removal of arsenic from arsenic contaminated water”, Indian Patent, Application no. 969/KOL/2009. **Granted**
8. **Bhagwati Prasad** and Chiradeep Ghosh; “Method for treating arsenic contaminated water using iron industry waste product”, Indian Patent, Application no. 671/KOL/2009. **Granted**
7. Alan Kalitsov, **Bhagwati Prasad**, Derek Stewart “Magnetoresistive memory device including a plurality of reference layers, Filed US Patent, Application no. 17/358,990 (2021).
6. Alan Kalitsov, Derek Stewart, **Bhagwati Prasad**, “Voltage-controlled magnetic anisotropy memory device including an anisotropy-enhancing dust layer and methods for forming the same – Part A”, Filed US Patent, Application no. 17/341,119 (2021).
5. Alan Kalitsov, Derek Stewart, **Bhagwati Prasad**, “Voltage-controlled magnetic anisotropy memory device including an anisotropy-enhancing dust layer and methods for forming the same – Part B”, Filed US Patent, Application no. 17/341,090 (2021).
4. Alan Kalitsov, Derek Stewart, **Bhagwati Prasad**, “Voltage-controlled magnetic anisotropy memory device including an anisotropy-enhancing dust layer and methods for forming the same – Part C”, Filed US Patent, Application no. 17/341,049 (2021).
3. **Bhagwati Prasad**, Joyeeta Nag, Seung-Yeul Yang, Adarsh Rajashekhar, Raghuveer S. Makala, “Ferroelectric field effect transistors having enhanced memory window and methods of making the same_A”, Filed US Patent, Application no.” 17/097,841 (2020).
2. **Bhagwati Prasad**, Joyeeta Nag, Seung-Yeul Yang, Adarsh Rajashekhar, Raghuveer S. Makala, “Ferroelectric field effect transistors having enhanced memory window and methods of making the same_B”, Filed US Patent, Application no.” 17/097,757 (2020).
1. **Bhagwati Prasad**, Pavan Kumar Bijalwan, Surendra Soni, Abhijeet Sangle, Soumilya Nayak, Monoji Dutta and Rajiv O Dusan; “Method for depositing hydrogenated amorphous silicon thin film (a-Si:H) solar cell on Steel substrate by hot wire chemical vapour deposition technique”, Filed Indian patent, Application no. 281/OL/2013.

CONFERENCES AND PRESENTATIONS

Selected Conference Presentations:

24. **Bhagwati Prasad**, “Beyond CMOS computing devices: Spintronics, Ferroelectrics, and Iontronics”, **Invited talk at the 66th DAE Solid State Physics Symposium, 18-22 December 2022, BIT Mesra, Ranchi, India**
23. Astha Khandelwal, Vinod Kumar, Yu-Hui Tang, Mark Blamire, and **Bhagwati Prasad**, “Current-induced switching in spin-filter tunnel devices”, **Oral talk at MRS Fall Meeting, Nov 27 – December 2, 2022, Boston, MA, USA**
22. **Bhagwati Prasad**, “Ultralow power magnetoelectric spintronics”, **Invited Oral talk at Spintronics Workshop, July 14-16, 2022, IIT Delhi, India**
21. **Bhagwati Prasad**, “Energy-efficient non-volatile memory for artificial intelligence applications”, **Oral presentation at the 7th BRICS Young Scientist Forum, August 29th - September 1st, 2022; Xiamen, Fujian Province, China**
20. **Bhagwati Prasad**, Vishal Thakare, Alan Kalitsov, Zimeng Zhang, and Ramamoorthy Ramesh, “Ferroelectric nonvolatile memories: Hafnia based ferroelectric tunnel junctions”, **Invited presentation at 13th Annual Non-volatile**

19. **Bhagwati Prasad**, Vishal Thakare, Alan Kalitsov, Zimeng Zhang, and Ramamoorthy Ramesh, "*Hafnia based ferroelectric tunnel junctions*", **Invited presentation at Electronic Materials and Applications (EMA), 19-21 January, 2022, Orlando, FL, USA.**
18. **Bhagwati Prasad**, Neil Smith, Lei Wan, Alan Kalitsov, Matt Carey, Jordan Katine, Tiffany Santos, "*Large perpendicular magnetic anisotropy and voltage controlled magnetic anisotropy effects at CoFe/MgO interface*", **Invited presentation at The 32nd Magnetic Recording Conference (TMRC) 2021 (August 16-19, 2021).**
17. **Bhagwati Prasad**, Alan Kalitsov, Vishal Thakare, Zimeng Zhang, Bruce Terris and Ramamoorthy Ramesh, "*Large tunnel electroresistance with ultrathin $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ ferroelectric tunnel barriers*", **Presentation in Materials Challenges for Memory, virtual conference organized by APL Materials, April 11-13, 2021.**
16. Yen-Lin Huang, **Bhagwati Prasad**, James Steffes, Chia-Ching Lin, Tanay Gosavi, Dmitri Nikonov, Mengmeng Yang, Zi Q Qiu, Jorge Iñiguez, Bryan Huey, Lane Martin, Ian Young, Sasikanth Manipatruni, Ramamoorthy Ramesh, "*An ultralow power magnetoelectric nonvolatile memory*", **Invited Presentation at American Physical Society, March 2-6, 2020; Denver, Colorado, USA.**
15. **Bhagwati Prasad**, Yen-Lin Huang, S. Manipatruni, Tanay Gosavi, Chia-Ching Lin, D. Nikonov, I. Young and R Ramesh, "*Ultralow energy electric field control of magnetism*", **Invited presentation at Electronic Materials and Applications (EMA), 23rd-25th January, 2019, Orlando, FL, USA.**
14. **Bhagwati Prasad**, Yen-Lin Huang, S. Manipatruni, Tanay Gosavi, Chia-Ching Lin, D. Nikonov, I. Young and R Ramesh, "*Ultralow power magnetoelectric nonvolatile memory*", **Invited presentation at EMRS Fall meeting, 17th-19th September, 2018, Warsaw, Poland.**
13. **Bhagwati Prasad**, Humaira Taz, Yen-Lin Huang, Zuhuang Chen, Vishal Thakare, Shang-Lin Hsu, Ramki Kalyanaraman, Ramamoorthy Ramesh, "*Robust Room Temperature Magnetoelectric Coupling in Multiferrioc Materials for Ultralow Energy Spintronic Applications*", **Oral presentation at 21st International Conference on Magnetism, 15th – 20th July, 2018, San Francisco, California, US.**
12. **Bhagwati Prasad**, G. Pfanzelt, E. F.-Tsirakis, M. J. Zachman, L. F. Fitting Kourkoutis, and J. Mannhart, "*Heterostructures with Integrated Functional Liquids*", **Oral presentation at 2018 MRS Spring Meeting, 2nd - 6th April, 2018, Phoenix, Arizona, US**
11. **Bhagwati Prasad**, Yen-Lin Huang, Zuhuang Chen, Humaira Taz, Anoop Damodaran, S Manipatruni, Chia-Ching Lin, D Nikonov, I Young, Ramamoorthy Ramesh "*Ultralow Energy Electric Field Control of Magnetism: Can We Get to 1 AttoJoule/bit?*", **Oral presentation at 2018 MRS Spring Meeting, 2nd - 6th April, 2018, Phoenix, Arizona, US.**
10. Yen-Lin Huang, **Bhagwati Prasad**, Zuhuang Chen, Allen Farhan, Anoop Damodaran, S Manipatruni, Chia-Ching Lin, D Nikonov, I Young, Ramamoorthy Ramesh "*One-volt switching of ferromagnetism at room temperature*" **Oral presentation at 2018 MRS Spring Meeting, 2nd - 6th April, 2018, Phoenix, Arizona, US.**
9. **Bhagwati Prasad**, G. Pfanzelt, E. F.-Tsirakis, M. J. Zachman, L. F. Fitting Kourkoutis, and J. Mannhart, "*A novel approach to integrate functional liquids with solid state devices*", **Invited presentation at SPIE Advanced Lithography Conference, 25 Feb - 1 March 2018, San Jose, California, US.**
8. Humaira Taz, **Bhagwati Prasad**, Liv Dedon, Jeremy Turcaud, Nikita Gaur, Sahar Saremi, Zuhuang Chen, Charles Henri-Lambert, Ajay Yadav, Tamil Sakthivel, Sudipta Seal, Ramamoorthy Ramesh, Ramki Kalyanaraman, "*Room Temperature Magnetoelectric Coupling in Amorphous Ferromagnetic Oxide/ BiFeO_3 Heterostructures*", **Oral presentation at 2017 MRS Fall Meeting, 26th Nov – 1st Dec 2017, Boston, Massachusetts, US.**
7. Salvatore Mesoraca, Josee Kleibeuker, **Bhagwati Prasad**, Judith MacManus-Driscoll, Mark Blamire "*AR-XPS Study of LiTi_2O_4 Thin Films Grown by Pulsed Laser Deposition*", **Oral presentation at 2016 MRS Fall Meeting, 27th Nov – 2nd Dec 2016, Boston, Massachusetts, US.**
6. **Bhagwati Prasad** and Mark G Blamire; "*Perovskite Oxide Spin Filters*", **Oral presentation at Nanotech France 2016, 1-3 June 2016, Paris, France.**
5. **Bhagwati Prasad** and Mark G Blamire; "*Ferromagnetic insulating manganite: A novel material for efficient spin filtering*", **Poster presentation at 21st International Workshop on Oxide Electronics, 28th Sept -1st Oct 2014, The Sagamore Resort, Bolton Landing, New York, US.**
4. **Bhagwati Prasad** and Mark G Blamire; "*Epitaxial oxide spin filter tunnel junction*", **Poster presentation at IEEE International Magnetism Conference (INTERMAG, EUROPE 2014), 4-8 May 2014, Dresden, Germany.**
3. **Bhagwati Prasad** and Mark G Blamire; "*Spin filtering through ferromagnetic insulating manganite tunnel barriers*", **Oral presentation at IOP Magnetism 2014, 7-8 April 2014, University of Manchester, UK.**
2. **Bhagwati Prasad** and Mark G Blamire; "*Strain-induced magnetic and transport properties of $\text{Sm}_{0.58}\text{Sr}_{0.42}\text{MnO}_3$ thin films*", **Poster Presentation at Frontiers in Unconventional Superconductivity and Magnetism, 10 January 2014,**

University of Bristol, UK.

1. Subhash Totha, **Bhagwati Prasad** and **Jitendra Kumar**; “Magnetic behavior of manganese oxide nanoparticles obtained by thermal decomposition of Sol-Gel derived oxalate”, **Oral presentation at International Conference on Particle Based Advanced Materials**, 10-13 May 2008, Orlando, USA.

Selected Technical and Invited Talks:

17. *Functional thin film materials for next-generation disruptive technological applications (Invited)*, December 2022
Tata Steel, Jamshedpur, India
16. *Beyond-CMOS computing: Spintronics, Ferroelectrics, and Iontronics (Invited -Colloquium)*, July 2022
IBM, San Jose, USA
15. *Beyond-CMOS computing: Spintronics, Ferroelectrics, and Magnetoelectrics (Invited)*, May 2022
NISER Bhubaneswar, India
14. *Beyond-CMOS computing: Spintronics, Ferroelectrics, and Iontronics (Invited)*, March 2022
CeNSE Department, IISc Bengaluru
13. *Emerging memory technologies (Invited)*, May 2021
University of Cambridge – U K
12. *Ferroelectric Memories*, June 2020
Western Digital, San Jose -USA
11. *Beyond-CMOS computing technologies: Spintronics and Iontronics (Invited)*, April 2019
Physics Department, IIT Delhi, India
10. *Oxide spintronics: A pathway beyond-CMOS computing (Invited)*, March 2018
Western Digital – San Jose, USA
9. *Integration of functional liquids in microelectronic devices (Invited-Colloquium)*, September 2017
IBM Research – Almaden, USA
8. *Heterostructures with integrated liquids (Invited)*, August 2017
Lawrence Berkeley National Lab, Berkeley, USA
7. *Perovskite Oxide Spin Filters*, January 2016
Department of Materials Science and Engineering, **University of California - Berkeley, USA**
6. *Epitaxial Oxide Spin-Filter Tunnel Junctions with Manganite Barriers (Invited)*, December 2014
Invited by Prof. J Mannhart, **Max Planck Institute for Solid State Research, Stuttgart, Germany.**
5. *Ferromagnetic insulating manganite: A novel material for efficient spin filtering (Invited)*, October 2014
Invited by Prof Jagadeesh Moodera, Francis Bitter Magnet Laboratory, **MIT, Boston, USA.**
4. *Epitaxial oxide spin filter tunnel junction (Invited)*, October 2014
Invited by Prof Caroline Ross, Department of Materials Science and Engineering, **MIT, Boston, USA.**
3. *Spin filtering through ferromagnetic insulating manganite tunnel barriers*, December 2013
Department of Materials Science and Metallurgy, **University of Cambridge, UK**
2. *Photovoltaic coating for solar energy application*, 2012
R&D Division, **Tata Steel Limited, Jamshedpur, India**
1. *Spintronics: Sources and Challenges*, 2007
Materials Science Programme, **Indian Institute of Technology, Kanpur, India**