

Mandar M. Deshmukh

Department of Condensed Matter Physics and Materials Science
Tata Institute of Fundamental Research,
Homi Bhabha Road, Mumbai, 400 005

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Date of Birth 20th October 1974

Citizenship Indian

Current position:

January 2006 - **Faculty member**
Associate Professor (2011-)
Reader(2007-2011)
Fellow (2006-2007)
Department of Condensed Matter Physics
and Materials Science (DCMP and MS),
Tata Institute of Fundamental Research
(TIFR), Mumbai, India 400005

Education:

August 1996-July 2002 **Cornell University, Ithaca NY**
Ph.D., Physics, August 2002
“Probing Magnetism at the Nanometer Scale Using Tunneling Spectroscopy” Advisor: Prof. D.C. Ralph

July 1992- April 1996 **Indian Institute of Technology, Bombay, India.**
B.Tech Engineering Physics

Research:

Jan 2006- **Principal investigator of an independent research group**
Emphasis on nanometer scale physics and nanoelectronics

[Publications on Google scholar](#)

October 2002- Dec2005 **Postdoctoral work, Harvard University**
Cambridge MA.
Molecular electronics, Mesoscopic superconductivity

June 1996-July 2002 **Physics Department, Cornell University, Ithaca NY.**
spin polarized tunneling via discrete quantum states, tunneling spectroscopy of individual metal nanoparticle.

Teaching: **TIFR, Mumbai**
Basic electronics and solid state physics

IIT Bombay
Nanoelectronics

Honors/Awards:

Shanti Swarup Bhatnagar Award 2015 (in Physics)
TWAS Affiliate (2014)
Swarnajayanthi Fellowship 2012
IBM Faculty Award 2012
B.M. Birla Physics Prize 2011

Community service:

Reviewer for Physical Review Letters, Physical Review B, Applied Physics Letters, Nano Letters, Nature Nanotechnology, New Journal of Physics, Japanese Journal of Applied Physics, and Journal of Vacuum Science and Technology B

Mentoring:

Post doctoral researchers

Abhilash T. S. (now at Cornell U.), Sunil Patil (College of Engineering Pune)
Prajakta Chaudhari, Padmalekha K.G.

PhD Students

Hari S. Solanki (2006-2011, Seagate), Vibhor Singh (2007- 2012, now Assistant Professor IISc), Sajal Dhara (2007-2012, now U. Rochester), Shamashis Sengupta (2007- 2012, now U. Paris sud), Sudipta Dubey (2011 - 2015, now at L. Neel Grenoble), John Mathew (2012- 2016; now at AMOLF Netherlands), Sameer Grover (2012 - ongoing), Biswajit Datta (2015-onwards)

Undergraduate students mentored:

Niveditha Samudrala (now at Yale), Ajay Bhat (now at Cornell), Madhav Kumar (now at Oxford), Lokeshwar Bandhu (now at Exeter), Bushra Irfan (now at IIT Delhi), Harish Srinivas (now at U.Michigan), Ganesh S. (now at Arizona State University), Arvind Pawan R. (now at Princeton), Adrien Allain (now postdoc at EPFL after PhD at L. Neel Grenoble), Rohan Dhall (now at USC), Priyanka D'Souza (Rhodes Scholar at Oxford), Pratiksha Dongare (Rice University), Pritesh Parikh (UCSD), Gobinath Jegannathan (2012-13), Raj Patel (U.Penn)

Detailed list of Publications:

As independent researcher in India (2006 onwards)

https://scholar.google.co.in/citations?user=_q4ulwsAAAAJ&hl=en)

1. Strong electronic interaction and multiple quantum Hall ferromagnetic phases in trilayer graphene
Biswajit Datta, Santanu Dey, Abhisek Samanta, Hitesh Agarwal, Abhinandan Borah, Kenji Watanabe, Takashi Taniguchi, Rajdeep Sensarma, and **Mandar M. Deshmukh**,
Nature Communications 8, 14518 (2017).

2. Dynamical strong coupling and parametric amplification of mechanical modes of graphene drums
John P Mathew, Raj Patel, Abhinandan Borah, R. Vijay, **Mandar M Deshmukh**
Nature Nanotechnology 11, 747-751 (2016).

Featured on the cover of Nature Nanotechnology
3. Low tension graphene drums for electromechanical pressure sensing
Raj Patel, John P Mathew, Abhinandan Borah, **Mandar M Deshmukh**
2D Mater. 3 011003 (2016).
4. Nanoscale electromechanics to measure thermal conductivity, expansion and interfacial losses
John P Mathew, Raj Patel, Abhinandan Borah, Carina B Maliakkal, TS Abhilash, **Mandar M Deshmukh**
Nano Lett., 15, 7621 (2015).
5. Fabrication and characterization of GaN nanowire doubly clamped resonators
Carina B Maliakkal, John P Mathew, Nirupam Hatui, A Azizur Rahman, **Mandar M Deshmukh**, Arnab Bhattacharya
J. Appl. Phys. 118, 114301 (2015).
6. Quantum Hall effect in tunable 1-D lateral superlattice in graphene--role of crossed electric and magnetic fields
Sudipta Dubey, and **Mandar M. Deshmukh**
Solid State Communications , Volumes 237-238, 59, (2016).
7. Carrier Transport in High Mobility InAs Nanowire Junctionless Transistors
Aniruddha Konar, John Mathew, Kaushik Nayak, Mohit Bajaj, Rajan K. Pandey, Sajal Dhara, K. V. R. M. Murali, and **Mandar M. Deshmukh**
Nano Lett., 15 1684 (2015).
8. Limits on the bolometric response of graphene due to flicker noise
Sameer Grover, Sudipta Dubey, John P. Mathew, and **Mandar M. Deshmukh**
Appl. Phys. Lett. 106, 051113 (2015).
9. Light matter interaction in WS₂ nanotube-graphene hybrid devices
John Mathew , Gobinath Jegannathan , Sameer Grover , Pratiksha D. Dongare, Rudheer D. Bapat , Bhagyashree A. Chalke , Shashank C Purandare , **Mandar M. Deshmukh**
Appl. Phys. Lett. 105, 223502 (2014).
10. Schottky barrier heights for Au and Pd contacts to MoS₂
Naveen Kaushik, Ankur Nipane, Firdous Basheer, Sudipta Dubey, Sameer Grover, **Mandar M. Deshmukh** and Saurabh Lodha
Appl. Phys. Lett. 105, 113505 (2014).
11. A facile process for soak-and-peel delamination of CVD graphene from substrates using water
Priti Gupta, Pratiksha D. Dongare, Sameer Grover, Sudipta Dubey, Hitesh Mangan, Arnab Bhattacharya, and **Mandar M. Deshmukh**

Scientific Reports 4, 3882 (2014).

12. Free-standing semipolar III-nitride quantum well structures grown on chemical vapor deposited graphene layers
Priti Gupta, A. A. Rahman, Nirupam Hatui, Jayesh B. Parmar, Bhagyashree A. Chalke, Rudheer D. Bapat, S. C. Purandare, **Mandar M. Deshmukh** and Arnab Bhattacharya,
Appl. Phys. Lett. **103**, 181108 (2013).
13. Dynamically Tracking the Strain Across the Metal-Insulator Transition in VO₂ Measured Using Electromechanical Resonators
Pritesh Parikh, Chitrалеema Chakraborty, T. S. Abhilash, Shamashis Sengupta, Chun Cheng, Junqiao Wu, and **Mandar M. Deshmukh**
Nano Lett., **13**, 4685 (2013).
14. Tunable Superlattice in Graphene To Control the Number of Dirac Points
Sudipta Dubey, Vibhor Singh, Ajay K. Bhat, Pritesh Parikh, Sameer Grover, Rajdeep Sensarma, Vikram Tripathi, K. Sengupta, and **Mandar M. Deshmukh**
Nano Lett., **13**, 3990 (2013).
15. Plasmon mode modifies the elastic response of a nanoscale charge density wave system
Shamashis Sengupta, Niveditha Samudrala, Vibhor Singh, Arumugam Thamizhavel, Peter B. Littlewood, Vikram Tripathi, and **Mandar M. Deshmukh**
Phys. Rev. Lett. **110**, 166403 (2013).
16. MOVPE growth of semipolar III-nitride semiconductors on CVD graphene
Priti Gupta, A.A. Rahman, Nirupam Hatui, M.R. Gokhale, **Mandar M. Deshmukh**, Arnab Bhattacharya
Journal of Crystal Growth, **372**, 105, (2013).
17. Wide Bandwidth Nanowire Electromechanics on Insulating Substrates at Room Temperature
T. S. Abhilash, John P. Mathew, Shamashis Sengupta, M. R. Gokhale, Arnab Bhattacharya, and **Mandar M. Deshmukh**,
Nano Lett., **12**, 6432 (2012).
18. Compact, inexpensive coaxial terminations and wiring for low temperature RF applications
E. Smith , R. De Alba , N. Zhelev , R. Bennett , V.P. Adiga , H.S. Solanki , V. Singh , **M.M. Deshmukh**
and J.M. Parpia
Cryogenics **52**, 461-464 (2012).
19. Coupling between quantum Hall state and electromechanics in suspended graphene resonator
Vibhor Singh, Bushra Irfan, Ganesh Subramanian, Hari S. Solanki, Shamashis Sengupta, Sudipta Dubey, Anil Kumar, S. Ramakrishnan and **Mandar M. Deshmukh**
Appl. Phys. Lett. **100**, 233103 (2012).
20. Dense Electron System from Gate-Controlled Surface Metal-Insulator Transition
Kai Liu , Deyi Fu , Jinbo Cao , Joonki Suh , Kevin X. Wang , Chun Cheng , D. Frank Ogletree , Hua Guo , Shamashis Sengupta , Asif Khan , Chun Wing Yeung , Salahuddin Sayeef , **Mandar M. Deshmukh** , and Junqiao Wu
Nano Lett., **12**, 6272 (2012).

21. High-Q electromechanics with InAs nanowire quantum dots
Hari S. Solanki , Shamashis Sengupta , Sudipta Dubey , Vibhor Singh , Sajal Dhara , Anil Kumar , Arnab Bhattacharya , S. Ramakrishnan , Aashish Clerk and **Mandar M. Deshmukh**
Appl. Phys. Lett. **99**, 213104 (2011).
22. Dual top gated graphene transistor in the quantum Hall regime
Ajay K Bhat , Vibhor Singh , Sunil Patil and **Mandar M. Deshmukh**
Solid State Communications **152**, 545-548 (2012).
23. Field-effect modulation of conductance in VO₂ nanobeam transistors with HfO₂ as the gate dielectric
Shamashis Sengupta, Kevin Wang, Kai Liu, Ajay K. Bhat, Sajal Dhara, Junqiao Wu, **Mandar M. Deshmukh**
App. Phys. Lett. **99**, 062114 (2011).
24. Facile fabrication of lateral nanowire wrap-gate devices with improved performance
Sajal Dhara, Shamashis Sengupta, Hari S. Solanki, Arvind Maurya, Arvind Pawan R., M. R. Gokhale, Arnab Bhattacharya, and **Mandar M. Deshmukh**
Appl. Phys. Lett. **99**, 173101 (2011).
25. Tunable thermal conductivity in defect engineered nanowires at low temperatures
Sajal Dhara, Hari S. Solanki, Arvind Pawan R., Vibhor Singh, Shamashis Sengupta, B.A. Chalke, Abhishek Dhar, Mahesh Gokhale, Arnab Bhattacharya, and **Mandar M. Deshmukh**
Phys. Rev. B **84**, 121307 (2011).
26. Nanoscale electromechanical resonators as probes of the charge density wave transition in NbSe₂
Shamashis Sengupta, Hari S. Solanki, Vibhor Singh, Sajal Dhara and **Mandar M. Deshmukh**
Physical Review B **82**, 155432 (2010).
27. Probing thermal expansion of graphene and modal dispersion at low temperature using graphene NEMS resonators
Vibhor Singh, Shamashis Sengupta, Hari S. Solanki, Rohan Dhall, Adrien Allain, Sajal Dhara, Prita Pant and **Mandar M. Deshmukh**
Nanotechnology **21**, 165204 (2010).
28. Tuning mechanical modes and influence of charge screening in nanowire resonators
Hari S. Solanki, Shamashis Sengupta, Sajal Dhara, Vibhor Singh, Sunil Patil, Rohan Dhall, Jeevak Parpia, Arnab Bhattacharya, and **Mandar M. Deshmukh**
Physical Review B, **81**, 115459 (2010).
29. Non-equilibrium breakdown of quantum-Hall state in graphene
Vibhor Singh and **Mandar M. Deshmukh**
Physical Review B, **80**, 081404R (2009).
30. Magnetotransport properties of individual InAs nanowires
Sajal Dhara, Hari S. Solanki, Vibhor Singh, Arjun Narayanan, Prajakta Chaudhari, Mahesh Gokhale, Arnab Bhattacharya, and **Mandar M. Deshmukh**

Physical Review B, **79**, 121311R (2009).

as PhD Student and Postdoctoral researcher

31. Magnetic switching of phase-slip dissipation in NbSe₂ nanoribbons
Abram Falk, **Mandar M. Deshmukh**, Amy L. Prieto, Jeff J. Urban, Andrea Jonas, and Hongkun Park
Physical Review B, 75, 020501(R) (2007).
32. Signatures of molecular magnetism in single-molecule transport spectroscopy
Moon-Ho Jo, Jacob E. Grose, Kanhayalal Baheti, **Mandar M. Deshmukh**, Jennifer J. Sokol, Evan M. Rumberger, David N. Hendrickson, Jeffrey R. Long, Hongkun Park and D.C. Ralph
Nano Letters, 6, 2014 (2006).
33. Vapor phase synthesis and characterization of FeSi nanowires
Lian Ouyang, Elizabeth S. Thrall, **Mandar M. Deshmukh** and Hongkun Park
Advanced Materials, 18, 1437 (2006).
34. Fabrication of asymmetric electrode pairs with nanometer separation made of two distinct metals
Mandar M. Deshmukh, Amy L. Prieto, Qian Gu, and Hongkun Park
Nano Letters, 3, 1383 (2003).
35. Using Single Quantum States as Spin Filters to Study Spin Polarization in Ferromagnets
Mandar M. Deshmukh, and D.C. Ralph
Physical Review Letters, 89, 266803 (2002).
36. Solving rate equations for electron tunneling via discrete quantum states
E. Bonet, **Mandar M. Deshmukh**, and D.C. Ralph
Physical Review B, 65, 045317 (2002).
37. Equilibrium and non-equilibrium electron tunneling via discrete quantum states
Mandar M. Deshmukh, E. Bonet, A.N. Pasupathy, and D.C. Ralph
Physical Review B, 65, 073301 (2002).
38. A Model for Ferromagnetic Nanograins with Discrete Electronic States
S. Kleff, J. VonDelft, **Mandar M. Deshmukh**, and D.C. Ralph
Physical Review B, 64, 220401(R) (2001).
39. Magnetic Anisotropy Variations and Non-Equilibrium Tunneling in a Cobalt Nanoparticle
Mandar M. Deshmukh, S. Kleff, S. Gueron, E. Bonet, A.N. Pasupathy, J. VonDelft, and D.C. Ralph
Physical Review Letters, 87, 226801 (2001).

40. Tunneling via Individual Electronic States in Ferromagnetic Nanoparticles
S. Gueron, **Mandar M. Deshmukh**, E.B. Myers, and D.C. Ralph
Physical Review Letters, 83, 4148 (1999).

41. Nanofabrication using a stencil mask
Mandar M. Deshmukh, D.C. Ralph, M. Thomas, and J. Silcox
Applied Physics Letters, 75, 1631 (1999).