Curriculum Vitae: Uma Divakaran

Personal Information

Uma Divakaran,
Associate Professor,
Indian Institute of Technology Palakkad,
Ahalia Integrated Campus, Kozhipara P.O, Palakkad, Kerala-678557,
Email:uma@iitpkd.ac.in
Tel:04923-226321

Previous Academic Positions held

1. Research Scholar, 2005-2010, IIT Kanpur.
2. Post Doctoral Fellow, University of Saarland, Saarbrücken, Germany, March 2010-August 2010.
3. Alexander von Humboldt Post Doctoral Fellow, University of Saarland, Saarbrücken, Germany, September 2010-January 2011.
4. Project Scientist, IIT Kanpur, September 2011-April 2012. (Maternity leave from Feb 2011 till August 2011)
5. Alexander von Humboldt Post Doctoral Fellow, University of Saarland, Saarbrücken, Germany, May 2012-November 2012.
6. Post Doctoral Fellow, IIT Kanpur, December 2012-June 2013
7. DST-INSPIRE Faculty, IIT Kanpur, July 2013, March 2015.
8. UGC-Assistant Professor, Centre for Excellence in Basic Sciences, Mumbai, April 2015-June 2016.
9. Assistant Professor, IIT Palakkad, July 2016.

Education

M. Sc.-Ph.D Dual Degree, Indian Institute of Technology Kanpur.
Thesis Title: Slow Quenching dynamics in quantum critical systems (2010).

B. Sc. (Physics), Miranda House, University of Delhi, Delhi (2003).

Research Interests Quantum phase transitions, Non-equilibrium dynamics in quantum phase transitions, Statistical mechanics of models of fracture and breakdown like fiber bundle model. Quantum machines and quantum chaos.

Research Students

Present Students

1. Manju C
   Research Area: Quantum Chaos

Alumni

1. Revathy B. S.,
   Thesis Title: *Quantum critical engines*
   Current Position: Post doctoral fellow at Raman Research Institute

Journal
Publications

Submitted

1. Improving performance of quantum heat engines by free evolution,
   Revathy B.S., Harsh Sharma and Uma Divakaran, arxiv:2302.07003

Published

First six papers are with IIT Palakkad affiliation

1. Exactly solvable one-dimensional quantum models with gamma matrices,
   Yash Chugh, Kusum Dhochak, Uma Divakaran, Prithvi Narayan and Amit K Pal,
   Phys. Rev. E 106 (2) 024114 (2022) *Published work with an M.Sc. student*
   https://link.aps.org/doi/10.1103/PhysRevE.106.024114
2. Bath Engineering Enhanced Quantum Critical Engines,
   Revathy B. S, Victor Mukherjee and Uma Divakaran,
   Entropy 24 (10) 1458 (2022) https://www.mdpi.com/1099-4300/24/10/1458
3. Many-body quantum thermal machines,
   Victor Mukherjee, Uma Divakaran,
   Journal of Physics: Condensed Matter 33 454001 (2021) https://dx.doi.org/10.1088/1361-648X/ac1b60
4. Universal finite-time thermodynamics of many-body quantum machines from Kibble-Zurek scaling,
   Revathy B. S., Victor Mukherjee, Uma Divakaran and Adolfo del Campo,
   Physical Review Research (Editors' Suggestion) 2 043247 (2020) https://journals.aps.org/prresearch/pdf/10.1103/PhysRevResearch.2.043247
5. Adiabatic dynamics of quasiperiodic transverse Ising model,
   Revathy B. S and Uma Divakaran,
   J. Stat. Mech: Theory and Experiment, 2020, 023108 (2020) https://iopscience.iop.org/article/10.1088/1742-5468/ab6dde Impact Factor:2.4, Citations:0
6. Sudden quenches in quasiperiodic Ising model,
   Uma Divakaran, Phys. Rev. E, 98, 032110 (2018)
   https://journals.aps.org/pre/abstract/10.1103/PhysRevE.98.032110
   Impact Factor: 2.2, Citations:2
7. Tuning the presence of dynamical phase transitions in a generalized XY spin chain
   Uma Divakaran, Shraddha Sharma and Amit Dutta
   Phys. Rev. E 93, 052133 (2016),
   http://link.aps.org/doi/10.1103/PhysRevE.93.052133
8. Slow quenches in a quantum Ising chain; dynamical phase transitions and topology
   Shraddha Sharma, Uma Divakaran, A. Polkovnikov and Amit Dutta

Phys. Rev. B 93, 144306 (2016),
http://dx.doi.org/10.1103/PhysRevB.93.144306

9. Effect of double local quenches on Loschmidt echo and entanglement entropy of a one-dimensional quantum system,
Atanu Rajak and Uma Divakaran,
J. Stat. Mech. 043107 (2016),
http://dx.doi.org/10.1088/1742-5468/2016/04/043107
10. Dynamic freezing and defect suppression in the tilted one-dimensional Bose-Hubbard model,
Uma Divakaran and K. Sengupta,
Phys. Rev. B 90, 184303 (2014).
http://link.aps.org/doi/10.1103/PhysRevB.90.184303
11. Nonequilibrium quantum relaxation across a localization-delocalization transition,
Gergo Roosz, Uma Divakaran, H. Rieger, F. Iglói,
Phys.Rev.B 90, 184202 (2014).
http://link.aps.org/doi/10.1103/PhysRevB.90.184202
12. Fidelity susceptibility and Loschmidt echo for generic paths in a three spin interacting transverse Ising model,
Atanu Rajak and Uma Divakaran,
J. Stat. Mech (2014) P04023.
http://iopscience.iop.org/1742-5468/2014/4/P04023/article
13. The three site interacting spin chain in a staggered field: Fidelity versus Loschmidt echo
Uma Divakaran,
Phys. Rev. E. 88, 052122 (2013).
http://link.aps.org/doi/10.1103/PhysRevE.88.052122
14. Scaling of the decoherence factor of a qubit coupled to a spin chain driven across quantum critical points.
Tanay Nag, Uma Divakaran and Amit Dutta,
Phys. Rev. B (Rapid Comm.) 86, 020401 (2012).
http://link.aps.org/doi/10.1103/PhysRevB.86.020401
15. Non-equilibrium quantum dynamics after local quenches.
Uma Divakaran, Ferenc Iglói and Heiko Rieger,
J. Stat. Mech 11, 10027 (2011).
http://iopscience.iop.org/1742-5468/2011/10/P10027
16. Quenching through Dirac and semi-Dirac points in optical Lattices: Kibble-Zurek scaling for anisotropic Quantum-Critical systems.
Europhys. Lett. 89, 67001 (2010)
Amit Dutta, R. R. P. Singh and Uma Divakaran,
http://dx.doi.org/10.1209/0295-5075/89/67001
17. Landau-Zener problem with waiting at the minimum gap and related quench dynamics of a many body system.
Uma Divakaran, Amit Dutta and Diptiman Sen,
Phys. Rev. B 81, 054306 (2010).
http://link.aps.org/doi/10.1103/PhysRevB.81.054306

18. Adiabatic dynamics in passage across quantum critical lines and gapless phases.
Debanjan Chowdhury, Uma Divakaran and Amit Dutta,
Phys. Rev. E 81, 012101 (2010).
http://link.aps.org/doi/10.1103/PhysRevE.81.012101

19. Reverse quenching in a one-dimensional Kitaev model.
Uma Divakaran and Amit Dutta,
Phys. Rev. B 79, 224408 (2009).
http://link.aps.org/doi/10.1103/PhysRevB.79.224408

20. Defect production due to quenching through a multicritical point.
Uma Divakaran, Victor Mukherjee, Amit Dutta and Diptiman Sen,
J. Stat. Mech: Theory and Experiment (2009) P02007.
http://iopscience.iop.org/1742-5468/2009/02/P02007

21. Quenching along a gapless line: A different exponent for defect density.
Uma Divakaran, Amit Dutta and Diptiman Sen,
Phys. Rev. B 78, 144301 (2008).
http://link.aps.org/doi/10.1103/PhysRevB.78.144301

22. Random fiber bundle with many discontinuities in threshold distribution.
Uma Divakaran and Amit Dutta,
Phys. Rev. E 78, 021118 (2008).
http://link.aps.org/doi/10.1103/PhysRevE.78.021118

23. The effect of the three-spin interaction and the next nearest neighbor interaction on the quenching dynamics of a transverse Ising model.
Uma Divakaran and Amit Dutta,
J. Stat. Mech: Theory and Experiment, November, P11001 (2007).
http://iopscience.iop.org/1742-5468/2007/11/P11001

24. Quenching Dynamics of a quantum XY spin-1/2 chain in a transverse field,
Victor Mukherjee, Uma Divakaran, Amit Dutta and Diptiman Sen,
Phys. Rev. B 76, 174303 (2007).
http://link.aps.org/doi/10.1103/PhysRevB.76.174303

25. Fibers on a graph and local load sharing.
Uma Divakaran and Amit Dutta,
Int. J. Modern Physics C 18, 6, (2007).

26. Critical behaviour of random fibers with mixed Weibull Distribution.
Uma Divakaran and Amit Dutta,
Phys. Rev. E. 75, 011109 (2007).
http://link.aps.org/doi/10.1103/PhysRevE.75.011109

27. Effect of discontinuity in the threshold distribution on the critical behavior of a random fiber bundle.
Uma Divakaran and Amit Dutta,
Phys. Rev. E, 75, 011117 (2007).
http://link.aps.org/doi/10.1103/PhysRevE.75.011117

Published Book

1. Quantum phase transitions in transverse field spin models: From Statistical Physics to Quantum Information
A. Dutta, G. Aeppli, B. K. Chakrabarti, U. Divakaran, T. F. Rosenbaum and D. Sen, Cambridge University Press (2015)

Conference Proceedings

1. Victor Mukherjee, Uma Divakaran, Amit Dutta and Diptiman Sen, Quenching dynamics of a quantum XY spin-1/2 chain in the presence of transverse field by the application of a generalized Landau–Zener formula. Pramana journal of physics, Vol. 71, No. 2, 403, (2008).
2. Uma Divakaran and Amit Dutta, Long-range connections, quantum magnets and dilute contact processes. Physica A Vol. 384, 39 (2007).

Articles in Books

1. Uma Divakaran, Victor Mukherjee, Amit Dutta and Diptiman Sen, *Defect production due to quenching through a multicritical point and along a gapless line*, Quantum Quenching, Annealing and Computation, Edited by Anjan K Chandra, Arnab Das and B. K. Chakrabarti. Lecture Notes Physics, Vol 802, pages 57-73 (2010), Springer-Verlag Berlin Heidelberg (2010).
2. Uma Divakaran and Amit Dutta, *Critical Behaviour of Mixed Fibers with Uniform Distribution*, Modelling critical and catastrophic phenomena in geoscience, page 515-520. Ed. by P. Bhattacharyya and B. K. Chakrabarti, Springer-Verlag -2006.

Schools, Conferences and Workshops

First eight conferences/talks are with IIT Palakkad affiliation

1. Invited talk, Young Investigators meet in quantum condensed matter theory, November 2022
2. Colloquium, Physics Department, IIT Tirupati, April 2022.
3. Invited talk, Young Investigators meet in quantum condensed matter theory, November 2021
4. Invited talk, Young Investigators meet in quantum condensed matter theory, November 2019
5. Invited talk, Young Investigators meet in quantum condensed matter theory, December 2018
6. Invited talk, Statistical Physics Community meeting, February 2018, ICTS Bangalore.
7. International Conference on Complex Quantum Systems, BARC Mumbai, 20-23rd February, 2017, Invited Speaker
8. Statphys Kolkata IX, 13-16 December 2016, Saha Institute of Nuclear Physics, Kolkata, Invited speaker
9. Quantum Disordered systems, 1-3 March 2016, Institute of Mathematical Sciences, Chennai, Invited speaker
10. Focussed workshop on *Many Body dynamics out of equilibrium*, 10-14 March 2015, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.
11. School and workshop on Physics of Cold Atoms, 10-16 February 2014, Harish Chandra Research Institute, Allahabad (India).

12. ICTS program on "US-INDIA Advanced Studies Institute on Thermalization: From Glasses to Black Boles", 10 June 2013-21 June 2013, Indian Institute of Science, Bangalore.
13. ICTS program on Non-Equilibrium Statistical Physics, 30 Jan -08 February 2010, Indian Institute of Technology Kanpur.
    Poster presentation, Waiting in Kitaev model
14. Summer College on nonequilibrium physics from classical to quantum low dimensional systems. 6-July 2009 to 24 July 2009, International Centre for Theoretical Physics, Trieste, Italy.
    Poster Presentation, Title: A study of reverse quenching in one-dimensional Kitaev model.
15. Condensed Matter Workshop Feb 20-22, 2009 at Indian Institute of Technology Kanpur, India
    Poster Presentation, Title: A study of reverse quenching in a one-dimensional Kitaev model. (Best Poster award)
16. International Conference on Quantum Phase Transition and Dynamics: Quenching, Annealing and Quantum Computation. Feb 3-7, 2009 at Saha Institute of Nuclear Physics, Kolkata, India.
    Poster Presentation, Title: A Study of reverse quenching in one-dimensional Kitaev model.
17. Unconventional Phases and Phase transitions in strongly correlated electron systems. June 3-7, 2008 at Max Planck Institute for Physics of Complex Systems, Dresden, Germany.
    Poster Presentation, Title: The effect of three spin interaction and next nearest neighbor interaction on the quenching dynamics of a transverse Ising model.
18. International Conference on Statphys-Kolkata VI. January 5-9 at Kolkata India, 2007.
    Poster presentation, Title: Crossover from non-universal to universal behavior in a random fiber bundle model.
19. International workshop on Mesoscopic and Disordered Systems, December 4-8, 2006. Indian Institute of Technology, Kanpur, India.
    Poster Presentation, Title: Quantum Annealing of ANNNI model- A preliminary study.
20. SERC School in Condensed Matter and Materials Physics. March 1-28, 2006, BHU, Varanasi, India.
21. International Workshop on Models of Earthquake: Physics Approaches December 13-16, 2005, Saha Institute of Nuclear Physics , Kolkata, India.
    Oral and Poster Presentation, Title: Dynamics of Random Fiber Bundle Model
22. Condensed Matter Workshop, February 4-6, 2005, Indian Institute of Technology Kanpur.
    Poster Presentation, Title: Critical behaviour of Random Fiber Bundle Model

Research Visits

1. Visitor, Quantum Science and Technology Group, University of Basque, Bilbao, Spain, May 2019
2. Visitor, Internation Centre for Theoretical Studies, January 2019
3. Visitor, Department of Physics, Indian Association for Cultivation of Sciences, Kolkata, India, September (2013).
4. Visitor, Department of Theoretical Solid State Physics, SZFKI, Budapest, Hungary. September-October 2012.
5. Visitor, Center for High Energy Physics, Indian Institute of Science Bangalore. September-October 2009.
6. Junior Guest Scientist, Condensed Matter and Statistical Physics Section, International Centre for Theoretical Physics (ICTP), Trieste Italy from 2nd June 2009 to 29th June 2009.
7. Visitor, International School for Advanced Studies (SISSA/ISAS), Trieste, Italy from 8th June 2008 to 18th June 2008.

Professional Activities

Referee in the following Journals:

1. APS Journals-Phys. Rev. Letters, Phys. Rev. B, Phys. Rev. E
2. Euro Physics Letters

Project Students

1. Nikhil Mesquita, Quantum Chaos, M.Sc. Project, IIT Palakkad (2023)
2. Mayurakshi Deb, Evolutin of measures of entanglement in kicked tops, M.Sc. Project, IIT Palakkad (2022)
3. Harsh Sharma, Enhancing the efficiency of quantum heat engines using Kicked Ising systems ,M.Sc Project, IIT Palakkad (2022)
4. Ram Sagar Sahani, Spectrum and Entanglement entropy of one-dimensional quasi periodic system, M.Sc Project, IIT Palakkad (2021)
5. Nabin Boro, M.Sc. Project, IIT Palakkad (2021)
6. Yash Chugh, Gamma Ising model, M.Sc. Project, IIT Palakkad (2021), co-supervised with Amit K Pal, Kusum Dhochak and Prithvi Narayan which resulted to a publication in Phys. Rev. E
7. Akshay K, Project, 7th and 8th semester (2015-16, odd semester), UM-DAE CBS Mumbai on *Density Matrix Renormalization Group.*
8. Rishabh Gupta, Reading Project, 7th and 8th semester (2015-16, odd semester), UM-DAE CBS Mumbai on *Quantum Phase Transitions*
9. Ravi Shankar, M.Sc. Project (2014-15), IIT Kanpur on *Critical exponents and entanglement entropy of transverse Ising model in a spatially modulated longitudinal field*