

Physics Department,
NITK Surathkal,
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EMPLOYMENT

Assistant Professor	National Institute of Technology Karnataka	Jul 2013 - Present
<ul style="list-style-type: none"> • Ten years experience teaching Physics theory and lab courses at undergraduate and graduate levels. • Guided three students to completion of PhD in theoretical physics. • Guided 10+ students to completion of MSc projects in theoretical physics. • Introduced MCQ format for in-semester quizzes for introductory undergraduate physics course. • Redesigned introductory undergraduate physics syllabus to make it modern and streamlined. • Introduced and taught courses on General Relativity and Quantum Computation at MSc level. 		
Visiting Associate	Inter-University Center for Astronomy and Astrophysics (IUCAA), Pune	Aug 2017 - Present
<ul style="list-style-type: none"> • Delivered research talks on my work to audience of astronomers and astrophysicists. 		
Teaching Assistant	Pennsylvania State University	Fall 2003 - Spring 2007
<ul style="list-style-type: none"> • Supervised physics lab courses for first year undergraduates. • Conducted one-on-one tutorials in physics theory for first year undergraduates. 		
Physics Tutor	University of Missouri at Rolla¹	Fall 2000 - Spring 2003
<ul style="list-style-type: none"> • Tutored first year undergraduates in introductory physics as part of institutional program. 		

EDUCATION

PhD, Cosmology	Pennsylvania State University	2003 - 2012
<ul style="list-style-type: none"> • Thesis title: "Many-body physics and the cosmological constant problem: An investigation" • Advisor: Stephon Alexander²; Co-Advisor Martin Bojowald³ • Used CosmoMC numerics and analytical calculations to suggest alternative to Lambda-CDM model in terms of local voids (doi: 10.1088/1475-7516/2009/09/025, arXiv:0712.0370) • Explored formation of cosmological condensate due to four-fermion interaction mediated by gravitational SL(2,C) connection (arXiv:hep-th/0609066). • Suggested possible resolution of cosmological constant problem via formation of cosmological condensate (conference paper, arXiv:hep-th/0702064) 		

RESEARCH HIGHLIGHTS⁴

- My work lies at the interface of many body physics, quantum information and quantum gravity
- Proposed description of different spacetime geometries (dS/AdS/flat) as corresponding to different phases of underlying microscopic many body physics ([paper](#), [arXiv](#)).
- Co-authored primer on Loop Quantum Gravity for newcomers, published as a monograph by Springer Nature in 2017 ([book](#), [arXiv](#)).
- Explored thermodynamics of black holes in anti-deSitter space with my PhD students and collaborators ([paper](#), [arXiv](#)).
- Proposed relation between scattering of elementary particles and non-perturbative quantum geometry ([paper](#), [arXiv](#)).

1 Now known as as the [Missouri University of Science and Technology](#)

2 Now Professor at [Brown University](#).

3 Professor at [Pennsylvania State University](#).

4 For a full list of my publications please visit [INSPIRE](#), [my website](#) or see below.

PROFESSIONAL REFERENCES

- [Dr. Marko Vojinovic](#), Group for Gravitation, Particles and Fields, Institute of Physics, University of Belgrade, Serbia, +38 163 724 1376, vmarko@ipb.ac.rs
- [Prof H. S. Nagaraja](#), Department of Physics, NITK Surathkal, Mangaluru, India, +91 824 247 3280, +91 948 023 1041, nagaraja@nitk.edu.in
- [Stephon Alexander](#), Professor of Physics, Department of Physics, Brown University, Box 1843, Providence, RI 02912-1843, USA, +1 215-264-7096 stephon_alexander@brown.edu
- [Martin Bojowald](#), Professor of Physics, 304A Whitmore Lab, Pennsylvania State University, PA, USA, +1 814 865 3502, bojowald@gravity.psu.edu
- G. Umesh, Professor (Retired), Department of Physics, National Institute of Technology Karnataka, Surathkal - 575025, Karnataka, India, +91-9901184376, +91-824-2473276, umesh52@gmail.com

SKILLS AND ATTRIBUTES

- Proficient in Python, Julia, SAGEMath.
- Proficient in quantum mechanics and quantum computing platforms ([QuTiP](#), [Qiskit](#), [Quirk](#)).
- Well-versed in deep learning techniques (CNNs, RNNs, Transformers) and platforms (PyTorch).
- Self-starter, highly motivated, hard worker, team builder.
- Ability to rapidly absorb new knowledge and paradigms.
- Verbal and written proficiency in English and Hindi.

TALKS, SEMINARS AND RESEARCH VISITS

- *Coherent States and Particle Scattering in Loop Quantum Gravity*, talk at [Loops '22](#), ENS de Lyon, Lyon, France, Jul 18 - Jul 22, 2022
- *Lorentz Invariance, Scattering Amplitudes and Subsystem Codes*, Online talk, [Current Challenges in Black Hole Physics and Cosmology](#), Yukawa Institute for Theoretical Physics (YITP), Kyoto University, Jun 20 - Jul 1, 2022
- *Coherent States and Particle Scattering in Loop Quantum Gravity*, Online talk, 9th Tux Workshop on Quantum Gravity, Feb 14 - Feb 22, 2021
- *The Quest for a Theory of Quantum Gravity*, Online seminar on the occasion of National Science Day, National Institute of Technology, Silchar (NIT Silchar), Feb 28, 2021
- *Introductory Lectures on Loop Quantum Gravity*, Online course consisting of 13 lectures, Dec 11, 2020 - Jan 11, 2021, (delivered via Zoom and [available on Youtube](#))
- *Quantum Error Correction in a Loop Quantum Gravity*, Jul 7, 2020, Online seminar, Inter-University Center for Astronomy and Astrophysics (IUCAA), Pune,
- *Workshop on Emergent Gravity Paradigm* (participant) [WEGP](#), Nov 8 - Nov 11, 2019, Department of Physics Cochin University of Science and Technology
- *Quantum Error Correction in a Loop Quantum Gravity Inspired Model of Elementary Particles*, talk at [Loops'19](#), Jun 17 - Jun 21, 2019, Pennsylvania State University, USA.
- *Connecting LQG and String Theory: From Quantum Geometry to the Nambu-Goto Action*, talk at [30th meeting of the Indian Association for General Relativity and Gravitation](#) (IAGRG), Jan 3 - Jan 5, 2019, BITS Hyderabad.
- *Connecting LQG and String Theory: From Quantum Geometry to the Nambu-Goto Action*, talk at [XXIII DAE-BRNS High Energy Physics Symposium](#) 2018, Dec 10 - Dec 14, 2018, IIT Madras.

- *Connecting LQG and String Theory: From Quantum Geometry to the Nambu-Goto Action*, seminar at the Physics Department, Birla Institute of Technology Pilani at Hyderabad ([BITS-Hyderabad](#)), Aug 14, 2018
- *Arrow of Time from Spontaneous Symmetry Breaking in Quantum Gravity*, Poster presentation at workshop on “Optimising, Renormalising, Evolving and Quantising Tensor Networks” ([EVONET18](#)) held at Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, Jun 18-22, 2018
- *Connecting LQG and String Theory: From Quantum Geometry to the Nambu-Goto Action*, talk at 6th Tux Workshop on Quantum Gravity, Tux, Austria, Feb 19-23, 2018
- Research Visit under Associateship Programme, Inter-University Centre For Astronomy And Astrophysics (IUCAA), Pune, India, Dec 29, 2017 - Jan 16, 2018
- *Differential Equations in Physics: From Newton to Einstein*, invited talk at National Workshop on Topics In Partial Differential Equations, NITK Surathkal, July 28, 2017
- *Phases of Spacetime: Gravity as a Condensate of Gauge Fields*, Talk in “Quantum Gravity” Parallel Session, IAGRG-29, May 18 - May 20, 2017, IIT Guwahati
- Research interaction with Prof. Romesh Kaul and Prof. Ghanshyam Date at IMSc Chennai from Apr 5-11, 2017
- *Phases of Spacetime: Gravity as a Condensate of Gauge Fields*, Poster presentation and “Promotional Talk for Young Scientist”, DAE-BRNS Symposium on High Energy Physics at Delhi University, December 12-16, 2016 (ref: [arXiv:1312.7119](#))
- Research Interaction undertaken under TEQIP-II program of Govt of India with Prof Pablo Arrighi at ENS Lyon, France & LIF Marseille, France, June 9-20, 2016
- *Phases of Spacetime: Gravity as a Condensate of Gauge Fields*, Poster presentation, International Conference on Gravitation and Cosmology (ICGC 2015) at IISER Mohali, India, December 14-18, 2015 (ref: [arXiv:1312.7119](#))
- *Phases of Spacetime: Gravity as a Condensate of Gauge Fields*, Seminar, School of Physics, University of Hyderabad, Hyderabad, India, September 7, 2015 (ref: [arXiv:1312.7119](#))
- *The ABC of Quantum Gravity*, National Institute of Technology Karnataka (NITK), INSPIRE Talk, Surathkal, India, December 16, 2013 (ref: [arXiv:1402.2757](#))
- *Loop Quantum Gravity for the Bewildered*, Colloquim, Center for Theoretical Physics, Jamia Millia Islamia, New Delhi, India, June 14, 2012 (ref: [arXiv:1402.3586](#))
- *Loop Quantum Gravity for the Bewildered*, Three Seminars given at Physics Department, University of Adelaide, Adelaide, Australia, August 19, 22 and 29, 2011 (ref: [arXiv:1402.3586](#))
- *Elementary Particles as Gates for Universal Quantum Computation*, Colloquim at Center for High Energy Physics, Indian Institute of Science, Bangalore, India, April 21, 2010 (ref: [arXiv:1307.0096](#))
- *Elementary Particles as Gates for Universal Quantum Computation*, Seminar at Mehta Research Institute, Allahabad, India, April 7, 2010 (ref: [arXiv:1307.0096](#))
- October 2009, [Visiting Researcher](#) at Perimeter Institute for Theoretical Physics, Waterloo, Canada

PUBLICATIONS/PREPRINTS

- **Deepak Vaid**, Sumukha S. Adiga, “*Thermal Intertwiners*” (under preparation)
 - **Deepak Vaid**, “*Arrow of Time from Spontaneous Symmetry Breaking in Spin Networks*” (under preparation)
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- T. K. Safir, C. L. A. Rizwan, and **Deepak Vaid**, “Ruppeiner geometry, $p - \nu$ criticality and interacting microstructures of black holes in dRGT massive gravity”, *Int. J. Mod. Phys. A*, vol. 37, no. 25, p. 2250158, doi: [10.1142/S0217751X22501585](https://doi.org/10.1142/S0217751X22501585), Oct 2022
 - **Deepak Vaid** and D. Suresh, “Coherent states and particle scattering in loop quantum gravity,”, *Eur. Phys. J. C*, vol. 82, no. 8, p. 723, doi: [10.1140/epjc/s10052-022-10701-6](https://doi.org/10.1140/epjc/s10052-022-10701-6); [arXiv:2208.10632](https://arxiv.org/abs/2208.10632), Aug 2022
 - **Deepak Vaid**, “Lorentz Invariance, Scattering Amplitudes and the Emergence of Semiclassical Geometry,”, [arXiv:2205.06777](https://arxiv.org/abs/2205.06777), May 2022
 - **Deepak Vaid**, “Connecting Loop Quantum Gravity and String Theory via Quantum Geometry,”, in XXIII DAE High Energy Physics Symposium, Singapore, 2021, pp. 391-399. doi: [10.1007/978-981-33-4408-2_55](https://doi.org/10.1007/978-981-33-4408-2_55)
 - K. V. Rajani and **Deepak Vaid**, “Comparative Study of Bulk and Surface Pressure of Charged AdS Black Hole,”, *Springer Proc. Phys.*, vol. 261, pp. 913-917, 2021, doi: [10.1007/978-981-33-4408-2_130](https://doi.org/10.1007/978-981-33-4408-2_130)
 - K. V. Rajani, C. L. A. Rizwan, A. N. Kumara, **Deepak Vaid**, and A. K. M., “Regular Bardeen AdS Black Hole as a Heat Engine,”, *Nucl. Phys. B*, vol. 960, p. 115166, doi: [10.1016/j.nuclphysb.2020.115166](https://doi.org/10.1016/j.nuclphysb.2020.115166), Nov 2020
 - C. L. A. Rizwan, A. N. Kumara, K. Hegde, and **Deepak Vaid**, “Coexistent physics and microstructure of the regular Bardeen black hole in anti-de Sitter spacetime,”, *Annals of Physics*, vol. 422, 2020, doi: [10.1016/j.aop.2020.168320](https://doi.org/10.1016/j.aop.2020.168320), [arXiv:2008.06472](https://arxiv.org/abs/2008.06472), Aug 2020
 - K. V. Rajani, C. L. A. Rizwan, A. N. Kumara, **Deepak Vaid**, and M. S. Ali, “Joule-Thomson Expansion of Regular Bardeen AdS Black Hole Surrounded by Static Anisotropic Quintessence Field” *Phys. Dark Univ.*, vol. 32, p. 100825, doi: [10.1016/j.dark.2021.100825](https://doi.org/10.1016/j.dark.2021.100825), [arXiv:2002.03634](https://arxiv.org/abs/2002.03634), Feb 2020
 - A. N. Kumara, C. L. A. Rizwan, **Deepak Vaid**, and K. M. Ajith, “Critical Behaviour and Microscopic Structure of Charged AdS Black Hole with a Global Monopole in Extended and Alternate Phase Spaces,”, [arXiv:1906.11550](https://arxiv.org/abs/1906.11550), Jan 2020
 - **Deepak Vaid**, “Quantum Error Correction in Loop Quantum Gravity,”, [arXiv:1912.11725](https://arxiv.org/abs/1912.11725), Dec 2019
 - C. L. A. Rizwan, A. N. Kumara, K. V. Rajani, **Deepak Vaid**, and K. M. Ajith, “Effect of Dark Energy in Geometrothermodynamics and Phase Transitions of Regular Bardeen AdS Black Hole,”, *Gen. Rel. Grav.*, vol. 51, no. 12, p. 161, Dec. 2019, doi: [10.1007/s10714-019-2649-4](https://doi.org/10.1007/s10714-019-2649-4), [arXiv:1811.10838](https://arxiv.org/abs/1811.10838), Nov 2018
 - C. L. Ahmed Rizwan, A. Naveena Kumara, **Deepak Vaid**, and K. M. Ajith, “Joule-Thomson expansion in AdS black hole with a global monopole”, [arXiv:1805.11053](https://arxiv.org/abs/1805.11053), May 2018
 - C. L. A. Rizwan and **Deepak Vaid**, “Second order phase transition in thermodynamic geometry and holographic superconductivity in low-energy stringy black holes,”, in *AIP Conference Proceedings*, vol. 1953, no. 1, p. 040026. doi: [10.1063/1.5032646](https://doi.org/10.1063/1.5032646), May 2018
 - **Deepak Vaid**, “Connecting Loop Quantum Gravity and String Theory via Quantum Geometry,” Nov. 2017, [arXiv:1711.05693](https://arxiv.org/abs/1711.05693), Nov 2017
 - **Deepak Vaid**, “Thermal Time and Kepler’s Second Law,”, Jul. 2016, [arXiv:1607.00955](https://arxiv.org/abs/1607.00955)
 - **Deepak Vaid** and S. Bilson-Thompson, LQG for the bewildered: The self-dual approach revisited. *Springer Nature*, 2016. doi: [10.1007/978-3-319-43184-0](https://doi.org/10.1007/978-3-319-43184-0), [arXiv:1402.3586](https://arxiv.org/abs/1402.3586), Feb 2014
 - **Deepak Vaid**, “Quantum Gravity for Dummies,”, [arXiv:1402.2757](https://arxiv.org/abs/1402.2757), Feb 2014
 - **Deepak Vaid**, “Superconducting and Antiferromagnetic Phases of Space-Time,” *Advances in High*
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Energy Physics, vol. 2017, doi: [10.1155/2017/7935185](https://doi.org/10.1155/2017/7935185), [arXiv:1312.7119](https://arxiv.org/abs/1312.7119), Dec 2013

- **Deepak Vaid**, “Non-abelian Gauge Fields from Defects in Spin-Networks.”, [arXiv:1309.0652](https://arxiv.org/abs/1309.0652), Sep 2013
 - **Deepak Vaid**, “Elementary Particles as Gates for Universal Quantum Computation,”, [arXiv:1307.0096](https://arxiv.org/abs/1307.0096), Jul 2013
 - **Deepak Vaid**, “Quantum Hall Effect and Black Hole Entropy in Loop Quantum Gravity,”, [arXiv:1208.3335](https://arxiv.org/abs/1208.3335), Aug 2012
 - **Deepak Vaid**, “Embedding the Bilson-Thompson model in an LQG-like framework,”, [arXiv:1002.1462](https://arxiv.org/abs/1002.1462), Feb 2010
 - S. Alexander, T. Biswas, A. Notari, and **Deepak Vaid**, “Local void vs dark energy: confrontation with WMAP and type Ia supernovae,” Journal of Cosmology and Astroparticle Physics, vol. 2009, no. 09, Sep. 21, 2009. doi: [10.1088/1475-7516/2009/09/025](https://doi.org/10.1088/1475-7516/2009/09/025), [arXiv:0712.0370](https://arxiv.org/abs/0712.0370), Dec 2007
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 - Stephon Alexander and **Deepak Vaid**, “Gravity Induced Chiral Condensate Formation and the Cosmological Constant.”, [arXiv:hep-th/0609066](https://arxiv.org/abs/hep-th/0609066), Sep 2006
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