Curriculum Vitæ: Shailesh Lal

Contact

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Employment Record

1. **16 February 2022 – present:** Visiting Post–Doctoral Fellow at the International Center for Theoretical Sciences – Tata Institute of Fundamental Research.

2. **14 April 2021 – 10 December 2021:** Data Scientist (Research), Kenkou GmBH, Berlin, Germany.

3. **1 November 2017 – 31 October 2020:** Post–Doctoral Fellow, Simons Collaboration on the Non-Perturbative Bootstrap, Faculty of Sciences, University of Porto.

4. **1 November 2015 – 31 October 2017:** Marie Sklodowska–Curie Individual Fellow at the *Laboratoire de Physique Théorique et Hautes Energies*, Université de Paris VI, Paris.

5. **15 October 2013 – 31 August 2015:** Post–Doctoral Fellow at the Department for Physics and Astronomy, Seoul National University.

6. **6 September 2012 – 5 September 2013:** Post–Doctoral Fellow at the International Center for Theoretical Sciences – Tata Institute of Fundamental Research.

Research Areas

Machine Learning and Neural Networks, Theory & applications to Physics,
AdS/CFT duality, Conformal Bootstrap, String Theory, Black Holes.
Heat Kernel Methods.

Grants & Fellowships

1. November 2015: Marie Sklodowska–Curie Individual Fellowship, awarded by The European Commission.

2. October 2014: The Dynasty Foundation, short trip scientific visits program funded a visit to The Lebedev Physical Institute, Moscow, Russia from October 7 – 11, 2014.

Education

Ph. D.   Harish-Chandra Research Institute, Allahabad, INDIA.
                Advisor: Prof. Rajesh Gopakumar.

                – Date of Award: 25 February 2013.

M. Sc. (Physics) University of Delhi, Delhi (2006), First Class.
                Project: A Survey of Supersymmetry and Supersymmetric Quantum Mechanics.
                Advisor: Prof. Amitabha Mukherjee.

B. Sc. (H) Phys. University of Delhi, Delhi (2004).
                First Class with Distinction (75.04%).

Certificate Courses

                Coursera Deep Learning Module (Deep Learning, Hyperparameter Tuning, Structuring MLPs, Convolutional Neural Nets, Sequence Models).

Invited Talks and Seminars (Total In Conferences: 14)

June 10 2022	**Machine Learning String Theory from very Few Examples**, Indian Institute of Technology, Hyderabad, India.
May 20 2022	**The World in a Grain of Sand**,International Centre for Theoretical Sciences, Tata Institute of Fundamental Research, India.
Aug 6 2021	**Machine Learning Symmetry**, Nankai Symposium on Mathematical Dialogues, Nankai University, China.
February 5 2021	**Machine Learning Symmetries Using Neural Networks**, Shing-Tung Yau Center of Southeast University, China.
January 28 2021	**Machine Learning Etudes for Symmetries**, Sanya Workshop on Algebraic Geometry and Machine Learning.
June 13, 2019	**Computing One Loop Free Energy in AdS**, Oskar Klein Centre & Stockholm University, Stockholm.
May 9 2019	**Quantum Corrections in Holographic Duals of free CFTs**, Korea Institute of Advanced Study, Seoul.
December 6, 2018	**Lower Symmetries and Slightly Quantum Gravity** *Higher Symmetries and Quantum Gravity* The Albert Einstein Institut, Golm, Germany.
October 17, 2017	**Quantum Effects in Higher Spin Holography and Tensionless AdS Strings** *University of Vienna*, Vienna, Austria.
July 14, 2017	**Stringy Higher-Spins at One-Loop** *New Ideas On Higher Spin Gravity and Holography*, Kyung-Hee University, Seoul, Korea.
April 26, 2017	**Quantum Corrections in Stringy HS Holography** *Workshop on Higher Spin Gauge Theories*, Mons, Belgium.
March 9, 2017	**Tensionless Strings at One Loop** *Rencontres Théoriciennes*, Paris, France.
January 11, 2017	**Higher Spins at One-Loop: I** 6th *Bangkok Workshop on High Energy Theory*, Bangkok, Thailand.
Novemer 10, 2016	**On Quantum Tests of the AdS/CFT Correspondence** *LMPT*, Université Francois-Rabelais, Tours, France.
May 9, 2016	**One Loop Test of Free SU(N) Adjoint Model Holography** *Higher Spin Theory and Duality*, MIAPP, Munich, Germany.
December 15 2014	**Logarithmic Corrections for Extremal Black Holes** *Indian Strings Meeting*, Puri, India.
December 8, 2014	**Computing Logarithmic Corrections to AdS Partition Functions** *Higher-Spin Theory and Holography* The Lebedev Physical Institute, Moscow, Russia.
November 4, 2014	**Computing Quantum Corrections to the Area Law** *Universiteit van Amsterdam*, Amsterdam.
October 28, 2014	**Heat Kernels on the AdS(2) Cone and Extremal Black Hole Entropy** *The Albert Einstein Institut,* Golm, Germany.
October 22, 2014	**Computing Quantum Corrections to Extremal Black Hole Entropy** *Stockholm University,* Stockholm, Sweden.
October 16, 2014	**Quantum Corrections to Extremal Black Hole Entropy** *The Abdus Salam International Centre for Theoretical Physics,* Trieste, Italy.
October 10, 2014	**The Heat Kernel on the AdS(2) Cone and Logarithmic Corrections to Extremal Black Hole Entropy** *The Lebedev Physical Institute,* Moscow, Russia.

March 31, 2014   **Logarithmic Corrections to Extremal Black Hole Entropy**
Korea Institute of Advanced Study, Seoul, Korea.

February 26, 2014   **Quantum Corrections to Bekenstein-Hawking Entropy**
International Centre For Theoretical Sciences, TIFR, Bangalore, India.

February 20, 2014   **Quantum Corrections to Extremal Black Hole Entropy**
Indian Association for the Cultivation of Science, Kolkata, India.

March 13, 2013   **The Heat Kernel on AdS(5) and Applications**
NORDITA, Stockholm, Sweden.

March 4, 2013   **The Heat Kernel on AdS(5) and Applications**
NIKHEF, Amsterdam, The Netherlands.

January 30, 2013   **CFT(4) Partition Functions and the Heat Kernel on AdS(5)**
Non-perturbative Gauge Theories, Holography, and All That, IISc Bangalore, India.

November 27, 2012 **Partition Functions for Higher Spin Fields in AdS**
The Institute of Mathematical Sciences, Chennai, India.

September 12, 2012 **Higher Spin Theories in Odd Dimensions**
Indian Institue of Science, Bangalore, India.

January 14, 2012   **Higher-Spin Theories in AdS(5)**
The 6th Asian Winter School on Strings, Particles, and Cosmology, Kusatsu, Japan.

December 11, 2011 **Higher Spin Theories in Odd Dimensions**
National Strings Meet, Delhi, India.

November 18, 2011 **Higher Spin Theories in Odd Dimensions**
ITF, University of Utrecht, Utrecht, The Netherlands.

November 16, 2011 **Higher Spin Theories in Odd Dimensions**
Universite Libre de Bruxelles, Brussels, Belgium.

November 15, 2011 **Higher Spin Theories in Odd Dimensions**
ITFA, University of Amsterdam, Amsterdam, The Netherlands.

November 10, 2011 **Higher Spin Theories in Odd Dimensions**
ITP, Vienna University of Technology, Vienna, Austria.

November 08, 2011 **Higher Spin Theories in Odd Dimensions**
SNS, Pisa, Italy.

November 07, 2011 **Higher Spin Theories in Odd Dimensions**
INFN, Tor Vergata, Rome, Italy.

November 02, 2011 **Higher Spin Theories in Odd Dimensions**
ETH, Zurich, Switzerland.

November 01, 2011 **Higher Spin Theories in Odd Dimensions**
CERN, Geneva, Switzerland.

April 07, 2011   **The Heat Kernel for Higher Spin Fields on** AdS_{2n+1}
Albert-Einstein-Institut, Golm, Germany.

April 01, 2011   **The Heat Kernel for Higher Spin Fields on** AdS_{2n+1}
Spring School on Superstring Theory and Related Topics, ICTP – Trieste, Italy.

January 04, 2011   **The Heat Kernel on** AdS_5 **and application**
Indian Strings Meet, Puri, India.

March 26, 2010   **The Next-to-Simplest Quantum Field Theories**
Spring School on Superstring Theory and Related Topics, ICTP – Trieste, Italy.

February 10, 2010 **The Next-to-Simplest Quantum Field Theories**
The National Strings Meet, Mumbai, India.

January 18, 2010   **The Next-to-Simplest Quantum Field Theories**
The 4th Asian Winter School Mahabaleshwar, India.

INVITED PARTICIPATION IN CONFERENCES AND WORKSHOPS

August 2021	**Nankai Symposium on Mathematical Dialogues**, Nankai University, China.
January 2022	**Sanya Workshop on Algebraic Geometry and Machine Learning**, Tsinghua Sanya International Mathematics Forum, China.
November 2019	**Simons Collaboration on the Non Perturbative Bootstrap, Annual Meeting**, Simons Foundation, New York, USA.
July 2019	**Simons Bootstrap Collaboration Meeting**, Sao Paolo, Brazil.
December 2018	**Higher Symmetries and Quantum Gravity**, Albert Einstein Institut, Golm, Germany
November 2018	**Conference on the Non Perturbative Bootstrap**, Simons Foundation, New York, USA.
August 2018	**LPTENS Summer Institute XLVII**, ENS, Paris, France
May 2018	**Bootstrap Meeting: Analytical Approaches**, Azores, Portugal.
July 2017	**New Ideas On Higher Spin Gravity and Holography**, Kyung-Hee University, Seoul, Korea.
May 2017	**Simons Bootstrap Collaboration Meeting**, Sao Paolo, Brazil.
April 2017	**Workshop on Higher Spin Gauge Theories**, Mons, Belgium.
January 2017	**6th Bangkok Workshop on High Energy Theory**, Bangkok, Thailand.
May 2016	**Higher Spin Theory and Duality**, Munich, Germany.
January 2015	**The 9th Asian Winter School on Strings, Particles and Cosmology,** Busan, Korea.
December 2014	**Indian Strings Meet,** Puri, India.
December 2014	**Higher Spin Theory and Holography,** Moscow, Russia.
January 2014	**IBS Symposium on Fields, Strings and Gravitation,** Seoul, South Korea.
March 2013	**Higher-Spins, Strings and Duality,** GGI – Florence, Italy.
January 2013	**Non-perturbative Gauge Theories, Holography, and All That,** IISc Bangalore, India.
December 2012	**Indian Strings Meet,** Puri, India.
October 2012	**Advanced Strings School,** Puri, India.
January 2012	**The 6th Asian Winter School on Strings, Particles, and Cosmology,** Kusatsu, Japan.
December 2011	**National Strings Meet,** Delhi, India.
March 2011	**Spring School on Superstring Theory and Related Topics,** ICTP – Trieste, Italy.
February 2011	**QFT 2011,** IISER Pune – Pune, India.
January 2011	**Indian Strings Meet,** Puri, India.
October 2010	**Advanced Strings School,** Puri, India.
March 2010	**Spring School on Superstring Theory and Related Topics,** ICTP – Trieste, Italy.
February 2010	**The National Strings Meet,** Mumbai, India.
January 2010	**The 4th Asian Winter School on Strings, Particles, and Cosmology,** Mahabaleshwar, India.
April 2009	**IPM String School and Workshop,** Tehran, Iran.
December 2008	**Indian Strings Meet,** Pondicherry, India.
October 2008	**Field Theoretic Aspects of Gravitation,** Shimla, India.

Teaching Experience

April – May 2022	**Machine Learning & String Theory:** An invited set of lectures given at IIT Kanpur on Machine Learning and some applications to string theory. The course page is viewable here. An advanced version of this course was taught informally at ICTS-TIFR to string theory graduate students.
Jan–March 2019	**Higher-Spin Theory**: This is a specialized course taught to beginning and advanced graduate students, covering the basics of Higher-Spin Theory using the AdS/CFT duality as a window into these theories. Topics covered include formulations of free higher spin fields, some basic tools of conformal field theory, Hagedorn transitions, relevance to tensionless strings, higher-spin algebras.

I have acted as teaching assistant for three courses while a graduate student at Harish-Chandra Research Institute (HRI), India (the norm is two). This is an institute primarily devoted to research in theoretical Physics and Mathematics, admitting only a few select students every year for doctoral study.

Aug–Dec 2009	**Teaching Assistant**, Quantum Field Theory (QFT) II. **Instructor**: Prof. Rajesh Gopakumar **Course Description**: This is a course consisting of advanced methods in QFT taught as an optional course to students immediately prior to their starting research work with an advisor. It is aimed at equipping them appropriately for this task. As the tutor, I took supplementary lectures to cover topics that could not be touched during the main lectures, but are of great utility in acquiring an understanding of the mathematical framework of QFT. I also checked and graded the assignments for the course, and provided feedback and discussions for the students taking the course.
Jan–May 2009	**Teaching Assistant**, Statistical Mechanics. **Instructor**: Prof. Ashoke Sen **Course Description:** This is a foundational course in Physics containing an introduction to key concepts required for a physicist, taught to students in the first year of their graduate program at Harish-Chandra Research Institute. This course was taught to approximately 10 students. As the tutor, I was responsible for evaluating the assignments for the course, and for tutorial sessions during which class problems were discussed.
Aug–Dec 2008	Teaching Assistant, Quantum Field Theory II. (Instructor: Prof. Rajesh Gopakumar) **Course Description:** Above.

Skills

Programming Languages	Python, Mathematica, C, C++, Fortran 90
Operating Systems	Linux (Basic administration), Windows

Commisions of Trust

Reviewed a three year research grant application for FONDECYT, the national Research Council of Chile, in 2019.

Reviewed an academic paper for Scipost Physics in 2020.

Reviewed an academic paper for the European Physical Journal C in 2020.

Reviewed an academic paper for Universe in 2021.