

Curriculum Vitae

Name : Spenta R. Wadia

Institution : International Centre for Theoretical Sciences (ICTS-TIFR),
Tata Institute of Fundamental Research,
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Bangalore 560089, India

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Current Position

- Aug. 2015 – : Emeritus Professor, ICTS-Tata Institute of Fundamental Research
- Aug. 2015 – : Infosys Homi Bhabha Chair Professor, International Centre for Theoretical Sciences (ICTS-TIFR) Bangalore

Appointments:

- Oct. 2007 – July 2015: (Founding) Director, International Centre for Theoretical Sciences (ICTS-TIFR), Tata Institute of Fundamental Research, Bangalore, India
- Aug. 2008 – July 2015 Distinguished Professor, Tata Institute of Fundamental Research, Mumbai, India
- 2007-2009 – Chair, Department of Theoretical Physics, Tata Institute of Fundamental Research, Mumbai, India
- Oct. 1982 – July 2015: Member of Natural Sciences Faculty, Tata Institute of Fundamental Research, Mumbai, India
- Aug. 1980 – May 1982: Staff Scientist, Enrico Fermi Institute, University of Chicago, USA
- Aug. 1978 – July 1980: Postdoctoral fellow, Enrico Fermi Institute, University of Chicago, USA; mentors: Yoichiro Nambu and Leo Kadanoff

Education:

- Doctor of Philosophy, City University of New York, 1978; mentor: Bunji Sakita
- Master of Science, Indian Institute of Technology, Kanpur, 1973
- Bachelor of Science, St. Xavier's College, Bombay University, 1971

Awards and Honours:

- KITP Simons Distinguished Scientist, 2018-19
- J. C. Bose National Fellow, Govt of India 2006-2011; 2011-16
- TIFR Alumni Association Excellence Award 2016
- Distinguished Alumnus, St. Xavier's College, Bombay University, 2009
- TWAS (The World Academy of Sciences) Physics Prize, 2004
- Steven Weinberg Prize of ICTP (International Centre for Theoretical Physics, Trieste, Italy) 1995

Fellowship of Professional Societies:

- Fellow, TWAS (The World Academy of Sciences), Trieste, Italy
- Fellow, National Academy of Sciences, Allahabad, India
- Fellow, New York Academy of Sciences, New York, USA
- Fellow, Indian National Science Academy, Delhi, India
- Fellow, Indian Academy of Sciences, Bangalore, India

Synergistic Activities

- Chair, Advisory Board, Bengaluru Science & Technology (BeST) Cluster
- Member, Committee for Mega Sciences Vision 2035, Govt of India
- Member, Mega Sciences Theme Group for Science, Technology and Innovation Policy (STIP) 2020, Govt of India
- Member, American Physical Society (APS) Committee on International Scientific Affairs, 2020-2022
- Member, International Science Council of ICTP-AP, University of Chinese Academy of Sciences (UCAS) 2018-
- Member, International Advisory Committee (IAC) of the International Institute of Physics (IIP) in Natal, Brazil, 2017-
- Member, Science Council of Asia Pacific Centre for Theoretical Physics (APCTP), S. Korea, 2010-2018
- Member, Physical Sciences Jury Panel, Infosys Science Foundation Prize for Physical Sciences, 2015-2017
- Chair, Sectional Committee for Physics, Indian National Science Academy, New Delhi, 2017-2019
- Editorial Committee, Asia Pacific Physics Newsletter (APPN), World Scientific, 2016-
- Organiser “Strings 2015” at ICTS-TIFR
- Editor, Asian Journal of Mathematics, International Press, Boston, 2015-
- Member, Promotions & Assessment Committee, Indian Institute of Science, Bengaluru, 2014-
- Member Advisory Board, Asia Pacific Mathematics Newsletter, World Scientific, 2010-
- Member, Program Advisory Committee, IAS Nanyang Technological University, Singapore 2009-2015
- Member, Commission on Mathematical Physics (C-18), International Union of Pure and Applied Physics (IUPAP), 1997-1999 and 1999-2002
- Council Service, Indian Academy of Sciences, Bangalore, 2013-2015
- Editor, European Journal of Physics C, 2012-2015
- Organiser “Strings 2001” at TIFR-Mumbai

Visiting positions on sabbatical leave from TIFR:

- Member, Institute for Advanced Study, Princeton, New Jersey, USA, 1990-92
- Scientific Associate, Theory Division, CERN, Geneva, Switzerland, 1996-97
- Scientific Associate, Theory Division, CERN, Geneva, Switzerland, 2003-04

Publications 2015-:

Research Papers:

1. **“A Dynamical Model of Black Hole Evaporation in the SYK Model coupled to a CFT”**
A. Gaikwad, A. Kaushal, G. Mandal and S. R. Wadia
In preparation
2. **“Current Algebra, a U(1) Gauge Theory and the Wess-Zumino-Witten Model”**
S. R. Wadia
DOI:10.1093/ptep/ptab021
Progress of Theoretical and Experimental Physics (2021)
3. **“Holographic dual to charged SYK from 3D Gravity and Chern-Simons”**
A. Gaikwad, L. K. Joshi, G. Mandal and S. R. Wadia
arXiv:1802.07746 [hep-th]
DOI:10.1007/JHEP02(2020)033
JHEP **2002**, 033 (2020)
4. **“Gravitational collapse in SYK models and Choptuik-like phenomenon”**
A. Dhar, A. Gaikwad, L. K. Joshi, G. Mandal and S. R. Wadia
arXiv:1812.03979 [hep-th]
DOI:10.1007/JHEP11(2019)067
JHEP **1911**, 067 (2019)
5. **“Coadjoint orbit action of Virasoro group and two-dimensional quantum gravity dual to SYK/tensor models”**
G. Mandal, P. Nayak and S. R. Wadia
arXiv:1702.04266 [hep-th]
DOI:10.1007/JHEP11(2017)046
JHEP **1711**, 046 (2017)
6. **“ChernSimons theories with fundamental matter: A brief review of large N results including Fermi-Bose duality and the S-matrix”**
S. R. Wadia
DOI:10.1142/S0217751X16300520
Int. J. Mod. Phys. A **31**, no. 32, 1630052 (2016).
7. **“Unitarity, Crossing Symmetry and Duality of the S-matrix in large N Chern-Simons theories with fundamental matter”**
S. Jain, M. Mandlik, S. Minwalla, T. Takimi, S. R. Wadia and S. Yokoyama
arXiv:1404.6373 [hep-th]
DOI:10.1007/JHEP04(2015)129
JHEP **1504**, 129 (2015)

Other scientific writings:

1. **“Stephen Hawking (1942-2018)”**
R. Gopakumar and S. R. Wadia
Reson **26**, 13–31 (2021).
2. **“The Science of Murray Gell-Mann”**
S. Jain and S. R. Wadia
arXiv:1909.07354 [physics.hist-ph]
Current Science **117**, 10 (2019)
3. **“The Science and Legacy of Richard Phillips Feynman”**
A. Dhar, A. D. Patel and S. R. Wadia
arXiv:1810.07409 [physics.hist-ph]
Physics News Vol 48, No 4, 2018, published by the Indian Physics Association

4. **“The Scientific Legacy of Stephen Hawking (1942-2018)”**
R. Gopakumar and S. R. Wadia
Current Science **114**, 07 (2018)
5. **“Seeing the universe in a new light”**
R. Gopakumar and S. R. Wadia
Current Science **110**, 07 (2016)
6. **“Gravitational waves: Beginning of a turning point in astronomy”**
R. Gopakumar and S.R. Wadia.
The Indian Express, 12 February 2016
7. **“Yoichiro Nambu: breaking the symmetry”**
S. R. Das and S. R. Wadia
CERN Courier 13 November 2015

Selected Talks 2015-

- **Modelling Black Hole Formation and Evaporation in the Sachdev-Ye-Kitaev (SYK) Model and its Dual Gravity Theory**, Conference on “The Dual Mysteries of Gauge Theories and Gravity”, IIT Madras, Chennai, 21 October 2020. Panel Discussion: <https://icsrpiis.iitm.ac.in/events/8891/panel.html>
- **Black Hole Dynamics in the SYK Model Holographic to 2-dim Gravity**, Online Conference on “Frontiers of holographic duality”, Steklov Mathematical Institute, Moscow, 6 May 2020
- **Black Holes: Beacons in our Search for a Quantum Theory of Space-time**, India Science Festival, IISER Pune, 11-12 January 2020.
- **Pure States, Black Hole Formation and Choptuik Scaling in the SYK Model**, Tenth Crete Regional Meeting on String Theory, Kolymbari, 18 September 2019.
- **Black Hole Formation in the Sachdev-Ye-Kitaev (SYK) Holographic Toy Model of Quantum Gravity in 2-dims**, International Conference on Frontiers of Fundamental Physics, The International Centre for Theoretical Physics Asia-Pacific (ICTP-AP), Beijing, China, 14 May 2019.
- **Why Do We Need a Quantum Theory of Gravity?**, IISER Thiruvananthapuram, 20 October 2019; Department of Physics and Astrophysics, University of Delhi, 17 October 2019; BHU, Varanasi, 8 March 2019.
- **Space-time and Gravity: From Newton to Hawking and Beyond**, ICTS Einstein Lecture, Assam University, Silchar, 8 October 2018.
- **Gravitational Collapse in the SYK Model**, Black Holes, Quantum Information and Space-time Reconstruction, CERN, Geneva, 23 August 2018.
- **Quantum Gravity in 2-dims and the Sachdev-Ye-Kitaev Model**, Quantum Spacetime Seminar, TIFR-Mumbai, 28 August 2017.
- **SYK/Tensor Models and 2-dim Quantum Gravity**, String Theory and Quantum Gravity, Monte Verita, Ascona, 5 June 2017.
- **The End of Space-time and Beyond**, ICTS Einstein Lecture, Christ University, Bangalore, 2 December, 2016.
- **Eyes and Ears on the Universe: Radio and Gravitational Wave Astronomy**, an introduction to a special session of the TWAS annual meeting in Kigali, Rwanda, 16 November 2016.
- **The S-matrix in Chern-Simons Theories with Fundamental Matter**, Quantum Field Theory, String Theory and Beyond, Hebrew University of Jerusalem, Israel, 28 February, 2016.
- **100 Years of General Relativity: Albert Einstein’s Revolution in Physics**, Ruia College, University of Bombay, Mumbai, 30 November 2015

- **String Theory and the Hidden Structure of Spacetime**, TeDX talk at St Xavier's College, Mumbai, 8 February 2015

Selected Publications (1976 -)

1. **“The Surface Term in Gauge Theories”**
J. L. Gervais, B. Sakita and S. Wadia.
DOI:10.1016/0370-2693(76)90467-6
Phys. Lett. **63B**, 55 (1976).
CCNY-HEP-76/6
2. **“The Role of Surface Variables in the Vacuum Structure of Yang-Mills Theory”**
S. Wadia and T. Yoneya.
DOI:10.1016/0370-2693(77)90010-7
Phys. Lett. **66B**, 341 (1977).
CCNY-HEP-76/13
3. **“A Study of U(N) Lattice Gauge Theory in 2-dimensions”**
S. R. Wadia.
arXiv:1212.2906 [hep-th]
EFI-79/44-CHICAGO, ICTS-2012-13, TIFR-TH-2012-47;
4. **“N = Infinity Phase Transition in a Class of Exactly Soluble Model Lattice Gauge Theories”**
S. R. Wadia.
DOI:10.1016/0370-2693(80)90353-6
Phys. Lett. **93B**, 403 (1980).
EFI-80/15-CHICAGO
5. **“On the Dyson-Schwinger Equations Approach to the Large N Limit: Model Systems and String Representation of Yang-Mills Theory”**
S. R. Wadia.
DOI:10.1103/PhysRevD.24.970
Phys. Rev. D **24**, 970 (1981).
EFI-80/47-CHICAGO
6. **“The Nambu-Jona-Lasinio Model: An Effective Lagrangian for Quantum Chromodynamics at Intermediate Length Scales”**
A. Dhar and S. R. Wadia.
DOI:10.1103/PhysRevLett.52.959
Phys. Rev. Lett. **52**, 959 (1984).
TIFR/TH/83-32
7. **“Nambu-Jona-Lasinio Type Effective Lagrangian. 2. Anomalies and Nonlinear Lagrangian of Low-Energy, Large N QCD”**
A. Dhar, R. Shankar and S. R. Wadia.
DOI:10.1103/PhysRevD.31.3256
Phys. Rev. D **31**, 3256 (1985).
TIFR-TH-84-37
8. **“Conformal Invariance and String Theory in Compact Space: Bosons”**
S. Jain, R. Shankar and S. R. Wadia.
DOI:10.1103/PhysRevD.32.2713
Phys. Rev. D **32**, 2713 (1985).
TIFR/TH/85-3
9. **“Stochastic Quantization on Two-dimensional Theory Space and Morse Theory”**
S. R. Das, G. Mandal and S. R. Wadia.
DOI:10.1142/S0217732389000873
Mod. Phys. Lett. A **4**, 745 (1989).
TIFR-TH-88-33

10. **“Quantization of the Liouville Mode and String Theory”**
S. R. Das, S. Naik and S. R. Wadia.
DOI:10.1142/S0217732389001209
Mod. Phys. Lett. A **4**, 1033 (1989).
TIFR-TH-88/58
11. **“New Critical Behavior in $d = 0$ Large N Matrix Models”**
S. R. Das, A. Dhar, A. M. Sengupta and S. R. Wadia.
DOI:10.1142/S0217732390001165
Mod. Phys. Lett. A **5**, 1041 (1990).
TIFR-TH-89-70
12. **“Excitations and interactions in $d = 1$ string theory”**
A. M. Sengupta and S. R. Wadia.
DOI:10.1142/S0217751X91000988
Int. J. Mod. Phys. A **6**, 1961 (1991).
TIFR-TH-90-33
13. **“Classical solutions of two-dimensional string theory”**
G. Mandal, A. M. Sengupta and S. R. Wadia.
DOI:10.1142/S0217732391001822
Mod. Phys. Lett. A **6**, 1685 (1991).
IASSNS-HEP-91-10
14. **“Nonrelativistic fermions, coadjoint orbits of $W(\infty)$ and string field theory at $c = 1$ ”**
A. Dhar, G. Mandal and S. R. Wadia.
hep-th/9207011
DOI:10.1142/S0217732392002512
Mod. Phys. Lett. A **7**, 3129 (1992)
TIFR-TH-92-40
15. **“String field theory of two-dimensional QCD: A Realization of $W(\infty)$ algebra”**
A. Dhar, G. Mandal and S. R. Wadia.
hep-th/9403050
DOI:10.1016/0370-2693(94)90511-8
Phys. Lett. B **329**, 15 (1994)
TIFR-TH-94-09
16. **“Universal Cellular Automata and Class 4”**
A. Dhar, P. Lakdawala, G. Mandal and S. R. Wadia.
cond-mat/9409080
DOI:10.1103/PhysRevE.51.3032
Phys. Rev. E **51**, 3032 (1995)
TIFR-TH-94-23
17. **“Quark confinement in $(2+1)$ -dimensional pure Yang-Mills theory”**
S. R. Das and S. R. Wadia.
hep-th/9503184
DOI:10.1103/PhysRevD.53.5856
Phys. Rev. D **53**, 5856 (1996)
TIFR-TH-94-42
18. **“Absorption versus decay of black holes in string theory and T symmetry”**
A. Dhar, G. Mandal and S. R. Wadia.
hep-th/9605234
DOI:10.1016/0370-2693(96)01127-6
Phys. Lett. B **388**, 51 (1996)
TIFR-TH-96-26

19. **“Gauge theory description of D-brane black holes: Emergence of the effective SCFT and Hawking radiation”**
S. F. Hassan and S. R. Wadia.
hep-th/9712213
DOI:10.1016/S0550-3213(98)00372-1
Nucl. Phys. B **526**, 311 (1998)
CERN-TH-97-344, IC-98-15
20. **“Gauge theory on a quantum phase space”**
L. Alvarez-Gaume and S. R. Wadia.
hep-th/0006219
DOI:10.1016/S0370-2693(01)00125-3
Phys. Lett. B **501**, 319 (2001)
CERN-TH-2000-130, TIFR-TH-00-33
21. **“Microscopic formulation of black holes in string theory”**
J. R. David, G. Mandal and S. R. Wadia.
hep-th/0203048
DOI:10.1016/S0370-1573(02)00271-5
Phys. Rept. **369**, 549 (2002)
TIFR-TH-02-07
22. **“Aspects of semiclassical strings in AdS(5)”**
G. Mandal, N. V. Suryanarayana and S. R. Wadia.
hep-th/0206103
DOI:10.1016/S0370-2693(02)02424-3
Phys. Lett. B **543**, 81 (2002)
TIFR-TH-02-20, DAMTP-2002-71
23. **“Finite temperature effective action, AdS(5) black holes, and 1/N expansion”**
L. Alvarez-Gaume, C. Gomez, H. Liu and S. Wadia.
hep-th/0502227
DOI:10.1103/PhysRevD.71.124023
Phys. Rev. D **71**, 124023 (2005)
CERN-PH-TH-2004-251, IFT-05-11, MIT-CTP-3591, TIFR-TH-05-03, CERN-PH-TH-04-251
24. **“Blackhole/String Transition for the Small Schwarzschild Blackhole of AdS(5)x S**5 and Critical Unitary Matrix Models”**
L. Alvarez-Gaume, P. Basu, M. Marino and S. R. Wadia.
hep-th/0605041
DOI:10.1140/epjc/s10052-006-0049-x
Eur. Phys. J. C **48**, 647 (2006)
CERN-PH-TH-2006-078, TIFR-TH-06-01
25. **“The Incompressible Non-Relativistic Navier-Stokes Equation from Gravity”**
S. Bhattacharyya, S. Minwalla and S. R. Wadia.
arXiv:0810.1545 [hep-th]
DOI:10.1088/1126-6708/2009/08/059
JHEP **0908**, 059 (2009)
TIFR-TH-08-40
26. **“Chern-Simons Theory with Vector Fermion Matter”**
S. Giombi, S. Minwalla, S. Prakash, S. P. Trivedi, S. R. Wadia and X. Yin.
arXiv:1110.4386 [hep-th]
DOI:10.1140/epjc/s10052-012-2112-0
Eur. Phys. J. C **72**, 2112 (2012)

27. **“Phases of large N vector Chern-Simons theories on $S^2 \times S^1$ ”**
 S. Jain, S. Minwalla, T. Sharma, T. Takimi, S. R. Wadia and S. Yokoyama.
 arXiv:1301.6169 [hep-th]
 DOI:10.1007/JHEP09(2013)009
 JHEP **1309**, 009 (2013)
 TIFR-TH-13-02, ICTS-2012-14

28. **“Unitarity, Crossing Symmetry and Duality of the S-matrix in large N Chern-Simons theories with fundamental matter”**
 S. Jain, M. Mandlik, S. Minwalla, T. Takimi, S. R. Wadia and S. Yokoyama.
 arXiv:1404.6373 [hep-th]
 DOI:10.1007/JHEP04(2015)129
 JHEP **1504**, 129 (2015)
 TIFR-TH-14-12, HRI-ST-1405, ICTS-2014-04

29. **“Coadjoint orbit action of Virasoro group and two-dimensional quantum gravity dual to SYK/tensor models”**
 G. Mandal, P. Nayak and S. R. Wadia.
 arXiv:1702.04266 [hep-th]
 DOI:10.1007/JHEP11(2017)046
 JHEP **1711**, 046 (2017)
 ICTS-2017-01, TIFR-TH-16-28

30. **“Gravitational collapse in SYK models and Choptuik-like phenomenon”**
 A. Dhar, A. Gaikwad, L. K. Joshi, G. Mandal and S. R. Wadia.
 arXiv:1812.03979 [hep-th]
 DOI:10.1007/JHEP11(2019)067
 JHEP **1911**, 067 (2019)

Doctoral Students

1. **Sanjay Jain**, Thesis: *Conformally Invariant Field Theory in 2-dims and Strings in Curved Space, 1987*
 Presently Professor, Department of Physics and Astronomy, University of Delhi; Current research: Complexity theory, Evolutionary networks.

2. **R. Shankar**, Thesis: *Nambu-Jona-Lasinio Type Effective Actions for Large N Quantum Chromodynamics, 1987*
 Retired Professor, The Institute for Mathematical Sciences, Chennai; Current research: Field theory applications to condensed matter systems; study of Himalayan glaciers.

3. **Gautam Mandal**, Thesis: *An Approach to the Theory of Strings Based on the Space of 2-dim. Field Theories, 1989*
 Presently Senior Professor and Chair, Department of Theoretical Physics, TIFR; Current research: String theory, Quantum Gravity.

4. **Anirvan Sengupta**, Thesis: *String Backgrounds in 1+1 Dims., 1992*
 Presently, Professor, Dept. of Physics and Astronomy, Rutgers University, USA; Current research: Biological Physics, Condensed Matter Theory.

5. **Porus Lakdawala**, Thesis: *Complexity at the Edge of Order and Chaos, 1996*
 Presently, Senior System Administrator, Oracle Corporation, California, USA.

6. **Justin Raj David**, Thesis: *String Theory and Black Holes, 1999*
 Presently, Professor and Chair Centre for High Energy Physics, Indian Institute of Science, Bangalore; Current research: String theory, Quantum Gravity.

7. **Pallab Basu**, Thesis: *Black Holes and the Finite Temperatures Gauge Theory, 2007*
 Presently, Senior Lecturer, University of the Witwatersrand, Johannesburg; Current research: String theory, Quantum Gravity.