CURRICULUM VITAE

1. NAME: Professor Kamal Lochan Panigrahi

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3. Personal data :

Nationality : Indian
Sex : Male
Marital Status : Married

4. Education

Degree	University	Year	Subject	Class/Remarks
Ph. D.	Institute of Physics/ Utkal University, Bhubaneswar	2004	String Theory	Thesis Topic: D-branes and Noncommutative String Theory
Diploma in Advanced Physics	Institute of Physics Bhubaneswar	1999	Physics	– -
M. Sc.	Sambalpur University, Sambalpur	1997	Physics	FIRST
B. Sc.	Utkal University, Bhubaneswar	1995	Physics	FIRST with Distinction
10+2	Council of Higher Secondary Edu, Odisha	1992	Physics Chemistry Mathematics	FIRST
High School	Board of Secondary Edu, Odisha	1990	Mathematics Gen. Science	FIRST

5. Postdoctoral Experience

- INFN Fellow at Dipartimento di Fisica, Universita di Roma, "Tor Vergata", ITALY (2003-2005)
- Postdoctoral fellow at Dipartimento di Fisica, Universita di Genova, ITALY (2005-2006)

6. Academic positions held

- **Professor**, Department of Physics at Indian Institute of Technology Kharagpur, since March-2018.
- Associate Professor, Department of Physics at Indian Institute of Technology Kharagpur (July 2013 to March 2018).
- Assistant Professor, Department of Physics & Meteorology, at Indian Institute of Technology Kharagpur (May 2009 to July 2013).
- Assistant Professor, Department of Physics at Indian Institute of Technology Guwahati (Feb. 2006 to April 2009) .

7. Teaching Experience

- I have been teaching the following undergraduate and postgraduate courses: Physics-I (B.Tech 1st year (UG)), Classical Mechanics-I (UG), Classical Mechanics-II (UG), Nuclear and Particle Physics (UG), High Energy Physics (UG and PG), Quantum Field Theory (UG), Heat and Thermodynamics (UG), Quantum Mechanics-I (UG), Quantum Mechanics-II (UG), String Theory (UG and PG), Advanced Mathematical Techniques (PG).

8. Ph. D. Students supervision

- Dr. Pratap Kumar Swain, Topic: Semiclassical strings and D-branes in diverse string backgrounds. (Graduated in 2013)
- Dr. Pabitra Mohan Pradhan, Topic: Rotating and Pulsating Strings in Anti-de Sitter Space. (Graduated in 2015)
- Dr. Sagar Biswas, Topic: Semiclassical strings on some nonlocal string and D-brane backgrounds. (Graduated in 2015)
- Dr. Aritra Banerjee, Topic: Classical solutions from integrable deformations of string sigma model (Graduated in 2016)

- Dr. Manoranjan Samal, Topic: Classical Strings in deformed AdS: finite size effect and chaos. (Graduated in 2019)
- Dr. Soumya Bhattacharya (jointly with Professor Sayan Kar), Topic: Perturbations of spiky strings in flat and curved backgrounds (Graduated in 2019)
- Dr. Sorna Prava Barik, Topic: Classical String solutions in $AdS_3 \times S^3$ with and without mixed fluxes: Finite-size Strings and Perturbations (Graduated in 2020)
- Dr. Aditra Chakraborty, Topic: Strings and D-branes in AdS: Integrabilily and Phenomenology. (Graduated in 2022)
- Dr. Priyadashini Pandit, Topic: N-spike strings in AdS space with mixed flux (Graduated in 2022)
- Nibedita Padhi, Topic: String Theory and Integrable models
- Pinaki Datta: Topic: String Theory
- Balbeer Singh: Topic: String Theory
- In addition I have supervised several M. Sc. projects

10. Sponsored Research

- Title: Semiclassical strings in AdS/CFT
  Funding Agency: Science and Engineering Research Board (SERB)
  Duration: Three years
  Amount: Rs. 12,56,800.00

11.Service rendered to other Institutions and Organizations

- Member of **Executive council and Court**, Jawaharlal Nehru University (JNU), Delhi (2019-2021)
- Member of **Governing Council**, Institute of Advanced Study in Science and Technology (IASST), Guwahati (Under DST, Govt. of India) 2019-2021

12. Institute/Department Responsibilities

- Chairman, Joint Entrance Examination (JEE) 2022
- Organsing Vice-Chairman, Joint Entrance Examination (JEE) Advanced 2021
- Professor-in-Charge, IIT Kharagpur-Bhubaneswar Extension centre, since 2020
- Program Coordinator, NCC (2017-2019)

- Chairman, Departmental Purchase Committee (2017-2020)
- Member, Department faculty Search Committee (2017-2020)
- Member, Department Administrative Committee (2017-2020)
- Chairman, Department Undergraduate Committee (2015-2017)
- Research Scholar Coordinator, Centre for Theoretical Studies (2014-2017)
- Department Representative: ERP (2014-2017)
- Department Faculty in charge: Time Table (2011-2014)
- Department Faculty in charge: Examinations (2011-2014)
- Faculty-in-charge: Int. M. Sc. second year laboratory in 2010.

13. Organization

- Convener "National Strings Meeting-2013" held at Indian Institute of Technology (IIT) Kharagpur during 22-27 December 2013.
- Organizing secretary International Conference on Theoretical and Applied Physics held at Department of Physics, IIT-Kharagpur during 1-2 December 2011.
- co-Director of XXIV SERC school on High Energy Physics, at IIT-Guwahati in March 2009.
- Organizer Workshop on High Energy Physics: Particle Physics, Strings and Cosmology held at IIT-Guwahati during Feb 21-23, 2008.
- STC QIP: A Roadmap of Quantum Mechanics to String Theory held at IIT-Guwahati during September 03-07, 2007.
- Faculty advisor for B. Tech Students for two years at IIT-Guwahati.

14. Honours, Scholarships :

- Scientific Visitor at Institut fur Mathematik und Physik, Humboldt-Universitat zu Berlin, Germany in 2018
- SFB Associate Professor Fellowship to visit DESY, Hamburg in 2016
- Scientific Visitor at CERN (2014)
- ICTP Junior Associate (2007-2013) (awarded by The Abdus Salam International Center for Theoretical Physics, Trieste, ITALY)
- Visiting Scientist (May-July 2007) at Center for Quantum Spacetime (CQUeST), Sogang University, Seoul

- Awarded a postdoctoral fellowship by the University of Genova, ITALY in 2005.
- Awarded a postdoctoral fellowship in 2003 (by the Instituto Nazionale di Fisica Nucleare (I.N.F.N.)) by the Government of ITALY to do research in the University of Rome, Italy.
- Qualified for the GATE 98 (Graduate Aptitude test in Engineering)
- Qualified for the joint CSIR-UGC NET (Conducted by the Council of Scientific and Industrial Research) for eligibility of lectureship held on 20-12-1998.
- Senior College Merit Scholarship (1992-1995)
- Junior College Merit Scholarship (1990-1992)

16. Visits Abroad (> 1 month)

- Scientific Visitor at Institut fur Mathematik und Physik, Humboldt-Universitat zu Berlin, Germany during May-June 2018.
- Visiting Associate Professor DESY, Hamburg during May-July 2016.
- Visiting Scientist CERN, Switzerland May-June 2014.
- Visited International Centre for Theoretical Physics (ICTP) Trieste, ITALY as Junior Associate during May-July 2013
- Visited ICTP, Trieste, ITALY as Junior Associate during May-July 2012
- Visited CERN, Switzerland as Visiting Scientist in December 2011.
- Visiting Scientist at Center for Quantum Spacetime (CQUeST), Seoul, Korea during May-July 2007.

17. Conferences and Workshops attended/to attend,Visits made/to make

1. "EXTENDED WORKSHOP IN STRING THEORY" held at Harish-Chandra Research Institute, Allahabad, India in November 1999.
2. "MILLENIUM MEETING IN STRING THEORY" held at Jawaharlal Nehru Center, Bangalore, India in January 2000.
3. "SERC SCHOOL IN THEORETICAL HIGH ENERGY PHYSICS" held at Saha Institute of Nuclear Physics, Kolkata, India in February 2000.
4. "STRINGS 2001" held at Tata Institute of Fundamental Research, Mumbai, India in January 2001.

5. "IMSC STRING WORKSHOP" held at Institute of Mathematical Sciences, Chennai, India in November, 2001.

6. " SPRING SCHOOL ON SUPERSTRINGS AND RELATED MATTERS" held at ICTP, Trieste, Italy in March 2002.

7. " WORKSHOP ON STRING THEORY" at the Harish-Chandra Research Institute (HRI), Allahabad, December 12 – 21, 2002.

8. "PASCOS 2003" at Tata Institute of Fundamental Research, Mumbai, India, January 3-8, 2003.

9. "INFN MEETING" at CAPRI, Italy in October 2003.

10. "INFN MEETING" AT PERUGIA, Italy in December 2003.

11. "SPRING SCHOOL ON SUPERSTRINGS AND RELATED MATTERS" held at ICTP, Trieste, Italy in March 2004.

12. "Strings at CERN" held at CERN, Switzerland in July 2004.

13. Visited Institute of Physics, INDIA in August 2004.

14. "SPRING SCHOOL ON SUPERSTRINGS AND RELATED MATTERS" held at ICTP, Trieste, Italy in March 2005.

15. "Advanced String School" held at Institute of Physics, Bhubaneswar, India in September 2006.

16. Visiting scientist at Institute of Physics, Bhubaneswar, India May-July 2008.

17. Participated in 'Strings 2009' held at University of Roma, Tor Vergata, Italy in June 2009

18. Visited University of Genova in June 2009.

19. Participated in National Strings Meeting, held at Indian Institute of Technology Bombay during February 10-15, 2010.

20. Visiting Scientist at CERN, Geneva during December 2010 for 3 weeks.

21. Visited ICTP, Trieste as Junior Associate during May-June 2012 for 6 weeks

22. Participated in Indian Strings Meeting, held at Puri, India during December 16-21, 2012.

23. Visited ICTP, Trieste as Junior Associate during 16 May-22 July 2013.

24. Participated in National Strings Meeting, held at Indian Institute of Technology Kharagpur during December 22-27, 2013.

25. Scientific Visitor at Theroy Division, CERN during 15 May-26 June 2014.

26. "STRINGS 2015" held at International Center for Theoretical Sciences, Bangalore, India in June 2015.

27. "String Theory: Past and Present" held at International Center for Theoretical Sciences, Bangalore, India in January 2017.

28. Scientific visitor at Theory Division CERN, May-June 2018

18. Seminars and Talks

1. Delivered a seminar on "D-brane Bound States from Charged Mcroscopic Strings" in the "IMSC STRING WORKSHOP" held at Institute of Mathematical Sciences, Chennai, India in November, 2001.

2. Delivered a seminar on "D-branes and Noncommutative String Theory" at "Institute of Physics, Bhubaneswar", in February, 2002.

3. Delivered a seminar on "Bound States of String Networks and D-branes" at "University of Roma, Tor Vergata", Italy in March, 2002.

4. Delivered a seminar on "p-p' branes in PP-wave Background" in "Workshop in string theory" at "Harish-Chandra Research Institute (HRI), Allahabad", in December, 2002

5. Delivered a seminar on "Intersecting p-p' branes in PP-wave Background" in "PASCOS 2003" at "Tata Institute of Fundamental Reseacrh, Mumbai, INDIA in January, 2003.

6. Delivered a seminar on "H-deformed branes and Horizons in plane wave Spacetime" at "University of Perugia, Italy, in December 2003.

7. Delivered a seminar on "H-deformed branes and Horizons in plane waves" at "University of Rome, Tor Vergata", Rome, Italy in February 2004.

8. Delivered a seminar on "Rolling branes in Dp-brane background", at "University of Rome, Tor Vergata", Rome, Italy in October 2004.

9. Delivered a seminar on "Rolling Brane Dynamics Near NS5-branes" at Dipartimento di Fisica, Universita di Genova in February 2005.

10. Delivered seminar on "D-brane dynamics in curved backgrounds"
at "Harish-Chandra Research Institute (HRI)", Allahabad, INDIA
at "Indian Institute of Technology (IIT)", Kanpur, INDIA
at "Indian Association for Cultivation of Science (IACS)", Kolkata, INDIA
and at "Institute of Physics", Bhubaneswar, INDIA in August 2005.

11. Delivered a seminar on "D-branes in cosmological backgrounds" at "Institute of Physics", India in March 2006.

12. Delivered a seminar on "D-brane dynamics" at "Institute of Mathematical Sciences", Chennai, India in March 2006.

13. Delivered a seminar on "Geometric tachyon dynamics, and D-branes in a big bang/big crunch universe" at "Center of High Energy Physics (CHEP), Indian Institute of Science", Bangalore, India in July 2006.

14. Delivered a seminar on "D-branes static and dynamics in curved backgrounds" at "Indian Institute of Technology, Guwahati, India in September 2006.

15. Invited seminar on "Lagrangian formulation of Higher spin theories on AdS space" at the international conference (Indian String Meeting (ISM06)) at Puri, India in December 2006.

16. Delivered a seminar on "D-branes in a Null Linear Dilaton Background" at Physics Academy of North East (PANE 07), Gauhati University, India in March 2007

17. Delivered a Seminar on "Massless Higher spin theories on AdS" at Center for Quantum Spacetime, Sogang University, Seoul in June 2007.

18. Delivered a seminar on "On the geometrical tachyon and universal open string tachyon", at Institute of Physics, India in October 2007.

19. Delivered a seminar on " The geometrical tachyon and universal open string tachyon", at Saha Institute of Nuclear Physics, in December 2007.

20. Delivered a seminar on " String theory: Is this a theory of everything ?", at Indian Institute of Science Education and Research (IISER) Kolkata , in February 2008.

21. Delivered a seminar on " Massless Higher Spin theories in AdS space", at S. N. Bose Centre for Basic Sciences, Kolkata in February 2008.

22. Delivered a seminar on "Spiky strings and Wilson loops in AdS(4) x CP**3" at the Department of Physics, University of Genova in June 2009.

23. Delivered a seminar on "AdS/CFT and Semiclassical Strings", at Indian Institute of Science Education and Research (IISER) Thiruvananthapuram, in July 2010.

24. Delivered a seminar on "Rotating Strings in AdS" at the Scuola Normale Superiore, PISA in June 2012.

25. Delivered a seminar on "String Theory and AdS/CFT duality" at the Sambalpur University, India in February 2014.

26. Delivered a seminar on "Semiclassical strings in AdS and AdS/CFT duality" at the Centre for High Energy Physics, Indian Institute of Sciences, Bangalore in July 2014.

27. Delivered a seminar on "Semiclassical strings on AdS x S and its deformations" at Banaras Hindu University in November 2014.

28. Delivered a seminar on "Strings in integrable deformations of AdS5 x S5" at Saha Institute of Nuclear Physics, Kolkata in February 2016.

29. Delivered a seminar on "String side story of AdS/CFT duality at NISER in February 2016.

30. Delivered a seminar on "On the string side of AdS/CFT and their deformations" in the Department of Physics at IIT-Kharagpur in March 2016.

31. Delivered a seminar on "Semiclassical strings and Perturbations" in the Institut fur Mathematik und Physik, Humboldt-Universitat zu Berlin, Germany in June 2018. .

19. List of Referees

1. **Professor Augusto Sagnotti**
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2. **Professor Ignatios Antoniadis**
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3. **Professor Carlo M. Becchi**
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4. **Professor Massimo Bianchi**
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List of Publications

1. A. Chakraborty, N. Padhi, P. Pandit and Kamal L. Panigrahi, "Neumann-Rosochatius system for strings on I-brane," JHEP **12** (2022), 022, [arXiv:2209.09933 [hep-th]].

2. A. Chakraborty, R. R. Nayak, P. Pandit and Kamal L. Panigrahi, "Neumann-Rosochatius system for rotating strings in $AdS_3 \times S^3 \times S^3 \times S^1$ with flux," JHEP **12** (2022), 059, [arXiv:2209.07379 [hep-th]].

3. S. Bhattacharya, S. Kar and Kamal L. Panigrahi, "Perturbations of giant magnons and single spikes in $R \times S^2$," [arXiv:2108.08622 [hep-th]].

4. R. R. Nayak, P. Pandit and Kamal L. Panigrahi,"N-spike string in $AdS_3 \times S^1$ with mixed flux," JHEP **11** (2021), 178, [arXiv:2108.01577 [hep-th]].

5. A. Chakraborty and Kamal L. Panigrahi, "Neumann-Rosochatius system for (m,n) string in $AdS_3 \times S^3$ with mixed flux," Eur. Phys. J. C **81** (2021) no.4, 281, [arXiv:2008.05139 [hep-th]].

6. S. Biswas, P. Pandit and Kamal L. Panigrahi, "N spike D-strings in AdS Space with mixed flux," Eur. Phys. J. C **80** (2020) no.8, 714, [arXiv:2003.08604 [hep-th]].

7. S. Prava Barik, R. R. Nayak and Kamal L. Panigrahi, "On finite-size spiky strings in $AdS_3 \times S^3 \times T^4$ with mixed fluxes,"JHEP **02** (2020), 071, [arXiv:1911.09306 [hep-th]].

8. A. Chakraborty and Kamal L. Panigrahi,"Neumann-Rosochatius system for strings in ABJ Model,"JHEP **12** (2019), 024, [arXiv:1909.12632 [hep-th]].

9. A. Banerjee, S. Biswas, P. Pandit and Kamal L. Panigrahi,"On N-spike strings in conformal gauge with NS-NS fluxes," JHEP **08** (2019), 124, [arXiv:1906.06879 [hep-th]].

10. S. P. Barik and Kamal L. Panigrahi, "Finite size effect from classical strings in $AdS_3 \times S^3$ with NS-NS flux," arXiv:1901.03026 [hep-th].

11. Kamal L. Panigrahi and M. Samal, "Finite Size Effect from Classical Strings in deformed $AdS_3 \times S^3$,"JHEP **1809** 162 (2018) arXiv:1807.04601 [hep-th].

12. A. Banerjee, S. Biswas and Kamal L. Panigrahi, "On multi-spin classical strings with NS-NS flux,"JHEP **1808**, 053 (2018), arXiv:1806.10934 [hep-th].

13. S. Bhattacharya, S. Kar and Kamal L. Panigrahi, "Perturbations of spiky strings AdS_3,"JHEP **1806**, 089 (2018), arXiv:1804.07544 [hep-th].

14. S. P. Barik, Kamal L. Panigrahi and M. Samal, "Spinning pulsating strings in $(AdS_5 \times S^5)_\kappa$,"Eur. Phys. J. **C 78** (2018) no.4, 280, arXiv:1801.04248 [hep-th].

15. S. P. Barik, Kamal L. Panigrahi and M. Samal, "Perturbations of Pulsating Strings," Eur. Phys. J. **C78** (2018) no.11, 882 arXiv:1708.05202 [hep-th].

16. S. Bhattacharya, S. Kar and Kamal L. Panigrahi, "Perturbations of spiky strings in flat spacetimes," JHEP **1701**, 116 (2017).

17. S. P. Barik, M. Khouchen, J. Kluson and Kamal L. Panigrahi, "$SL(2,Z)$ invariant rotating (m,n) strings in $AdS_3 \times S^3$ with mixed flux," Eur. Phys. J. C **77**, no. 5, 298 (2017).

18. A. Banerjee and Kamal L. Panigrahi, "On circular strings in $(AdS_3 \times S^3)_\kappa$," JHEP **1609**, 061 (2016).

19. Kamal L. Panigrahi and M. Samal, "Chaos in classical string dynamics in $\hat{\gamma}$ deformed $AdS_5 \times T^{1,1}$," Phys. Lett. B **761**, 475 (2016).

20. A. Banerjee, K. L. Panigrahi and M. Samal, "A note on oscillating strings in $AdS_3 \times S^3$ with mixed three-form fluxes," JHEP **1511**, 133 (2015).

21. A. Banerjee, S. Bhattacharya, and Kamal L. Panigrahi, "Spiky strings in κ-deformed AdS," JHEP **1506**, 057 (2015).

22. S. Biswas and Kamal L. Panigrahi, "Rotating and Orbiting Strings in Dp-brane background," JHEP **1503** 020 (2015).

23. Kamal L. Panigrahi, P. M. Pradhan and M. Samal, "Pulsating strings on $(AdS_3 \times S^3)_\kappa$," JHEP **1503** 010 (2015).

24. A. Banerjee and Kamal L. Panigrahi, "On the Rotating and Oscillating strings in $(AdS_3 \times S^3)_\kappa$," JHEP **1409** 048 (2014).

25. A. Banerjee, Kamal L. Panigrahi and P. M. Pradhan, "Spiky strings on $AdS_3 \times S^3$ with NS-NS flux," Phys. Rev. D **90**, 10, 106006 (2014).

26. A. Banerjee, S. Biswas and Kamal L. Panigrahi, "Semiclassical Strings in Supergravity PFT," Eur. Phys. J. **C74** (2014) 10, 3115.

27. S. Biswas and Kamal L. Panigrahi, "Semiclassical Strings on Curved Branes," JHEP **1310**, 106 (2013).

28. P. M. Pradhan and Kamal L. Panigrahi, "Pulsating Strings With Angular Momenta,", Phys. Rev. D **88**, 086005 (2013).

29. T. K. Dey and Kamal L. Panigrahi, "Mass Deformed L-BLG Theory From ABJ Theory", Phys. Rev. D **86**, 126007 (2012), arXiv:1209.5216[hep-th]

30. Kamal L. Panigrahi and P. K. Swain, "On the D-brane solutions in Godel Universe", arXiv: 1207.5459 [hep-th].

31. Kamal L. Panigrahi and P. M. Pradhan, "On Rotating and Oscillating Four-Spin Strings in $AdS_5\times S^5$", JHEP **1211**, 053 (2012), arXiv:1206.4920 [hep-th].

32. S. Biswas and Kamal L. Panigrahi, "Spiky Strings on I-brane",JHEP **1208**, 044 (2012), arXiv:1206.2539 [hep-th].

33. Kamal L. Panigrahi, P. M. Pradhan and P. K. Swain, "Three Spin Spiky Strings in β-deformed Background," JHEP **1206** 057 (2012), arXiv:1203.3057 [hep-th].

34. Kamal L. Panigrahi, P. M. Pradhan, P. K. Swain. Rotating Strings in $AdS_4 \times CP^3$ with B-NS holonomy, JHEP **1201** 113, 2012, arXiv:1109.2458 [hep-th].

35. P. S. Kwon, G. Y. Jun, Kamal L. Panigrahi, M. Sami, Inflation driven by single geometric tachyon with D-brane orbiting around NS5-branes, Phys. Lett. **B712** 10, (2012) arXiv:1106.4118 [hep-th].

36. S. Biswas, Kamal L. Panigrahi, Spiky Strings on NS5-branes, Phys. Lett. B701 481, (2011), arXiv:1103.6153 [hep-th].

37. J. Kluson and Kamal L. Panigrahi, T-Duality For String in Horava-Lifshitz Gravity, Eur. Phys. J. C 71, 1595, (2011), arXiv:1006.4530 [hep-th].

38. Kamal L. Panigrahi and S. Roy, Drag force in a hot non-relativistic, non-commutative Yang-Mills plasma, JHEP **1004** 003, 2010, arXiv: 1001.2904 [hep-th].

39. J. Kluson and Kamal L. Panigrahi, Wilson Loops from D-branes in $AdS_4 \times \mathbf{CP}^3$ with B_{NS} holonomy,, Eur. Phys. J. **C67** 565, 2010, arXiv:0906.2148 [hep-th].

40. B. Gwak, B. H. Lee, Kamal L. Panigrahi and C. Park, Semiclassical strings in $AdS_3\times S^2$, JHEP **0904** 071, 2009, arXiv:0901.2795 [hep-th]

41. S. Jain and Kamal L. Panigrahi, Spiky Strings in $AdS_4\times \mathbf{CP}^3$ with Neveu-Schwarz Flux, JHEP **0812** 064, 2008. arXiv:0810.3516 [hep-th].

42. J. Kluson and Kamal L. Panigrahi, Defects and Wilson Loops in 3d QFT from D-branes in $AdS_4 \times \mathbf{CP}^3$, Euro. Phys. J. C **61**, 339, 2009, arXiv:0809.3355 [hep-th]

43. B. H. Lee, Kamal L. Panigrahi, C. Park, Spiky strings on $AdS_4 \times \mathbf{CP}^3$,JHEP **0811** 066, 2008, arXiv:0807.2559 [hep-th].

44. J. Kluson, B. H. Lee, Kamal L. Panigrahi, C. Park, Magnon like solutions for strings in I-brane background, JHEP **0808**, 032 (2008), arXiv:0806.3879 [hep-th].

45. B. H. Lee, R. R. Nayak, Kamal L. Panigrahi, C. Park, On the giant magnon and spike solutions for strings on $AdS_3\times S^3$, JHEP **0806** 065 (2008) arXiv:0804.2923 [hep-th].

46. Kamal L. Panigrahi, and H. Singh, Spinflation from Geometric Tachyon, JHEP **0805**: 088 (2008), arXiv:0802.4230 [hep-th].

47. J. Kluson, and Kamal L. Panigrahi, D1-brane in beta-Deformed Background, JHEP **0711**: 011 (2007), arXiv:0710.0148 [hep-th]

48. Kamal L. Panigrahi, and H. Singh, Assisted Inflation from Geometric Tachyon, JHEP **0711**: 017 (2007) arXiv:0708.1679 [hep-th].

49. J. Kluson, and Kamal L. Panigrahi, On the Universal Tachyon and Geometrical Tachyon, JHEP **0706** :015, 2007 arXiv:0704.3013 [hep-th].

50. J. Kluson, R. R. Nayak, and Kamal L. Panigrahi, Giant Magnon in NS5-brane background, JHEP **0704**: 099,2007 hep-th/0703244.

51. N. Ohta and Kamal L. Panigrahi, Supersymmetric Intersecting Branes in Time-dependent Backgrounds, Phys. Rev. **D74**, 126003 - 126008 (2006) hep-th/0610015.

52. A. Fotopoulos, Kamal L. Panigrahi, M. Tsulaia, Lagrangian formulation of Higher Spin Theories on AdS Space, Phys. Rev. **D 74**, 085029 - 085037 (2006) hep-th/0607248.

53. R. R. Nayak, Kamal L. Panigrahi, and S. Siwach, Time-dependent supergravity solutions in null dilaton background, Phys. Lett. **B640** 214 (2006),arXiv:hep-th/0605278.

54. R. R. Nayak, and Kamal L. Panigrahi, D-brane solutions in a light-like linear dilaton background, Phys. Lett. **B638** 362 (2006), arXiv:hep-th/0604172.

55. J. Kluson, R. R. Nayak, and Kamal L. Panigrahi, D1-brane with Overcritical Electric Field in AdS3 and S-brane, JHEP **05** (2006) 022, arXiv: hep-th/0602211.

56. J. Kluson, R. R. Nayak, and Kamal L. Panigrahi, D-brane dynamics in a plane wave background, Phys. Rev. **D 73**, 066007 (2006), arXiv: hep-th/0512159.

57. J. Kluson, and Kamal L. Panigrahi, Anti-de Sitter D-brane Dynamics, JHEP **0511** (2005) 045, arXiv: hep-th/0509065.

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Research Summary

My research focus of attention is theoretical high energy physics with special interest on relationship between string theory and quantum field theories, so called Gauge-Gravity duality and string inspired cosmology. I have also been interested in D-brane solutions when supersymmetry is broken by some effect like a potential.

- Last few years I have been working on AdS/CFT duality in the sector of semi-classical string states with large quantum numbers. This includes studying string spectrum on AdS backgrounds and their integrable deformations, analyzing multi-spin solitonic string solutions via the AdS/CFT (or string theory/gauge theory) duality. Additionally, the conjecture relates highly nonperturbative problems in gauge theory to questions in classical superstring theory or supergravity. That has opened new ways to address some problems in nonperturbative gauge theory by using string theory methods.

- In the large N limit one can neglect string interactions and consider free string theory. In the strong t' Hooft coupling limit, $\lambda \to \infty$, the string theory is described by type IIB supergravity on $AdS_5 \times S^5$. Many results were obtained in the supergravity approximation. It is very important to go beyond to understand the structure of string theory on $AdS_5 \times S^5$ with flux, and compute its spectrum. The spectrum of states of the string theory determines conformal dimensions of primary operators dual to these string states.

- The spectrum of string states with large R-charges at strong t' Hooft coupling can be analyzed by using semi-classical approach. The spectrum of string states with small R-charges can be found at the strong t' Hooft coupling as an expansion in $\frac{1}{\sqrt{\lambda}}$. The low-lying string spectrum can be computed at small t' Hooft coupling as a power series expansion in λ. This allows us to predict conformal dimensions of operators of $\mathcal{N} = 4$ SYM theory at strong t' Hooft coupling, and perform nontrivial checks of the AdS/CFT correspondence.

- The discovery of integrability structure on both sides of the duality has made the progress faster and more meaningful. The full spectral problem of AdS/CFT is solved by integrability, in the sense that integrability provides the full set of algebraic equations that determine it. Integrability methods are however severely limited in the regime of long, strongly coupled operators, nevertheless teaches us a lot about the string side. Studying string solutions in the string theory side has been tractable and in the limit of large charges, they have been shown to be dual to gauge theory operators.

- Together with the study of lower-dimensional AdS models, like the $AdS_3 \times S^3 \times R^4$, it is also possible to deform the superstring on AdS and its dual $\mathcal{N} = 4$ SYM, to relax some of the symmetries while preserving the integrable structure. This has taught us what the conditions are under which Integrability is still present, and it would

allow us to study cases that are less special than the maximally supersymmetric theory in four dimensions. It is still unclear how to construct the duals of these σ-models, in other words how to deform the $\mathcal{N} = 4$ SYM. It would be extremely interesting and important to build it explicitly.

- Study of string theory on $AdS_3 \times S^3 \times R^4$ with mixed Ramond-Ramond and Neveu-Schwarz- Neveu-Schwarz flux is another interesting subject. The corresponding type IIB supergravity background is the near-horizon limit of the mixed NS5-NS1 + D5-D1 solution that is the basis for an interesting example of AdS/CFT duality. This model has been shown to be classically integrable. We have investigated a large class of string solutions in this background. For the folded strings the corresponding cusp anomalous dimension receives corrections due to the inclusion of the NS-NS flux. The relevance of this is the dual gauge theory needs a better understanding.

- The $AdS_5 \times S^5$ background has been obtained by taking the near horizon limit of a D3-branes stack. Can one get $(AdS_5 \times S^5)_\kappa$ background as a limit of some supergravity solution of "deformed" branes ?

- With the information from the string solutions on $(AdS_5 \times S^5)_\kappa$ can one predict the nature of the operators on the possible dual field theory side, namely how to include the deformation at the level of specific operators ?

- It is a common fact that the phase space of most mechanical systems is not integrable. The general proof of the non integrability of a two dimensional sigma model in arbitrary background can be done by first reducing it to a 1d subsystem and then showing the 1d subsystem is non-integrable. This can be done either by studying string motion in the phase space numerically or by analytic method using normal variational equation(NVE). One can ask whether there is any link between the marginal deformations and the chaos ? whether all marginal deformations lead to chaotic behaviour ? What happens to these classical chaos at the quantum level ? Of course the string trajectories will lead to excitations of heavy string states. Hence in the field theory side they would correspond to operators with very large quantum numbers

- D-branes play very important role in understanding various string dynamics including that of black holes. We are also interested in exploring the behavior of probe branes when supersymmetry is broken by some effects, like a potential. Suppose that the low-energy supergravity acquires a dilaton potential, which in 10D Einstein frame would be $\exp(\frac{3}{2}\phi)$, how would it affect the standard brane solutions ? There is an interesting cosmological dynamics, while static AdS type configurations are generically unstable. We wish to pursue further in this direction as well to study the brane dynamics.

- In the study of tachyon dynamics, in open string theories, construction of various time dependent classical solutions has been an important area of research in the

recent past. These solutions represent the decay of an unstable D-brane or a brane-antibrane pair as the tachyon rolls towards the minimum of the potential. These solutions, in general, are constructed by perturbing the boundary conformal field theory that describes the D-brane by an exact marginal deformation. We have studied rolling radion dynamics of electrified D-brane in NS5-brane background, both in effective field theory and in full open string theory, by constructing the relevant boundary states. By applying Lorentz covariance, we show how the decay of electrified D-brane is related to that of bare D-brane. We compute spectral moments of final state energy and winding quantum number. Using Lorentz covariance argument, we explain in elementary way why winding quantum number should be included and derive rules how to do so.

- The tachyon in the open string theories has been interpreted as an inflaton field and one derives various quantities pertaining to slow roll inflation. We have studied the effect of rolling of N D3-branes in the vicinity of NS5-branes. We find out that this system coupled with the four dimensional gravity gives the slow roll assisted inflation of the scalar field theory. Once again this expectation is exactly similar to that of N-tachyon assisted inflation on unstable D-branes.

- The formulation of string theory in cosmological (or broadly time-dependent backgrounds) has been one of the most exciting and challenging subject. Among other things, it is important to see how the string theory resolves the initial space-like singularities of the early universe. We have investigated the D-branes in a two-dimensional Lorentzian orbifold $R^{1,1}/\Gamma$ with a discrete boost Γ. This space is known as Misner or Milne space, and includes big crunch/big bang singularity. In this space, there are D0-branes in spiral orbits and D1- branes with or without flux on them. In particular, we observe imaginary parts of partition functions, and interpret them as the rates of open string pair creation for D0-branes and emission of winding closed strings for D1-branes. computed and found to be less singular than closed string case. We have further investigated the Nappi-Witten model as a $(SL(2;R) \times SU(2))/(U(1) \times U(1))$ Wess-Zumino-Witten model, that describes a four dimensional anisotropic universe starting at a big bang singularity, expanding for a while and end at a big crunch singularity. It has also regions that contain closed-time-like curves (CTCs). We have investigated, with probe D-branes, the singularities and the CTCs. We show that the D-brane metric from the DBI action does not contain singularities and the wave functions on them are well behaved even in the presence of closed time like curves.

- Massless Higher Spin gauge theories are classical field theories which describe self-interacting massless fields with an arbitrary spin. Being an interesting subject by itself Higher Spin gauge theories recently triggered an increasing interest because of their possible connection with the string and M-theory, namely it has been conjectured that massless Higher Spin theory is the most symmetrical phase of string theory the later being spontaneously broken phase of the former. We have given

an alternative formulation to reducible higher spin fields on AdS which, though describes the same physical polarizations, is new in a sense that it is carried out in a $(D+1)$-dimensional ambient space of a D-dimensional AdS. We have formulated the Lagrangian description of reducible Higher Spin fields in the framework of BRST approach. We believe that this formulation might be useful for further studies of interacting Higher Spin Fields on AdS.