Curriculum Vitae
SAURYA DAS

Personal details
Date of birth: 30 June 1970
Nationality: Canadian, Indian.
Languages: English, Bengali, Hindi (fluent), French (fair)

Current position
Professor of Physics
Department of Physics and Astronomy
University of Lethbridge, Alberta, Canada

Contact information
Department of Physics and Astronomy
University of Lethbridge
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http://scholar.ulethbridge.ca/sauryadas/
https://www.researchgate.net/profile/Saurya_Das

Other/previous positions

- Affiliate member, Perimeter Institute of Theoretical Physics, Waterloo, Ontario, Canada.
- 2008 -2013: Associate Professor of Physics (tenured), University of Lethbridge, Alberta, CANADA. Became a full professor in 2013.
- 2003 - 2008: Assistant Professor of Physics, University of Lethbridge, Alberta, Canada.
- 2002 - 2003: Post Doctoral Fellow at University of New Brunswick, Fredericton, Canada.
- 2000 - 2002: Post Doctoral Fellow at The University of Winnipeg & Winnipeg Institute for Theoretical Physics, Winnipeg, Canada.
- 1998 - 2000: Post Doctoral Fellow at Center for Gravitational Physics and Geometry, The Pennsylvania State University, U.S.A.
- 1994 - 1998: Research Fellow at The Institute of Mathematical Sciences, Chennai, India.

Education and awards

- Ph.D. in Theoretical Physics from The Institute of Mathematical Sciences, Chennai (Madras), India (1999).
- First class in M.Sc. (by research) in Theoretical Physics from The Institute of Mathematical Sciences, Chennai (Madras), India (1994).
- First class in B.Sc. (Physics Honours) from Presidency College, Calcutta, India (1992) - ranked second in the University.
- **Awards:** Best Ph.D. thesis award. Honorable mention in the Gravity Research Foundation Essay Competitions - 2001, 2007 and 2014.

Research Interests

- Cosmology: Dark energy, dark matter, inflation, resolution of singularities.
- Quantum Gravity Theory: Resolution of singularities.
- Quantum Gravity Phenomenology: Experimental signatures of quantum gravity, especially in low energy systems.
- Physics of Black Holes: Entanglement as a source of black hole entropy, information loss problem. Applications of Quantum Information Science.

Publications

Highlights
Number of published papers: 69
(59 in peer-reviewed journals and 10 in refereed conference proceedings)
Total number of citations: 2450
h-index: 23. i10-index: 44. Research Gate (RG) Score: 33.57 (top 7.5 percentile)
Number of papers cited more than 200 times: 01
Number of papers cited more than 150 times: 04
Number of papers cited more than 50 times: 10
3 papers received Honorable Mention in the Gravity Research Foundation Essay Competition (2001, 2007 and 2014).
In addition to quantum gravity and cosmology, I also worked on quantum information theory (Refereed publication [20] and [22].)
Our proposal to implement Deutsch's algorithm in an adiabatic quantum computer (refereed publication no.[20]) was carried out in a two NMR based quantum computer (A. Mitra *et al*, J. Magn. Reson. **177(2)** (2005) 285-298, arXiv: quant-ph/0503060).
Our approach to test quantum gravity effects in the laboratory was applied to quantum optics and gravity wave detection. These results were published in Nature Physics (I. Pikovski et al, **8** (2012) pp.393-397 [arXiv:1111.1979], and Marin et al, **9** (2013) 71-73).

Refereed Publications

[59] "Cosmic coincidence or massive graviton?"
Saurya Das.
Int. J. Mod. Phys. D (to appear), arXiv: 1405.4011
(Received honorable mention in *Gravity Research Foundation Essay Competition 2014*).

[58] "Quantum Raychaudhuri equation."
Saurya Das.
Phy. Rev. **D89** (2014) 084068 [arXiv:1311.6539].

[57] "Entanglement entropy in all dimensions."
Samuel L Braunstein, Saurya Das, S. Shankaranarayanan.
Journal of High Energy Physics 1307 (2013) 130 [arXiv:1110.1239 (hep-th)].

[56] "Can MOND type hypotheses be tested in a free fall laboratory environment? "
Saurya Das, S. N. Patitsas.
Physical Review D87 (2013) 107101 [arXiv:1305.6333 (gr-qc)].

[55] "The Canadian Prairie Theoretical Physics Network: A novel approach to building research and teaching capacity on the Canadian prairies and beyond."

Dinesh Singh, Saurya Das.
Physics in Canada, Vol. 68, No.1, 33-34 (2012).

[54] "Effect of the Generalized Uncertainty Principle on Post-Inflation Preheating."
Wissam Chemissany, Saurya Das, Ahmed Farag Ali, Elias C. Vagenas,
JCAP 1112:017 (2011) [arXiv:1111.7288 (hep-th)].

[53] "Quantum aether and an invariant Planck scale."
Saurya Das, Elias C. Vagenas,
Europhysicsl Letters **96** (2011) 50005 [arXiv:1110.3753 (gr-qc)].

[52] "Planck scale effects on some low energy quantum phenomena."
Saurya Das, R. B. Mann,
Phys. Lett. **B704** (2011) 596-599 [arXiv: 1109.3258 (gr-qc)].

[51] "A proposal for testing Quantum Gravity in the lab."
Ahmed Farag Ali, Saurya Das, Elias C. Vagenas.
Phys. Rev. **D84** (2011) 044013 (10 pages) [arXiv:1107.3164 (hep-th)].
(90+ citations)

[50] "Relativistic particle in a three-dimensional box."
Pedro Alberto, Saurya Das, Elias C. Vagenas .
Physics Letters **A375** (2011) 1436-1440 [arXiv: 1102.3192 (quant-ph)].

[49] "Quantum Gravity Corrections and Entropy at the Planck time."
Spyros Basilakos, Saurya Das, Elias C. Vagenas.
JCAP 1009:027 (2010) [arXiv:1009.0365 (hep-ph)].

[48] "Discreteness of Space from the GUP II: Relativistic Wave Equations."
Saurya Das, Elias C. Vagenas, Ahmed Farag Ali.
Phys. Lett. **B690** (2010) 407-412 [arXiv:1005.3368 (hep-th)].
(90+ citationss+)

[47] "Reply to Comments on "Universality of Quantum Gravity Corrections"".
Saurya Das, Elias C. Vagenas.
Phys. Rev. Lett. **104** (2010) 119002 [arXiv:1003.3208 (hep-th)].

[46] "Discreteness of Space from the Generalized Uncertainty Principle."
Ahmed Farag Ali, Saurya Das, Elias C. Vagenas.
Phys. Lett. **678** (2009) 497-499 [arXiv:0906.5396 (hep-th)]. (150+ citations)

[45] "Universality of Quantum Gravity Corrections."
S. Das, E. C. Vagenas.
Phys. Rev. Lett. **101** (2008) 221301 [arXiv:0810.5333 (hep-th)].
(170+ citations)

[44] "Multiple kinetic k-essence, phantom barrier crossing and stability."
Sourav Sur, Saurya Das.
JCAP 0901:007, 2009 [arXiv:0806.4368(astro-ph)].

[43] "Stability and hierarchy problems in string inspired braneworld scenarios."
Saurya Das, Anindya Dey, Soumitra SenGupta.
Europhys. Lett. **83** (2008) 51002 [arXiv:0704.3119 (hep-th)].

[42] "Cosmological constant, brane tension and large hierarchy in a generalized Randall-Sundrum braneworld scenario."
Saurya Das, Debaprasad Maity, Soumitra SenGupta.
Journal of High Energy Physics (JHEP) 0805 (2008) 042 [arXiv:0711.1744].

[41] "Power-law corrections to entanglement entropy of black holes."
Saurya Das, S. Shankaranarayanan, Sourav Sur.
Phys. Rev. **D77** (2008) 064013 (16 pages) [arXiv:0705.2070 (gr-qc)].
(50+ citations)

[40] "Gravitational non-commutativity and Gödel-like spacetimes."
Saurya Das, Jack Gegenberg.
Gen. Rel. Grav. **40** (2008) 2115-2129 [arXiv:hep-th/0407053].

[39] "Gravitational anomalies: a recipe for Hawking radiation."
Saurya Das, Sean P. Robinson, Elias C. Vagenas.
Int. J. Mod. Phys. **D17** (2008) 533-539 [arXiv:0705.2233 (hep-th)].
This essay received an *Honorable Mention* in the 2007 Essay Competition of the Gravity Research Foundation.
(90+ citations)

[38] "Where are the black hole entropy degrees of freedom ?"
Saurya Das, S. Shankaranarayanan.
Class. & Quant. Grav. **24** (2007) 5299-5306 [arXiv:gr-qc/0703082].

[37] "Gravitational Anomalies, Hawking Radiation, and Spherically Symmetric Black Holes."
Elias C. Vagenas, Saurya Das.
JHEP 0610 (2006) 025 (12 pages) [arXiv:hep-th/0606077].
(Cited 68 times, as of 2012)

[36] "Readdressing the hierarchy problem in a Randall-Sundrum scenario with bulk Kalb-Ramond background."
Saurya Das, Anindya Dey, Soumitra SenGupta.
Class. & Quant. Grav. **23** (2006) L67-L72 [arXiv:hep-th/0511247].

[35] "How robust is the entanglement entropy-area relation?"
Saurya Das, S. Shankaranarayanan.
Phys. Rev. **D73** (2006) 121701-121705 (Rapid Communications) [arXiv:gr-qc/0511066].

[34] "High frequency quasi-normal modes for black holes with generic singularities II: Asymptotically non-flat spacetimes."
Archisman Ghosh, S. Shankaranarayanan, Saurya Das.
Class. & Quant. Grav. **23** (2006) 1851-1874 [arXiv:hep-th/0510186].

[33] "Charged black holes in generalized dilaton-axion gravity."
Sourav Sur, Saurya Das, Soumitra Sengupta.
JHEP **10** (2005) 064 (34 pages) [arXiv:hep-th/0508150].

[32] "High frequency quasi-normal modes for black-holes with generic singularities."
Saurya Das, S. Shankaranarayanan.
Class. & Quant. Grav. **22** (2005) L7-L21 [arXiv:hep-th/0410209].

[31] "Spectrum of rotating black holes and its implications for Hawking radiation."

Saurya Das, H. Mukhopadhyay, P. Ramadevi.
Class. & Quant. Grav. **20** (2005) 453-465 [arXiv:hep-th/0407051].

[30] "How classical are TeV-scale black holes?"
Marco Cavaglià, Saurya Das.
Class. & Quant. Grav. **21** (2004) 4511-4522 [arXiv:hep-th/0404050].
(100+ citations)

[29] "On the Microcanonical Entropy of a Black Hole"
Rajat K. Bhaduri, Muoi N. Tran, Saurya Das.
Phys. Rev. **D69** (2004) 104018-104023 [arXiv:gr-qc/0312023].

[28] "Will be Observe Black Holes in LHC?"
Marco Cavaglià, Saurya Das, Roy Maartens.
Class. & Quant. Grav. **20** (2003) L205-L212 [arXiv:hep-ph/0305223].
(150+ citations)

[27] Entropy Corrections for Schwarzschild and Reissner-Nordström Black Holes. "
M. M. Akbar, Saurya Das
Class. & Quant. Grav. **21** (2004) 1383-1392 [arXiv:hep-th0304076].
(50+ citations)

[26] "Anti-de Sitter black holes, perfect fluids and holography."
Saurya Das, Viqar Husain (hep-th/0303089).
Class. & Quant. Grav. **20** (2003) 4387-4401 [arXiv:hep-th/0303089].

[25] "Varying Fine Structure Constant and Black Hole Physics".
Saurya Das, Gabor Kunstatter.
Class. & Quant. Grav. **20** (2003) 20152-24 [arXiv:hep-th/0212334].

[24] "Discrete Spectra of Charged Black Holes".
Andrei Barvinsky, Saurya Das, Gabor Kunstatter.
Found. Phys. **32** (2002) 1851-1862 [arXiv:hep-th/0209039].

[23] "Quantum Mechanical Spectra of Charged Black Holes".
Saurya Das, P. Ramadevi, U. A. Yajnik, A. Sule
Phys. Lett. **B565** (2003) 201-206 [arXiv:hep-th/0207169].

[22] "Energy and Efficiency of Adiabatic Quantum Search Algorithms"
Saurya Das, Randy Kobes, Gabor Kunstatter.
J. Phys. A: Math. Gen. **36** (2003) 1-7 [arXiv:quant-ph/0204044].

[21] "Black Hole Area Quantization".
Saurya Das, P. Ramadevi, U. A. Yajnik.
Mod. Phys. Lett. **A17** (2002) 993-1000 [arXiv:hep-th/0202076].

[20] "Adiabatic Quantum Computation and Deutsch's Algorithm" .
Saurya Das, Randy Kobes, Gabor Kunstatter.
Phys. Rev. **A65** (2002) 062310-062313 [arXiv:quant-ph/0111032].

[19] "General Logarithmic Corrections to Black Hole Entropy".
Saurya Das, Parthasarathi Majumdar, Rajat K. Bhaduri.
Class. & Quant. Grav. **19** (2002) 2355-2368 [arXiv:hep-th/0111001].

(200+ citations)

[18] "Quantum Mechanics of Charged Black Holes".
Andrei Barvinsky, Saurya Das, Gabor Kunstatter.
Phys. Lett. **B517** (2001) 415-420 [arXiv:hep-th/0102061].
(60+ citations)

[17] "Can Black Holes Decay into Naked Singularities?"
Saurya Das, Jack Gegenberg, Viqar Husain.
Int. J. Mod. Phys. **D10** (2001) 807-810 [arXiv:gr-qc/0107072].
This essay received an *Honorable Mention* in 2001 Gravity Research Foundation Essay competition.

[16] "Scalar Field Spacetimes and the AdS/CFT Correspondence".
Saurya Das, Jack Gegenberg, Viqar Husain.
Phys. Rev. **D64** (2001) 065027-065031 [arXiv:hep-th/0101169].

[15] "Spectrum of Charge Black Holes - The Big Fix Mechanism Revisited".
Andrei Barvinsky, Saurya Das, Gabor Kunstatter.
Class. and Quant. Grav. **18** (2001) 4845-4862 [arXiv:gr-qc/0012066].
(80+ citations)

[14] "Conserved Quantities in Kerr-anti-de Sitter Spacetimes in Various Dimensions".
Saurya Das, Robert B. Mann.
JHEP **0008** (2000) 033 (11 pages) [arXiv:hep-th/0008028].
(70+ citations)

[13] "A New Holographic Entropy Bound from Quantum Geometry".
Saurya Das, Romesh K Kaul, Parthasarathi Majumdar.
Phys. Rev. **D 63** (2001) 044019-044022 [arXiv:hep-th/0006211].
(70+ citations)

[12] "Statistical Entropy of Schwarzschild Black Strings and Black Holes".
Saurya Das, Amit Ghosh, P. Mitra.
Phys. Rev. **D 63** (2001) 024023-024026 [arXiv:hep-th/0005108].

[11] "Asymptotically Anti-de Sitter Space-times: Conserved Quantities".
Abhay Ashtekar, Saurya Das.
Class. & Quant. Grav. **17** (2000) L17-L30 [arXiv:hep-th/9911230].
(170+ citations)

[10] "Black Hole Emission Rates and the AdS/CFT Correspondence"
Saurya Das, Arundhati Dasgupta.
Journal of High Energy Physics **9910** (1999) 025 (30 pages) [arXiv:hep-th/9907116].

[9] "Planckian Scattering of D-branes."
Saurya Das, Arundhati Dasgupta, P. Ramadevi, Tapobrata Sarkar.
Phys. Lett. **B 428** (1998) 51-58 [arXiv:hep-th/9801184].

[8] "High Energy Effects on D-Brane and Black Hole Decay Rates. "
Saurya Das, Arundhati Dasgupta, Tapobrata Sarkar.
Phys. Rev. **D55** (1997) 7693-7700 [arXiv:hep-th/9702075].

[7] "Can Extremal Black Holes Have Non-Zero Entropy? "
Saurya Das, Arundhati Dasgupta, P. Ramadevi.
Mod. Phys. Lett. **A 12** (1997) 3067-3080 [arXiv:hep-th/9608162].

[6] "Planckian Scattering from Kerr Black Holes: Eikonal and Beyond."
Saurya Das, R. Parthasarathy .
Gen. Rel. Grav. **29** (1997) 1545-1556 [arXiv:hep-th/9603007].

[5] "Eikonal Particle Scattering and Dilaton Gravity."
Saurya Das, Parthasarathi Majumdar.
Phys. Rev. **D55** (1997) 2090-2098 [arXiv:hep-th/9512209].

[4] "Aspects of Planckian Scattering Beyond the Eikonal."
Saurya Das, Parthasarathi Majumdar.
Pramana **51** (1998) 413-419 [arXiv:hep-th/9504060].

[3] "Shock Wave Mixing in Einstein and Dilaton Gravity".
Saurya Das, Parthasarathi Majumdar.
Phys. Lett. **B 348** (1995) 349-354 [arXiv:hep-th/9411129].

[2] "Electromagnetic and Gravitational Scattering at Planckian Energies."
Saurya Das, Parthasarathi Majumdar.
Phys. Rev. **D51** (1995) 5664-5675 [arXiv:hep-th/9411061]

[1] "Electromagnetic Charge Monopole versus Gravitational Scattering at Planckian Energies."
Saurya Das, Parthasarathi Majumdar.
Phys. Rev. Lett. **72** (1994) 2524-2526 [arXiv:hep-th/9307182].

Refereed Conference Proceedings

[10] "Phenomenological Implications of the Generalized Uncertainty Principle."
Saurya Das, Elias C. Vagenas.
Invited talk given by SD at 'Theory Canada IV, Montreal, Canada, June 4-7, 2008.
Can. J. Phys. **87** (2009) 233-240 [arXiv:0901.1768 (hep-th)].
Note: This was the most cited paper in Can. J. Phys. during 2009-2010
(80+ citations))

[9] "Black hole entropy from entanglement: A review." Saurya Das, S. Shankaranarayanan, Sourav Sur.
Invited Review in book: Classical and Quantum Gravity Research Progress, Nova Publishers (2008) [arXiv:0806.0402].

[8] "Power-law corrections to black-hole entropy via entanglement"
Saurya Das, S. Shankaranarayanan, Sourav Sur.
To appear in the Proceedings of "BH2, Dynamics and Thermodynamics of Blackholes and Naked Singularities", May 10-12 2007, Milano, Italy [arXiv:0711.3164 (gr-qc)].

[7] "Where are the degrees of freedom responsible for black hole entropy?"
Saurya Das, S. Shankaranarayanan, Sourav Sur.
Invited talk given by SD at 'Theory Canada III, Edmonton, Canada, June 14-16, 2007.
Can. J. Phys. **86(4)** (2008) 653-658 [arXiv:0708.2098 (gr-qc)].

[6] "Entanglement as a source of black hole entropy. "
Saurya Das, S. Shankaranarayanan.
Invited talk given by SD at 'Recent Developments in Gravity' (NEB XII), Nafplion, Greece, 30 June 2006.
J. Phys. Conf. Ser. **68** (2007) 012015 [arXiv:gr-qc/0610022].

[5] "Randall-Sundrum with Kalb-Ramond field: return of the hierarchy problem?"
Saurya Das, Anindya Dey, Soumitra SenGupta.
Contributed talk given by SD at 'Recent Developments in Gravity' (NEB XII), Nafplion, Greece, 30 June 2006.
Refereed Proceedings published in J. Phys. Conf. Ser. **68** (2007) 012009 [arXiv:gr-qc/0610021].

[4] "Is entanglement entropy proportional to area?"
Morteza Ahmadi, Saurya Das, S. Shankaranarayanan.
Invited talk given by SD at 'Theory Canada I', Vancouver, Canada, June 2-5, 2005.
Refereed Proceedings published in Can. J. Phys. **84(S2)** (2006) 1-7 [arXiv:hep-th/0507228]

[3] "Black Hole Thermodynamics: Entropy, Information and Beyond."
Saurya Das.
Plenary talk given by SD at 'Fifth International Conference on General Relativity and Cosmology (ICGC)', Cochin, India Jan 5-10 2004.
Pramana **63** (2004) 797-816 [arXiv:hep-th/0403202].

[2] "Rapid Data Search using Adiabatic Quantum Computation".
Daria Ahrensmeier, Saurya Das, Randy Kobes, Gabor Kunstatter, Haitham Zaraket.
Proceedings of 6th International Conference on Quantum Communication, Measurement and Computing, M.I.T., July 22-26, 2002 [arXiv:quant-ph/0208107].

[1] "Eikonal Approach to Planck Scale Physics."
Saurya Das.
Plenary talk given at XVIII Conference of the Indian Association for General Relativity and Gravitation, Madras, February 15-17, 1996 [arXiv:hep-th/9607006].

Publications under peer review

[3] "Dark energy and dark matter from Bose-Einstein condensate."
Saurya Das, Rajat K. Bhaduri.
arXiv:1411.0753 (Submitted to Phys. Lett. B.)

[2] "Cosmology from quantum potential."
Ahmed Farag Ali, Saurya Das.
arXiv:1404.3093 (Submitted to Phys. Rev. D.)

[1] "Generalized Uncertainty Principle and Self-Adjoint Operators."
Venkat Balasubramanian, Saurya Das, Elias C. Vagenas.
arXiv:1404.3962 (submitted to Ann. Phys.)

Supervision

Post-doctoral fellows
(co-supervised with Prof. M. W. Walton)

3. **Pablo Diaz Benito** (2015-).

2. **Wissam Chemissany** (2008-2010). Currently Research Associate at Standford Institute for Theoretical Physics, Stanford University.

1. **Sourav Sur** (2006-2008). Currently Assistant Professor at Delhi University, India.

Ph.D. students

2. **Ali Nassar** (2009-2013). Currently Post-Doctoral Fellow at Center for Theoretical Physics, Zewail University of Science and Technology, Egypt.

1. **Ahmed Farag Ali** (2008-2012). Currently Assistant Professor at Center for Theoretical Physics, Zewail University of Science and Technology, Egypt.

M.Sc. students

3. **Soumen Deb** (2012-2014). Expected to graduate in December 2014.

2. **Steve Sidhu** (2010-2012) (co-supervised with Prof. M. W. Walton). Currently ATG Cyclotron operator at TRIUMF, Vancouver.

1. **Morteza Ahmadi** (2004-2006). Currently Ph.D. candidate at Advanced Micro & Nano Devices Lab, Department of Systems Design Engineering, University of Waterloo, Canada.

Undergraduate students

6. Physics and Astronomy Arvid Schultz Fellows (co-supervised with other departmental members): **Andrew Robb** (2014), **Brent Peterson** (2010), **Tory Oravec** (2009).

5. **Oba Powis** (2012 and 2013). Co-supervised with Prof. S. N. Patitsas. Currently English Teacher in Japan.
Oba worked on a Theoretical and Experimental Project (on a Table-top experiment proposed by S. Das and S. N. Patitsas, in refereed publication no.[56]).

4. **Venkat Balalsubramanian** (2011). Currently Ph.D. student of Applied Mathematics at University of Western Ontario, Canada.
Venkat co-authored a research paper based on his work done under my supervision (Paper no. 1 under peer-review).

3. **Archisman Ghosh** (2005). Currently Post-doctoral fellow at the International Centre for Theoretical Sciences, Tata Institute of Fundamental Research, Bangalore, India.
Archisman co-authored a research article based on his work done under my supervision (Refereed publication no.[34]).

2. **Surhud More** (2004). Co-supervised with Prof. M. W. Walton. Currently KIPMU Fellow at the Kavli Institute for the Physics and Mathematics of the Universe at the University of Tokyo, Japan.
Surhud authored a research paper based on his work done under my supervision, Class. Quant. Grav. **22** (2005) 4129-4140 [arXiv:gr-qc/0410071].

1. **Crystal Genert** (2004). Currently High School Physics Teacher in Calgary, AB.

Research Grants

Natural Sciences and Engineering Research Council of Canada (NSERC): I have been continuously funded since my first appointment as a faculty member at the University of Lethbridge in 2003 (average grant per year: $23,000).

Funds from the offices of the Dean and VP (Research), University of Lethbridge : $90,000, to hire post-doctoral fellows Dr. Sourav Sur and Dr. Pablo Diaz Benito.

University of Lethbridge Research Fund (ULRF): I have been awarded the ULRF three times, in 2004, 2010 (jointly with Prof. K. Peacock) and 2012 (jointly with Prof. S. N. Patitsas). Total grant amount: $18,000.

University of Lethbridge Teaching Development Fund (ULTDF): Awarded in 2004 for developing a new course (*Contemporary Physics*), which is a required course for all Physics majors. Grant amount: $3,000.

University of Lethbridge start up fund: Awarded in 2003. Grant amount: $10,000.

University of Lethbridge Travel Funds: Awarded many times, to travel to conferences. Total grant amount: $10,000 (approximately).

Teaching
I have taught the following courses at the University of Lethbridge unless stated otherwise:

[1] Physics 1000: **Introduction to Physics I**
(Spring 2004, 2008, 2009, Fall 2004, 2005, 2007, 2008, 2009, 2011).

[2] Physics 2000: **Introduction to Physics II**
(Spring 2007).

[3] Math 2213: **Linear Algebra**
(Summer 2002 at The University of New Brunswick).

[4] Physics 2150: **Quantum Mechanics I**
(Spring 2012, 2014).

[5] Physics 3150: **Quantum Mechanics II**
(Fall 2010, 2012, 2014).

[6] Physics 3031: **Mathematical Methods of Theoretical Physics**
(Fall 2002 at The University of New Brunswick).

[7] Physics 3200: **Classical Mechanics**
(Fall 2003, 2005, 2009, 2011, 2012).

[8] Physics 3750: **Contemporary Physics**
(Spring 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014).

[9] Physics 3840, Physics 5840, Physics 7840: **Computational Physics**
(Spring 2004, 2006. A combined undergraduate and graduate course).

[10] Physics 4175: **The Electromagnetic Interaction**
(Fall 2004, 2007, 2008,2010).

[11] Physics 5990: **Theoretical Physics: General Relativity**
(Fall 2004. A graduate course.).

[12] Physics 7990: **Advanced Theoretical Physics**
(A graduate course. Fall 2004.).

[13] Physics 7850: **Theoretical Physics I**
(A gaduate course - Spring 2011, 2015).

Seminars, colloquia etc.

Plenary/Invited Talks

Institute of Quantum Science and Technology, University of Calgary, 15 October 2014.
Black Holes IX, University of Saskatchewan, 15 May 2013.
Universities Physics Seminar Series Talks, Universities of Saskatchewan and Regina, February 2011.
Chandrayana (commemorating 100th birthday anniversary of Astrophysicist and Nobel Laureate Subrahmanyan Chandrasekhar), Chennai, India, 06 January 2011.
Max-Planck Institute for the History of Physics, Berlin, Germany, 2011.
Canadian Association of Physicists Annual Congress, Toronto, Canada, June 2010.
Theoretical Physics Institute, University of Alberta, 2010.
Institute of Quantum Information Science, University of Calgary, 18 November, 2009; November 2003.
National University of Singapore, 5 August, 2009.
University of Madrid, 2009.
Indian Statistical Institute, Kolkata, 30 July 2009.
J C Bose Institute, Kolkata, India, 14 August 2009.
Time and Universe (TaU) Workshop, 12 June 2008.
New Developments in Gravity (**NEB XII**), Nafplion, Greece, 29 June-2 July, 2006.
Field Theoretic Aspects of Gravitation V, Goa, India, 18-23 December, 2006.
APCTP-TPI Meeting on Gravity, Cosmology and Astrophysics - II, University of Alberta, Edmonton, Canada, 18-23 December, 2006 (declined).
Canadian Association of Physicists Lecture Tour Speaker for Saskatchewan (Universities of Regina and Saskatchewan), March 2006, British Columbia (Universities of British Columbia, Victoria, Northern British Columbia and Simon Fraser University), January-February 2008, Ottawa (University of Ottawa and Carleton University), March 2009, March 2010, Manitoba (University of Winnipeg, Brandon University, University of Manitoba).
April 2011, University of Alberta.
International Centre for Theoretical Physics, Trieste, Italy, 6 July 2006.
University of New Brunswick, November 2006 (two talks).
Theory Canada I, University of British Columbia, Vancouver, 3 June, 2005, Theory Canada III, University of Alberta, 16 June 2007, **Theory Canada IV**, Université de Montreal, 6 June 2008, **Theory Canada V**, University of New Brunswick, 6 June 2009.
Canadian Association of Physicists Annual Congress, Winnipeg, 16 June 2004, Toronto, June 2010.
Physique Théorique et Mathématique, Université Libre de Bruxelles, Belgium, 18 February 2004.
Quantum Information Science Group, University of Calgary, 26 March 2004.
World Year of Physics Einstein Celebrations, Univerity of Calgary, 18 November 2005.
International Conference on Gravitation and Cosmology, Cochin, India, January 2004.
St. Xavier's College, Kolkata, India, August 2010.
Indian Association for the Cultivation of Science, Kolkata, India, July 2003, January 2004, August 2004, August 2005, January 2007, August 2007, August 2009.
Saha Institute of Nuclear Physics, Kolkata, India, July 2003, August 2004, August 2005, August 2009.
S N Bose National Centre for Basic Sciences, August 2005.
Jadavpur University, Kolkata, India, July 2003 and July 2004.
Atlantic Canada Gravity Conference, Fredericton, New Brunswick, May 2000, April 2004

and April 2005.
XVIII Conference of the Indian Association for General Relativity and Gravitation, Chennai, February 1996.

Invited Colloquia

Lethbridge Astronomical Society, 28 April 2006.
Indian Institute of Technology, Roorkee, July 2005.
Indian Institute of Technology, Kanpur, July 2005.
Bengal Engineering and Science University, August 2005.
Un3iversity of Calgary, 24 October 2003.
University of Lethbridge, 6 November 2003.
The University of Winnipeg, March 2001.
Variable Energy Cyclotron Centre, Kolkata, India, January 2001.
Jadavpur University, Kolkata, India, January 2001.

Seminars

Perimeter Institute, Waterloo, Canada, 14 December 2004, 15 June 2006 and 9 November 2006, 20 February 2014 .
Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, 3 July 2003, July 2006.
Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge, UK, January 2003.
European Centre for Nuclear Research (CERN), Geneva, Switzerland, January 2003.
University of Portsmouth, UK, January 2003.
Spinoza Institute, University of Utrecht, The Netherlands, June 2001.
Max-Planck Institut für Gravitationphysik (Albert Einstein Institut), Golm, Germany, June 2001 and June 2010.
Princeton University, Stanford University, Calteech, ICTP, Penn State, Ecole Polytechnique, Saclay, University of Maryland, Syracuse University, City University of New York, Universities of Waterloo, Rome II, Pisa, Winnipeg, Tata Institute of Fundamental Research, Mumbai, Harish Chandra Research Institute, Saha Institute of Nuclear Physics, Kolkata, India, S N Bose Center for Basic Sciences, Kolkata, India, Centre for Theoretical Studies, Bangalore, India (1997-2000).

Organized conferences etc.

Co-organizer of **13th Canadian Conference on General Relativity and Relativistic Astrophysics**, Calgary, May 2009, the **First meeting of CPTPN, Lethbridge, August 2010**, **Theory Canada 7, Lethbridge, June 2012**.

Helped establish the **Theoretical Physics Group** at the Dept of Physics and Astronomy, University of Lethbridge (2008), **The Canadian Prairie Theoretical Physics Network (CPTPN)**, 2009.

Refereeing and Thesis Examiner

Referee for Phys. Rev. Lett., Phys. Rev. A and D, Phys. Lett. A and B, J. Phys. A, JHEP, CJAP, Mod. Phys. Lett. A, Int. J. Mod. Phys., Found. Phys., Int. J. Theo. Phys., Can. J. Phys., Gen. Rel. Grav.

External thesis examiner for 10 Ph.D. students (national and international).

Dated: 05 November 2014