

Curriculum Vitae

SAURYA DAS

Personal details

Date of birth: 30 June 1970

Citizenship: Canadian

Languages: English, Bengali, Hindi (fluent), French (functional)

Current position

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

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Other/previous positions

- Affiliate Member, Perimeter Institute of Theoretical Physics, Waterloo, Canada.
- Theme Leader, *Quantum Foundations and Quantum Gravity*, Quantum Alberta (Universities of Alberta, Calgary and Lethbridge).
- Full Professor of Physics University of Lethbridge, Alberta, Canada.
- 2008 - 2013: Associate Professor of Physics (tenured), University of Lethbridge, Alberta, Canada.
- 2003 - 2008: Assistant Professor of Physics, University of Lethbridge, Alberta, CANADA.
- 2002 - 2003: Postdoctoral Fellow at University of New Brunswick, Fredericton, Canada.
- 2000 - 2002: Postdoctoral Fellow at The University of Winnipeg & Winnipeg Institute for Theoretical Physics, Winnipeg, CANADA.
- 1998 - 2000: Postdoctoral Fellow at The 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, India (1999).
- First class in M.Sc. (by research) in Theoretical Physics from Anna University, Chennai, India (1994).
- First class in B.Sc. (Physics Honours) from Presidency College, University of Calcutta, Kolkata, India (1992) - ranked second in the University.

- **Awards:** Best Ph.D Thesis Award. Honorable Mention in the Gravity Research Foundation Essay Competitions - 2001, 2007, 2014, 2015, 2016.

Research interests

- Cosmology: Dark energy, dark matter, inflation, resolution of singularities.
- Quantum gravity phenomenology: Experimental signatures of quantum gravity, especially in low energy systems.
- Quantum gravity theory: Resolution of singularities.
- Physics of black holes: Entanglement as a source of black hole entropy, information loss problem. Applications of quantum information science.

Brief description of research

My research has focussed on aspects of quantum gravity, black hole physics and cosmology. Some of my significant contributions have been in the following areas:

Corrections to black hole entropy: We showed that thermodynamic fluctuations of a black hole gives rise to corrections which always go as the logarithm of horizon area. Thus we were able to explain for the first time why corrections of this nature were obtained earlier, irrespective of the underlying quantum gravity theory being used to compute those corrections (Das, Majumdar, Bhaduri, *Class. Quant. Grav.* **19** (2002) 2355).

Black holes in LHC: We studied corrections to black hole production and decay rates in the LHC due to thermodynamic fluctuations, and the generalized uncertainty principle (GUP). Experiments looking for such black holes in the LHC and other accelerators would need to take these corrections into account (Das, Cavaglia, Maartens, *Class. & Quant. Grav.* **20** (2003) L205-L212; Das, Cavaglia, *Class. & Quant. Grav.* **21** (2004) 4511-452).

Quantum gravity phenomenology: Despite the immensity of the Planck energy scale, we noted that Planck scale effects can induce corrections to low energy quantum systems and phenomena (such as Lamb shift, Landau levels, scanning tunneling microscope, superconductivity, quantum Hall effect etc.) via the GUP, some of which can be at the threshold of current experimental accuracies. We also showed that the GUP implied that measured lengths, areas and volumes are quantized near the Planck scale. This points towards fundamental discreteness of space at short distances (Das, Vagenas, *Phys. Rev. Lett.* **101** (2008) 221301; Ali, Das, Vagenas, *Phys. Lett.* **B678** (2009) 497-499).

Singularity resolution, dark matter and dark energy: It has always been expected that quantum mechanics would resolve classical spacetime singularities. In a recent paper (Das, *Phys. Rev.* **D89** (2014) 084068) it was shown that this can happen in a simple manner: by replacing classical geodesics with quantal (Bohmian) trajectories in the Raychaudhuri equation (which predicts that all classical geodesics are incomplete and spacetime is singular via the Hawking-Penrose singularity theorems), and showing that these quantal trajectories are in fact complete. In other words, the quantal trajectories of fundamental particles in nature will go on forever, and will never encounter any singularities. Further, this also gives rise to a new quantum potential which translates into a cosmological constant term in the Friedmann equations, which govern the evolution of our Universe. As few reasonable assumptions about the quantum wavefunction, i.e. it is homogeneous and isotropic at large scales, consistent with the cosmological principle) and that it represents a condensate of gravitons or axions with a small mass, consistent with all theories and observations, then correctly reproduces the small observed cosmological constant (dark energy) in nature (Ali, Das, *Phys. Lett.* **B741** (2015) 276). We also calculated the critical temperature of this condensate

and argued that this must have formed in the very early universe, and may also account for the observed dark matter (Das, Bhaduri, *Class. & Quant. Grav.* **32** 2015 105003).

Entanglement as a source of black hole entropy: We showed that while the ground states of quantum fields traced across a horizon gives the area law, excited states result in power law corrections to this law. We showed that most of the entanglement entropy arose from degrees of freedom closest to the horizon, and that the well-known divergence of this entropy in higher dimensions can be cured by computing the Renyi entropy instead of the von Neumann entropy (Das, Shankaranarayanan, *Sur, Phys. Rev.* **D77** (2008) 064013; Braunstein, Das, Shankaranarayanan, *JHEP* 1307 (2013) 130).

I also worked in **Quantum information theory**. My collaborators and I showed that the Deutsch algorithm can be efficiently implemented in an adiabatic quantum computer, and that speed-ups of the search problem can be achieved by choosing novel adiabatic Hamiltonians (Das, Kobes, Kunstatter, *J. Phys. A: Math. Gen.* **36** (2003) 1, *Phys. Rev.* **A65** (2002) 062310).

Publications

Highlights

Number of published papers: 98

(86 in peer-reviewed journals and 12 in refereed conference proceedings, invited reviews and white papers)

Total number of citations: 3140

h-index: 33. i10-index: 67. Research Gate (RG) Score: 37.74 (top 5 percentile)

Number of papers cited more than 200 times: 07

Number of papers cited more than 100 times: 05

Number of papers cited more than 50 times: 08

7 papers received Honorable Mention in the Gravity Research Foundation Essay Competition (2001, 2007, 2014, 2015, 2016 2018 and 2020).

In addition to quantum gravity and cosmology, I also worked on quantum information theory (Refereed publications [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).

Media

Nature Asia: *New origin of universe model pours water on Big Bang theory*, by Zeeya Merali, January 2015.

Ebela (Kolkata, India): January 2015, by Madhumita Dutta.

phys.org: *No Big Bang? Quantum equation predicts universe has no beginning*, by Lisa Zyga, February 2015.

Live Science: *Big Bang, Deflated? Universe May Have Had No Beginning*, by Tia Ghose, February 2015.

Daily Mail, UK: *Did the Big Bang ever happen?*, by Ellie Zolfagharifard, February 2015.

Toronto Star: *Canadian scientists take aim at Big Bang Theory*, by Peter Edwards, February 2015.

Scientific American: *What 2016 Holds for the Mysterious World of Physics*, by Tia Ghose, January 2016.

Nautilus: *Why Our Universe Doesn't Have a Birthday?*, by Susie Nelson, January 2016.

The Meliorist (University of Lethbridge student newspaper): *Two questions on Life, The Universe and Everything*, by Drew Dennis, April 2015.

The Endeavour (Lethbridge College student newspaper): *Local professor asks big questions*, by Sarah Redekop, April 2016.

Refereed Publications

- [86] “Cosmological Complexity.”
Arpan Bhattacharyya, Saurya Das, S. Shajidul Haque, Bret Underwood.
Phys. Rev. **D 101**, 106020 (2020) [arXiv:2001.08664].
- [85] “Polymer quantization and advanced gravitational wave detector.”
D. Jaffino Stargen, S. Shankaranarayanan, Saurya Das. Phys. Rev. **D100**, 086007 (2019) [arXiv:1907.05863].
- [84] “Constraints and Horizons for de Sitter with Extra Dimensions.”
Saurya Das, S. Shajidul Haque, Bret Underwood.
Phys. Rev. **D 100**, 046013 (2019) [arXiv:1905.05864].
- [83] “Dark Matter as a Non-Relativistic Bose-Einstein Condensate with Massive Gravitons.”
Emma Kun, Zoltán Keresztes, Saurya Das, László Á. Gergely.
Symmetry **10**, 520 (2018) [arXiv:1905.04336].
- [82] “Lorentz invariant mass and length scales.”
Pasquale Bosso, Saurya Das.
Int. J. Mod. Phys. **D28**, 1950068 (2019) [arXiv:1812.05595].
- [81] “Relativistic Generalized Uncertainty Principle.”
Vasil Todorinov, Pasquale Bosso, Saurya Das.
Ann. Physics **405**, 92-100 (2019) [arXiv:1810.11761].
- [80] “Comments on ”Schwinger’s Model of Angular Momentum with GUP” by H. Verma et al,
arXiv:1808.00766.”
Pasquale Bosso, Saurya Das.
Euorphysics Letters, vol.175, n.1, 10002 (2019) [arXiv:1809.02605].
- [79] “Generalized ladder operators for the perturbed harmonic oscillator.”
Pasquale Bosso, Saurya Das.
Ann. Physics **396**, 254-265 (2018) [arXiv:1808.10505].
- [78] “Dimensional reduction via a novel Higgs mechanism.”
Saurya Das, Mir Faizal.
Gen. Rel. Grav. **50**, 87 (2018) [arXiv:1806.07520].
- [77] “Renormalizing gravity: a new insight into an old problem.”
Saurya Das, Mir Faizal, Elias C. Vagenas.
Int. J. Mod. Phys. **D27**, 1847002 (2018) [arXiv:1805.05665].
- [76] “Potential tests of the Generalized Uncertainty Principle in the advanced LIGO experiment. ”
Pasquale Bosso, Saurya Das, Robert B. Mann.
Phys. Lett. **B** (to appear) [arXiv:1804.03620].
- [75] “Towards the Raychaudhuri Equation Beyond General Relativity.”
Daniel J Burger, Saurya Das, S. Shajidul Haque, Nathan Moynihan, Bret Underwood.

Phys. Rev. **D98**, 024006 (2018) [arXiv:arXiv:1802.09499].

[74] “Relativistic particle in a box: Klein-Gordon vs Dirac Equations.”
Pedro Alberto, Saurya Das, Elias C. Vagenas.
Eur. J. Phys. **35**, No.2, 025401 [arXiv:1711.06313].

[73] “Gravitation as a source of decoherence.” Saurya Das, Matthew P. G. Robbins, Elias C. Vagenas.
Int. J. Mod. Phys. **D27**, No. 01, 1850008 (2018) [arXiv:1709.07154].

[72] “Planck scale Corrections to the Harmonic Oscillator, Coherent and Squeezed States.”
Pasquale Bosso, Saurya Das, Robert B. Mann.
Phys. Rev. **D96**, 066008 (2017) [arXiv:1704.08198].

[71] “Reply to ”Comment on ”Quantum Raychaudhuri Equation”.”
Saurya Das.
Phys. Rev. **D95**, 068502 (2017) [arXiv:1702.05219].

[70] “Amplified transduction of Planck-scale effects using quantum optics.”
Pasquale Bosso, Saurya Das, Igor Pikovski, Michael R. Vanner.
Phys. Rev. A **96**, 023849 (2017) [arXiv: 1610.06796]

[69] “The central role of symmetry in physics.”
Saurya Das, Gabor Kunstatter.
Invited review article for the Journal of Applied and Fundamental Sciences (Assam Don Bosco University, India). Journal of Applied and Fundamental Sciences (Assam Don Bosco University, India), Vol.2(2), 69-77 (2016) [arXiv: 1609.02038].

[68] “Generalized Uncertainty Principle and Angular Momentum.”
Pasquale Bosso, Saurya Das.
Annals of Physics **383** (2017) 416-438 (2017) [arXiv: 1607.01083].

[67] “Stringent theoretical and experimental bounds on graviton mass.”
Ahmed Farag Ali, Saurya Das.
to appear in Int. J. Mod. Phys. **D25** (2016) 1644001 [arXiv:1605.05928]
(Received honorable mention in *Gravity Research Foundation Essay Competition 2016*).

[66] “Discreteness of Space from GUP in a Weak Gravitational Field.”
Soumen Deb, Saurya Das, Elias C. Vagenas.
Phys. Lett. B **755** (2016) 17 [arXiv:1601.07893].

[65] “Time crystals from minimum time uncertainty.”
Faizal Mir, Mohammed M. Khalil, Saurya Das.
Eur. Phys. J. **C76** (2016) 30 [arXiv:1501.03111].

[64] “Bose-Einstein condensation as an alternative to inflation”
Saurya Das.
Int. J. Mod. Phys. **D24** (2015) 1544001 [arXiv: 1509.02658]
(Received honorable mention in *Gravity Research Foundation Essay Competition 2015*).

- [63] “Generalized Uncertainty Principle Corrections to the Simple Harmonic Oscillator in Phase Space”
Saurya Das, Matthew P. G. Robbins, Mark A. Walton.
Can. J. Phys. **94**(1) (2016) 139-146 [arXiv:1412.6467].
- [62] “Dark energy and dark matter from Bose-Einstein condensate.”
Saurya Das, Rajat K. Bhaduri.
Class. Quant. Grav. **32** (2015) 105003 [arXiv:1411.0753].
- [61] “Generalized Uncertainty Principle and Self-Adjoint Operators.”
Venkat Balasubramanian, Saurya Das, Elias C. Vagenas.
Ann. Phys. **360** (2015) 1-18 [arXiv:1404.3962].
- [60] “Cosmology from quantum potential.”
Ahmed Farag Ali, Saurya Das.
Phys. Lett. **B741** (2015) 276 [arXiv:1404.3093].
- [59] “Cosmic coincidence or massive graviton?”
Saurya Das.
Int. J. Mod. Phys. **D23** (2014) 1442017 [arXiv: 1405.4011]
(Received honorable mention in *Gravity Research Foundation Essay Competition 2014*).
- [58] “Quantum Raychaudhuri equation.”
Saurya Das.
Phys. 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].
- [56] “Can MOND type hypotheses be tested in a free fall laboratory environment? ”
Saurya Das, S. N. Patitsas.
Phys. Rev. **D87** (2013) 107101 [arXiv:1305.6333].
- [55] “The Canadian Prairie Theoretical Physics Network: A novel approach to building research and teaching capacity on the Canadian prairies and beyond.”
Dinesh Singh and 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].
- [53] “Quantum aether and an invariant Planck scale.”
Saurya Das, Elias C. Vagenas,
Europhysics Letters **96** (2011) 50005 [arXiv:1110.3753].
- [52] “Planck scale effects on some low energy quantum phenomena.”
Saurya Das, R. B. Mann,
Phys. Lett. **B704** (2011) 596-599 [arXiv: 1109.3258].
- [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].
 (145+ 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].
 (140+ citations)
- [47] “Reply to Comments on “Universality of Quantum Gravity Corrections””.
 Saurya Das, Elias C. Vagenas.
 Phys. Rev. Lett. **104** (2010) 119002 [arXiv:1003.3208].
- [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].
 (225+ citations)
- [45] “Universality of Quantum Gravity Corrections.”
 Saurya Das, Elias C. Vagenas.
 Phys. Rev. Lett. **101** (2008) 221301 [arXiv:0810.5333].
 (400+ 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].
- [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].
 (85+ 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.
- [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].
 (90+ citations)
- [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].
 (135+ 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].
 (180+ 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.
 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) 2015-2023 [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].
 (250+ citations)
- [18] “Quantum Mechanics of Charged Black Holes”.
 Andrei Barvinsky, Saurya Das, Gabor Kunstatter.
 Phys. Lett. **B517** (2001) 415-420 [arXiv:hep-th/0102061].
 (90+ 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].
(90+ 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].
(80+ 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].
(75+ 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].
(225+ 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, invited reviews and White papers

[12] “Probing the Nature of Black Holes: Deep in the mHz Gravitational-Wave Sky.”
Vishal Baibhav et al (I am one of the co-authors).
White paper submitted to ESA’s Voyage 2050 on behalf of the LISA Consortium 2050 Task Force.

[11] “Bose-Einstein condensate in cosmology.”
Saurya Das, Rajat K. Bhaduri.
Invited review written for the special issue of **Physics News 40** (no.2-3), 81 (2019) on the occasion of 125th. birthday anniversary of S. N. Bose.

[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.
Refereed Proceedings published in 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 (100+ citations).

[9] “Black hole entropy from entanglement: A review.”
Saurya Das, S. Shankaranarayanan, Sourav Sur.
Invited Review. To appear in the edited book: Classical and Quantum Gravity Research Progress, Nova Publishers (2008) [arXiv:0806.0402 (gr-qc)].

[8] “Power-law corrections to black-hole entropy via entanglement”
Saurya Das, S. Shankaranarayanan, Sourav Sur.
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.
Proceedings published in 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.

Refereed Proceedings published in 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.

Refereed Proceedings published in 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.

Refereed 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].

Supervision

Post-doctoral fellows

(co-supervisor Prof. M. A. Walton)

3. Pablo Diaz Benito (2015-).

2. Wissam Chemissany (2008-2010). Currently Postdoctoral Fellow at the Institute of Theoretical Physics, University of Hannover, Germany.

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

Ph.D. students

5. Mitja Fridman (2020-).

4. Vasil Todorinov (2018-).

3. Pasquale Bosso (2015-2017).

2. Ali Nassar (2009-2013). Co-supervisor Prof. M. A. Walton. 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 Centre for Theoretical Physics, Zewail University of Science and Technology, Egypt.

M.Sc. students

5. Matthew Robbins (2015-). Co-supervisor Prof. M. A. Walton.

4. Braden Wiens (2015-). Co-supervisor Prof. S. N. Patitsas.
3. Soumen Deb (2012-2014).
2. Steve Sidhu (2010-2012) Co-supervised with Prof. M. A. Walton. Currently ATG Cyclotron operator at TRIUMF, Vancouver.
1. Morteza Ahmadi (2004-2006) (Ph.D. 2013, University of Waterloo). Founder, Qidni labs, Waterloo, Canada.

Undergraduate students

7. Dylan Sutherland (2018-2019), Dylan worked with S. Shankaranarayanan and myself on black hole thermodynamics, with a MITACS Globalink scholarship. With help of the scholarship, Dylan visited IIT-Bombay, India, for 6 months, as part of the research project.
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-supervisor Prof. S. N. Patitsas. Currently pursuing graduate studies at the University of Toronto. 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 (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. A. Walton. Currently Project Assistant Professor 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 2004 by NSERC Discovery Grants (average grant per year: \$24,000).

I am one of 9 Principal Investigators of the “Quantum Technologies Project” under the Major Innovation Fund of Economic Development, Trade and Tourism, Government of Alberta. Total approved grant amount: \$5.6 million over three years (2019-2022).

University of Lethbridge Research Fund (ULRF): I have been awarded the ULRF four times, in 2004, 2010 (jointly with Prof. K. Peacock), 2012 (jointly with Prof. S. N. Patitsas) and 2018 (jointly with Prof. M. Walton). Total grant amount: \$27,000.

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: \$12,000.

University of Lethbridge Travel Funds: Awarded several times. 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, Spring 2018).
- [2] Physics 2000: **Introduction to Physics II**
(Spring 2007).
- [3] Math 2213: **Linear Algebra**
(Summer 2002 at The University of New Brunswick).
- [4] Physics 3031: **Mathematical Methods of Theoretical Physics**
(Fall 2002 at The University of New Brunswick).
- [5] Physics 2150: **Quantum Mechanics I**
(Spring 2012, 2016).
- [6] Physics 2800: **Methods in Mathematical Physics**
(Fall 2016, 2018).
- [7] Physics 3150: **Quantum Mechanics II**
(Fall 2010, 2012, 2014, 2016).
- [8] Physics 3200: **Classical Mechanics**
(Fall 2003, 2005, 2009, 2011, 2012).
- [9] Physics 3750: **Contemporary Physics**
(Spring 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019).
- [10] Physics 3840, Phys 5840, Phys 7840: **Computational Physics**
(Spring 2004, Spring 2006. A combined undergraduate and graduate course).
- [11] Physics 4175: **The Electromagnetic Interaction**
(Fall 2004, 2007, 2008, 2010).
- [12] Physics 5990: **Theoretical Physics: General Relativity**
(Fall 2004. A graduate course.).
- [13] Physics 7990: **Advanced Theoretical Physics**
(Fall 2004. A graduate course).
- [14] Physics 4850/5850/7850/5300/7300: **Theoretical Physics I & II**
(Graduate course - Spring 2011 - Spring 2019. Teaching duties shared with two-three other theoreticians).

Seminars, colloquia etc.

Plenary/Invited Talks

- University of Saskatchewan (28 November 2017).
- Winnipeg Institute of Theoretical Physics (01 October 2015) and University of Winnipeg (02 October 2016).
- Theory Canada 10, Calgary, 12 June 2015.
- Professor Shyamal Sengupta Memorial Lecture, January 2016 (declined).
- 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, University 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.
 University 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.

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 Gravitationsphysik (Albert Einstein Institut), Golm, Germany, June 2001.

Princeton University, Stanford University, CALTECH, 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).

Conferences, Workshops etc: (Presented contributed talk in each of the following)

12th Marcel Grossman Meeting, Paris, 15 July 2009.

The Dark Side of Extra Dimensions, Banff, 13 May 2005.

Black Holes III (Kananaskis, 2001), Black Holes IV (Honey Harbour, 2003) and Black Holes V (Banff, 2005), Black Holes VI (White Point, NS, 2008), Black Holes VII (Banff, 2009).

Canadian Conferences on General Relativity and Relativistic Astrophysics (Edmonton 2001, Guelph 2003, Winnipeg 2014).

Canadian Association of Physicists Annual Congress (Quebec City, 2002 & 2008, Charlottetown, Prince Edward Island, 2003, Moncton, NB, 2009, Calgary 2012).

Workshop on Strong Gravitational Fields (ITP, Santa Barbara, April 1999).

Sixth International Conference on Quantum Communication, Measurement and Computing (M.I.T., 2002).

Spinoza Meeting on Gravitation (Utrecht, 1998).

Spring School on String Theory, Gauge Theory and Quantum Gravity (ICTP, Trieste, 1995, 1996 and 1998).

Atlantic Canadian GR meeting (Antigonish, NS, 2001; Fredericton NB, 2004, 2005).

Heuristics in Physics (a workshop on the history and philosophy of physics), Bad Honnef, Germany, December 2010.

Workshop on the History of Quantum Gravity, Berlin, Germany, June 2011.

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 15 Ph.D. students (national and international).

Dated: 01 May 2020