

## Curriculum Vitae

### MUSTAPHA ISHAK-BOUSHAKI, Ph.D., Associate Professor

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Languages: English, French, and Arabic



### Educational History:

Ph.D. in Cosmology (2003), Queen's University at Kingston, Canada  
B. Sc. In Physics (1998), University of Montreal, Montreal, Canada  
B. A. Sc. in Computer Sciences (1994), University of Quebec at Montreal, Canada

### Previous Employment History – principal academic positions since the Bachelor's degree:

Research Associate, 01-01-2003 to 07-31-2005, Princeton University, New Jersey, USA  
Lecturer, Fall 2003 and Spring 2004, Princeton University, New Jersey, USA  
Research Assistant, 07-01-1998 to 12-31-2002, Queen's University, Kingston, Canada  
Teaching assistant 07-01-1998 to 12-31-2002, Queen's University, Kingston, Canada

### Professional recognitions, honors, memberships, etc., (study, teaching, research, service):

2007 Award for Outstanding Teacher of the Year from the School of Natural Sciences and Mathematics. University of Texas at Dallas

2008 Journal paper selected by Prof. Gerardus 't Hooft (Nobel Laureate in Physics 1999) on the *Chief Editor List* (June 2008) of the *Foundation of Physics Journal*. Article title: *Remarks on the formulation of the cosmological constant/dark energy questions*. Mustapha Ishak. *Foundation of Physics Journal*, 37:1470-1498, (2007).

2002-2004 Postdoctoral Fellowship for Excellence in Research and Leadership from the Natural Sciences and Engineering Research Council of Canada (NSERC).

2002 Journal Paper voted by the Editorial Board of *Classical and Quantum Gravity Journal* as one of the journal's highlights of 2002. Article title: *Interactive Geometric Database, Including Exact Solutions of Einstein's Field Equations*, Mustapha Ishak and Kayll Lake, *Classical and Quantum Gravity* 19, 505 (2002).

2001-2002 Ontario Graduate Scholarship, Queen's University, Kingston, Ontario, Canada.

2000-2001 Ontario Graduate Scholarship in Science and Technology, Queen's University, Kingston, Ontario, Canada.

1999-2000 Queen's Graduate Award, Queen's University, Kingston, Ontario, Canada.

1998-1999 Dean's Graduate Award, Queen's University, Kingston, Ontario, Canada.

## Grants (total of ~\$700K as PI)

PI, National Science Foundation AAG program, to start in 2011 (3 years) (Project in Astrophysics and Gravitational Lensing)

PI, Department of Energy, Theory, to start in 2010 (3 years) (Project in Cosmology and Dark Energy)

PI, NASA Astrophysics Theory Program, to start in 2009 (3 years) (Project in Cosmology and Cosmic Acceleration)

PI, Texas Space Grant Consortium, to start in 2008 (Research Project in Astrophysics and Cosmic Acceleration)

PI, From Corporate Sector – Frito-Lay, 2008 (Research Project I in Gravity & statistics)

PI, From Corporate Sector – Frito-Lay, 2009 (Research Project II in Gravity & statistics)

PI, Hoblitzelle foundation, 2006 (Grant to build a Computer Cluster)

## Research interests:

- The Acceleration of the expansion of the Universe: Cosmological Constant, Dark Energy, ...
- Gravitational Lensing and applications to cosmology
- Constraining cosmological parameters and cosmological models using probes such as gravitational lensing, the cosmic microwave background (CMB), and supernova searches.
- General Relativity and Cosmological Exact Solutions to Einstein's Equations
- Projects at the intersection of modern cosmology and General Relativity
- Junction conditions for matching spacetimes and constructing wormholes and thin-shells
- Computer Algebra (symbolic computing) and application to cosmology and general relativity

## Teaching experience:

### The University of Texas at Dallas

Spring 2010 PHYS2325 Mechanics; PHYS5349 Cosmology

Fall 2009 PHYS2325 Mechanics; PHYS3312 Classical Mechanics

Spring 2009 PHYS2325-001 Mechanics; PHYS2325-002 Mechanics;

Fall 2008 PHYS2325 Mechanics; PHYS2325 Classical Mechanics

Spring 2008 PHYS2325 Mechanics; PHYS2325 Mechanics

Fall 2007 PHYS3312 Classical Mechanics; PHYS5349 Cosmology

Spring 2007 PHYS2325 Mechanics and Heat; PHYS2325 Mechanics and Heat

Fall 2006 PHYS2325 Mechanics and Heat; PHYS3312 Classical Mechanics

Spring 2006 PHYS2325 Mechanics and heat; PHYS5V49 Cosmology

Fall 2005 PHYS2325 Mechanics and Heat,

### Princeton University

Spring 2004 AST203: The Universe,

Fall 2003 PHYS103: General Physics,

### Queen's University, Kingston, Ontario, Canada

1998-2001 Teaching assistant and laboratory demonstrator for several physics courses including: PHY106, PHY107, PHY113, PHY414

### University of Quebec in Montreal, Canada

1990-1992 Teaching assistant and demonstrator for several computer science courses including: INF1000, INF1090, INF3200, INF4200

## **Students supervision and mentoring:**

### **Recently Graduated Ph.D. Students:**

James Richardson (graduated in 2008). Working in the corporate sector.

Jacob Moldenhaeur (graduated in 2010). Assistant Professor at Francis Marion University, SC.

### **Current Ph.D. students:**

Jason Dossett (Ph.D. graduation planned for 2013) supported by DOE Fellowship

Anthony Nwankwo (Ph.D. graduation planned for December 2011) supported by NASA grant

Austin Peel (Ph.D. graduation year 2014) supported by DOE grant

Michael Troxel (Ph.D. graduation year 2014) supported by NSF grant

Tharake Wijenayake (Ph.D. graduation year 2015) new student TA

### **Part-time Ph.D. students:**

Chris Allison

Jeffrey Scott

Brian Troup

### **Undergraduate student supervision:**

Katherine Morgan (undergraduate Thesis/research, 2006)

Lee Isaac Trawick, (undergraduate Thesis/research, 2006)

Wendy Gartenberg, (undergraduate Thesis/research, 2007)

John Wilson (undergraduate Thesis/research, 2007)

Jason Dossett, (undergraduate Thesis/research, 2007 and 2008)

Tan Lee, (undergraduate Thesis/research, 2008)

Austin Peel (undergraduate Thesis/research, 2007)

John Thompson (Undergraduate Thesis/Research, 2008)

### **High-school students summer internships:**

Tim Carlton summer 2006

Ray Whitside, summer 2007

Sid Mittal, summer 2008

Parker Maginley, summer 2008

Brandyn Lee, summer 2009

Scott Meesse, summer 2009

Genway Huang, summer 2010

Evan Remmele, summer 2011

### **Current and Previous Professional Affiliations:**

American Astronomical Society

American Physical Society

Canadian Astronomical Society

Canadian Physical Society

### **National and International Service contributions:**

Served as proposal reviewer for National Science Foundation (NSF) - Astronomy and Astrophysics Research Grants program.

Served as proposal reviewer for NASA Astronomy and Astrophysics Postdoctoral Program.

Served as proposal reviewer for Research Foundation of Canada/Quebec for Natural Sciences and Technology

### **University Service Contributions:**

Member of the University Academic Senate  
Member of the Senate Advisory Committee on Research  
Member of the Physics Department committee on undergraduate curriculum and education  
Member of the Physics Graduate Admission Committee  
Member of the Physics Department committee for standard test evaluation  
Outside Chair for Ph.D. Final Examinations

### **Journal Referee for:**

Physical Review Letters; Physical Review D; Astronomy & Astrophysics; Classical and Quantum Gravity; Monthly Notices of Royal Astronomy Society; General Relativity and Gravitation; Euro-Physics Letters

### *The Cosmology, Relativity, and Astrophysics group at UT Dallas*

Dr. Ishak-Boushaki formed a research group in cosmology at UT Dallas with currently 4 full-time graduate students, 3 part-time graduate students, and 2 undergraduate students. All are attending the weekly cosmology research meetings and working on specific projects with Ishak-Boushaki. Ishak-Boushaki is very grateful for the continuous encouragement and help from good colleague Dr. Wolfgang Rindler.



From left to right: Dr. Mustapha Ishak-Boushaki, Jacob Moldenhauer, James Richardson, Chris Allison, Jason Dossett, Jeffrey Scott, David Garred, Delilah Whittington, Anthony Nwankwo, Brian Troup, and Dr. Wolfgang Rindler.

## Journal Papers (incomplete list):

- "***The growth of structure in the Szekeres inhomogeneous cosmological models and the matter-dominated era***", Mustapha Ishak, Austin Peel. Submitted to **JCAP** (2011). Paper available at astro-ph:arXiv:1104.2590
- "***Figures of merit and constraints from testing General Relativity using the latest cosmological data sets including refined COSMOS 3D weak lensing***", Jason Dossett, Jacob Moldenhauer, Mustapha Ishak. Published in **Physical Review D 84, 023012 (2011)**. Paper available at astro-ph:arXiv:1006.0014.
- "***The Relevance of the Cosmological Constant for Lensing***", Mustapha Ishak, Wolfgang Rindler, Jason Dossett. Invited Review Article Published in **General Relativity and Gravitation** 42: 2247-2268 (2010). Paper available at astro-ph:arXiv:1006.0014.
- "Luminosity distance and redshift in the Szekeres inhomogeneous cosmological models ", Anthony Nwankwo, Mustapha Ishak, John Thompson. Published in **JCAP (2011)**. Paper available at astro-ph:arXiv:1006.0014.
- "***Constraints on growth index parameters from current and future observations***", Jason Dossett, Mustapha Ishak, Jacob Moldenhauer, Yungui Gong, Anzhong Wang. Published in **JCAP 1004:022 (2010)**. Paper available at astro-ph:arXiv:1004.3086.
- "***Supernova, baryon acoustic oscillations, and CMB surface distance constraints on  $f(G)$  higher order gravity models***", Jacob Moldenhauer, Mustapha Ishak, John Thompson, Damien A. Easson. Published in **Physical Review D 81, 063514 (2010)**. Paper available at astro-ph:arXiv:1004.2459.
- "***A minimal set of invariants as a systematic approach to higher order gravity models II: Physical and Cosmological Constraints***" Jacob Moldenhauer, Mustapha Ishak.. Published in **Journal of Cosmology and Astroparticle Physics 0912: 020 (2009)**. Paper available at astro-ph:arXiv:0912.5332.
- "***Contiguous redshift parameterizations of the growth index***", Mustapha Ishak, Jason Dossett. **Physical Review D 80, 043004 (2009)**. arXiv:0905.2470v2 [astro-ph].
- "***Growth factor parameterization in curved space***", Yungui Gong, Mustapha Ishak, Anzhong Wang, 2009. **Physical Review D 80, 023002 (2009)**. arXiv:0903.0001v1 [astro-ph].
- "***A minimal set of invariants as a systematic approach to higher order gravity models***", Mustapha Ishak, Jacob Moldenhauer. Published in **Journal of Cosmology and Astroparticle Physics 01: 024 (2009)**. Paper available at the Los Alamos Archive Server as astro-ph:arXiv:0808.0951.
- "***Dark Energy or Apparent Acceleration Due to a Relativistic Cosmological Model More Complex than FLRW?***" Mustapha Ishak, James Richardson, David Garred, Delilah Whittington, Anthony Nwankwo, Roberto Sussman, Published in **Physical Review D, 78, 123531, (2008)**. Paper available at the Los Alamos Archive Server as astro-ph/0708.2943.

- ***“Light Deflection, Lensing, and Time Delays from Gravitational Potentials and Fermat’s Principle in the Presence of a Cosmological Constant”***. Mustapha Ishak. . Published in **Physical Review D**, **78**, 103006, (2008). Paper available at the Los Alamos Archive Server as arXiv:0801.3514v2 [astro-ph].
- ***“A new independent limit on the cosmological constant/dark energy from the relativistic bending of light by Galaxies and clusters of Galaxies”*** Mustapha Ishak, Wolfgang Rindler, Jason Dossett, Jacob. Moldenhauer, Chris Allison. Published in **Monthly Notices of the Royal Astronomical Society**, **Volume 388**, **3**, 1279 (2008). Paper available at the Los Alamos Archive Server as arXiv:0801.3514v2 [astro-ph].
- ***“Inverse approach to Einstein’s equations for fluids with vanishing anisotropic stress tensor”*** James Richardson, Mustapha Ishak. Published in **Physical Review D** **77**, 044005, 2008. Paper available at the Los Alamos Archive Server as gr-qc/0707.1351.
- ***“Remarks on the formulation of the cosmological constant/dark energy questions.”*** Mustapha Ishak. Published in **Foundation of Physics Journal**, **37**:1470-1498,2007. Paper available at the Los Alamos Archive Server as astro-ph/0504416.
- ***“Intrinsic galaxy alignments from the 2SLAQ and SDSS surveys: luminosity and redshift scalings and implications for weak lensing surveys”***. Christopher M. Hirata, Rachel Mandelbaum, Mustapha Ishak, Uros Seljak, Robert Nichol, Kevin A. Pimblet, Nicholas P. Ross, David Wake. Published in **Monthly Notices of the Royal Astronomy Society Journal** **volume 381**, 1197-1218 (2007). Paper available at the Los Alamos Archive Server as astro-ph/0701671.
- ***“The Contribution of the Cosmological Constant to the Relativistic Bending of light Revisited.”*** Wolfgang Rindler and Mustapha Ishak. **Physical Review D**, **76**, 043006 (2007). Paper available at the Los Alamos Archive Server as arXiv:0709.2948v1 [astro-ph]
- ***“ Probing Cosmic Acceleration Beyond the Equation of State: Distinguishing between Dark Energy and Modified Gravity Models”*** Mustapha Ishak, Amol Upadhye, David N. Spergel. Paper available at astro-ph/0507184. **Physical Review D**, **74**, 043513 (2006).
- ***“Detection of large scale intrinsic ellipticity-density correlation from the Sloan Digital Sky Survey and implications for weak lensing surveys”*** Rachel Mandelbaum, Christopher M. Hirata, Mustapha Ishak, Uros Seljak, Jonathan Brinkmann. **Monthly Notices of the Royal Astronomical Society**, **367** (2006) 611-626. Paper available at Los Alamos Archive Server as astro-ph/0509026.
- ***“Probing decisive answers to dark energy questions from cosmic complementarity and lensing tomography”*** Mustapha Ishak (2005). **Monthly Notices of the Royal Astronomical Society**, **V363**, issue 2, p469 (2005). Paper available at Los Alamos Archive Server as astro-ph/0501594.
- ***“Dynamical dark energy: Current constraints and forecasts”*** Amol Upadhye, Mustapha Ishak, Paul J. Steinhardt (2004). **Physical Review D**, **72**, 063501 (2005). Paper available at Los Alamos Archive Server as astro-ph/0411803.
- ***“Spectroscopic source redshifts and parameter constraints from weak lensing and CMB.”*** Mustapha Ishak and Christopher M. Hirata. **Physical Review D**, **71**, 023002 (2005). Paper available at Los Alamos Archive Server as astro-ph/0405042.

- **"On Perfect Fluid Models In Non-Comoving Null (Observational) Spherical Coordinate,"** Mustapha Ishak, **Physical Review D**, **69**, 124027 (2004). Paper available at Los Alamos Archive Server as gr-qc/0405099.
- **"Weak Lensing and CMB: Parameter forecasts including a running spectral index,"** Mustapha Ishak, Christopher M. Hirata, Patrick McDonald, Uros Seljak. **Physical Review D**, **69**, 08314 (2003). Paper available at Los Alamos Archive Server as astro-ph/0308446.
- **"An Inverse Approach to Einstein's Equations for non-conducting fluids,"** Mustapha Ishak and Kayll Lake (2003). **Physical Review D**, **68**, 104031 (2003). Paper available at Los Alamos Archive Server as gr-qc/0304065.
- **"Adiabatic Models of the Cosmological Radiative Era,"** Roberto A. Sussman and Mustapha Ishak. **General Relativity and Gravitation**, Vol. **34**, No. **10**, (2002). Paper available at Los Alamos Archive Server as gr-qc/0111010.
- **"Stability of Transparent Spherically Symmetric Thin Shells and Wormholes,"** Mustapha Ishak and Kayll Lake. **Physical Review D**, **65**, 044011 (2002). Paper available at Los Alamos Archive Server as gr-qc/0108058.
- **"Interactive Geometric Database, Including Exact Solutions of Einstein's Field Equations,"** Mustapha Ishak and Kayll Lake, **Classical and Quantum Gravity** **19**, 505-514 (2002). Paper available at Los Alamos Archive Server as gr-qc/0111008. Paper voted by the Editorial Board of Classical and Quantum Gravity Journal as one of the highlights of 2002.
- **"The Tolman VII solution, trapped null orbits and w-modes,"** Nicholas Neary, Mustapha Ishak and Kayll Lake. **Physical Review D**, **64**, 028001 (2001). Paper available at Los Alamos Archive Server as gr-qc/0104002.
- **"Exact solutions with w-modes,"** Mustapha Ishak, Luke Chamandy, Nicholas Neary and Kayll Lake. **Physical Review D**, **64**, 024005 (2001). Paper available at Los Alamos Archive Server as gr-qc/0007073.

#### Articles published in proceedings volumes:

- Ishak, Mustapha; Richardson, James; Garred David; Whittington Delilah; Nwankwo Anthony; Sussman Roberto. 2010.  
Apparent Acceleration Due to Relativistic Cosmological Models More Complex than FLRW as a Possible Alternative to Dark Energy. **Proceedings of the 12<sup>th</sup> Marcel Grossmann Meeting on General Relativity**, eds. T.Damour, R.Jantzen and R. Ruffini, World Scientific, Singapore, 2010.
- Ishak, Mustapha. 2010  
A brief discussion of cosmic acceleration and dark energy problems. **African skies** 14: 9-12 (2010). **Proceedings of the Auresian Workshop on Astronomy and Astrophysics**, Batna, Edited by Peter Martinez, 2010.
- Ishak, Mustapha; Chamandy, Luke; Lake, Kayll. 2000.  
Exact Solutions with w-modes: Scattering of gravitational waves By neutron stars. **Proceedings of the 20th Texas Symposium on Relativistic Astrophysics**, American Institute of Physics. Editors J.C.Wheeler and H. Martel, 2000.

- Sussman, Roberto; Ishak, Mustapha. Inhomogeneous Cosmologies with Adiabatic Evolution. ***Proceedings of Developments in Mathematical and Experimental Physics, Volume A: Cosmology and Gravitation***. Edited by A. Macias, F. Uribe and E. Diaz. Published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002, p.285.
- Ishak, Mustapha; Musgrave, Peter; Mourra, John; Stern, Jonathan; Lake, kayll. 1999. GRLite and GRTensorJ: Graphical User Interfaces to the Computer Algebra System GRTensorII, ***Proceedings of the Eight Canadian Conference on General Relativity and Relativistic Astrophysics***, American Institute of Physics. Editors C.P.Burgess and R.C.Myers, 1999.

### **Selected talks, presentations, Seminars, or Colloquia (incomplete):**

- “Why is cosmic expansion accelerating?” Colloquium at Baylor University (Baylor, TX, 2011)
- Colloquium at the University of Texas at Brownsville, Brownsville, TX, 2010. Why is the expansion of the universe accelerating? One of the biggest puzzles in cosmology!
- Public Lecture to the Texas Astronomy Society, University of Texas at Dallas, Richardson, TX, 2010. Why is the expansion of the universe accelerating?
- Colloquium at the University of Texas at Arlington, Arlington, TX, 2010. Why is the expansion of the universe accelerating? One of the biggest puzzles in cosmology!
- Conference of the American Astronomical Society, AAS Meeting #215, Washington DC, 2010. On The Growth Rate Index Parameter and Cosmic Acceleration.
- Conference for the Advancement of Science Teaching. Colleyville, Texas. 2010. Cosmology and Our Universe: Why Dark Energy and is it Real?
- Sixteenth Annual Meeting of the Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching. Austin. 2010. Cosmology and Our Universe: Why Dark Energy, and is it Real?
- “Apparent Acceleration Due to Relativistic Cosmological Models More Complex than FLRW as a Possible Alternative to Dark Energy”. 12th Marcel Grossmann Meeting on General Relativity and Gravitation, (Paris, 2009)
- “Dark Energy or Apparent Acceleration Due to a Relativistic Cosmological Model More Complex than FLRW?” Colloquium at Baylor University (Baylor, TX, 2009)
- “The Contribution of The Cosmological Constant/Dark Energy to The Bending of Light Revisited: Applications To Gravitational Lensing, Time Delays and an Upper-bound on The Cosmological Constant”. Presentation at the Conference of the American Astronomical Society, AAS Meeting #212, (St-Louis, MI, 2008).

- “Dark Energy or Apparent Acceleration Due to a Relativistic Cosmological Model More Complex than FLRW?”. Presentation at the Conference of the American Astronomical Society, Meeting #211, (Austin, TX, 2008).
- “The Contribution of The Cosmological Constant/Dark Energy to The Bending of Light and its Applications”. Presentation at the 2008 Joint Fall Meeting of the Texas and Four Corners Sections of APS, AAPT, SPS, and the Societies of Hispanic & Black Physicists (EL-Paso, TX, 2008)
- Cosmic Acceleration: A Review. Distinguished speaker at the Auresian Workshop on Astronomy and Astrophysics. (University of Batna, 2008)
- “The Contribution of The Cosmological Constant/Dark Energy to The Bending of Light Revisited: Applications To Gravitational Lensing, Time Delays and an Upper-bound on The Cosmological Constant”. Talk at the Conference of the American Astronomical Society (St-Louis, 2008).
- “The Contribution of The Cosmological Constant/Dark Energy to The Bending of Light and its Applications.” Presentation at the 2008 Joint Fall Meeting of the Texas and Four Corners Sections of APS, AAPT, SPS, and the Societies of Hispanic & Black Physicists (EL-Paso, 2008)
- Dark Energy or Apparent Acceleration Due to a Relativistic Cosmological Model More Complex than FLRW?. Talk at the Conference of the American Astronomical Society (AAS), #211, (Austin, 2008).
- “Dark Energy versus Modified Gravity Models: Probing Cosmic Acceleration Beyond the Equation of State”. Talk selected at the Origin of Dark Energy Conference, Waterloo, ON, (May 2007).
- “Dark Energy versus Modified Gravity Models: Probing Cosmic Acceleration Beyond the Equation of State” at the AAS/AAPT Joint Meeting, of the American Astronomical Society, (Seattle, 2007).
- “Cosmic acceleration: Dark Energy or Modified gravity?” Colloquium given at NASA Goddard Space Flight Center, Baltimore, MA (June, 2006).
- “Cosmic Acceleration: A Dark Energy Component or a Signature of Modified Gravity at Cosmological Scales?” Colloquium given at the Southern Methodist University, Dallas, TX (October 2006).
- “Gravitational Weak Lensing and Cosmic Acceleration” Seminar given at the 1st Texas Cosmology Network Meeting at the University of Texas at Austin, Austin, TX (September, 2006).
- “Recent progress in cosmology and the cosmic acceleration problem” Colloquium given at the Physics Department at Austin College, Sherman, TX. (November 2005).
- “Probing decisive answers to dark energy questions from cosmic complementarity and lensing tomography”, Selected talk at the 3rd Oxford-Princeton Workshop on Cosmology, (Princeton, 2005).

- "Dark Energy Questions and Cosmological Probe" Colloquium given at the Physics Department of the University of Texas at Dallas, Dallas, (February 2005).
- "Dynamical Dark Energy: Current and future constraints from cosmic complementarity and weak lensing tomography" Workshop on Gravitational Lensing, Dark Energy, and Dark Matter at the Ohio Center for Theoretical Science. The Ohio State University, Columbus, OH, (January 2005).
- "Model-dependent and independent constraints on dark energy from weak lensing (cosmic shear) tomography". Seminar given at the Gravitational Lensing Workshop at the Institute for Advanced Studies, Princeton-IAS, NJ, (2004).
- "Future constraints on Dark Energy from complementary observations and weak lensing tomography (a critical discussion)" Seminar given at the Princeton University & Institute for Advanced Studies joint Gravitational Lensing Seminar. Princeton, NJ, (2004).
- "How and when are we going to constrain dark energy parameters to a satisfactory level of precision?" Talk given at the International Workshop on Particle Physics and the Early Universe (COSMO-04), organized by CITA, Toronto, ON, (2004).
- "Inverse Problems In General Relativity and the Cosmic Acceleration." Seminar given at the Gravity Group at Princeton University, Princeton, NJ, (2003).
- "From Inverse Problems In General Relativity to a Possible Solution to the Cosmic Acceleration Problems" Talk given at the Tenth Canadian Conference on General Relativity and Relativistic Astrophysics, University of Guelph, ON, (2003).
- "Weak Lensing and CMB: Cosmological parameter forecasts including a running spectral index." Invited talk given at the 13th Kingston Theoretical Astrophysics Meeting, UBC, (Vancouver, 2003).
- "GRDB and applications to astrophysics and cosmology" Invited talk given at the Canadian Institute for Theoretical Astrophysics, Toronto, ON, (2002).
- "An inverse approach to Einstein Field Equations: fitting cosmological model," Invited talk given at the joint astrophysics seminars of University of Montreal & McGill University, Montreal, (2002)

#### **Workshops and Summer Schools attended on Dark Energy:**

***"Conference and workshop on Dark Energy at McMaster University and the Perimeter Institute." May 2007.*** The conference was meant to bring together observers and theorists in astronomy, cosmology and particle physicists to highlight the observational evidence and theoretical ideas for Dark Energy, and to highlight the most promising future directions. To this end the meeting included broad review talks with which to start the discussion on each of the main areas of enquiry. The workshop focused on novel theoretical ideas on the nature of the dark sector and their prospects for observations. The workshop format was intended to be very informal, with few talks and ample time for discussions and interactions.

***"Gravitational Lensing, Dark Energy and Dark Matter Workshop" at the Ohio Center for Theoretical Science, Ohio State University, Columbus, 2005.*** "The goals of this workshop were to assess the current constraints on the nature of dark matter and dark energy from strong

and weak gravitational lensing and gravitational microlensing, and to assess the prospects for stronger constraints with the ambitious surveys and instruments presently being planned or going into operation. Specific topics included: models of dark matter and dark energy, microlensing constraints on baryonic dark matter, mass profiles of galaxies and clusters, evidence for dark matter substructure, cosmic shear and galaxy-galaxy lensing as probes of dark matter and dark energy, systematic uncertainties in lensing measurements and their interpretation, wide-area imaging surveys from the ground and from space, lensing of high-redshift 21cm emission and CMB anisotropies, and the interplay of lensing and CMB constraint"

**"Prospects in Theoretical Physics,"** Summer School attended at the Institute for Advanced Study, July 2003. An intensive summer program exploring the compelling new problems and research opportunities at the interface of Astroparticle Physics and Cosmology.

**"1st and 3rd Oxford-Princeton Workshops on Cosmology,"** at the Dept. of Astrophysical Sciences, Peyton Hall, Princeton University, (March 2003 and February 2005). The focus of the workshops was to discuss new results from: CMB temperature and polarization experiments and galaxy surveys. As well as their cosmological implications: theoretical interpretations; new constraints on cosmological parameters; links with complementary results such as cluster abundances, Ly-alpha, weak and strong lensing.

**"Cosmological Probes of Dark Energy".** Workshop attended at the Center for Cosmological Physics at the University of Chicago, December 2001. The workshop was devoted to addressing the efficacy of various cosmological probes of dark energy, including SNeIa, weak and strong gravitational lensing, galaxy and cluster counts, CMB anisotropy, and the Alcock-Paczynski test. The workshop brought together experts to study and discuss the important details and systematics associated with these cosmological probes as well as new ideas or strategies.