

**MUSTAPHA ISHAK-BOUSHAKI, Ph.D., Assistant Professor**

Address: Department of Physics, the University of Texas at Dallas,  
P.O. Box 830688, FO23. Richardson,  
TX 75083-0688,  
Phone: 1(972) 883-2815  
Email: mishak@utdallas.edu  
Url: <http://www.utdallas.edu/physics/faculty/ishak-boushaki.html>  
Languages: English and French

**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

**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

PI, NASA Astrophysics Theory Program, to start in 2009 (Research Project in Astrophysics)  
PI, Texas Space Grant Consortium, to start in 2008 (Research Project in Astrophysics)  
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)

## Teaching experience:

### The University of Texas at Dallas

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:

### Current Ph.D. students:

Jason Dossett  
Jacob Moldenhauer  
Anthony Nwankwo  
John Thompson

### Graduated Ph.D. Students:

James Richardson (Ph.D. graduated in 2008!).

### 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

### **Other Employment History:**

Senior Analyst-Programmer, 1995-1998, St-Pierre Auction Ltd., Montreal, Canada.  
Analyst-Programmer, 1992-1994, St-Pierre Auction Ltd., Montreal, Canada.

### **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 Examination

### **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

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

American Astronomical Society  
American Physical Society  
Canadian Astronomical Society  
Canadian Physical Society

### **Other Current and Past Synergetic Activities**

Previous work ("*Probing Cosmic Acceleration Beyond the Equation of State: Distinguishing between Dark Energy and Modified Gravity Models*" Mustapha Ishak, Amol Upadhye, David N. Spergel. Physical Review D, 74, 043513 (2006)) was subject of an invited press release at Princeton University and an invited interview by the *Astronomy Magazine*. The results were broadly disseminated in magazine articles and online science news (*Astronomy Magazine*, *SPACEDAILY*, and *Spaceflight Now*, *NASA Beyond Einstein web site*.)

Chaired the Princeton & IAS Gravitational Lensing Seminar

Co-chairing special North-Texas Cosmology and Relativity seminar in order to promote astrophysics, cosmology and relativity in the Dallas Metroplex area.

## *The Astrophysics, Cosmology, and Relativity 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:**

- ***“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.

#### Proceedings papers:

*Exact Solutions with w-modes: Scattering of Gravitational Waves By Neutron Stars,* Mustapha Ishak, Luke Chamandy and Kayll Lake (2000).

In the Proceedings of the 20th Texas Symposium on relativistic Astrophysics (American Institute of Physics. Editors J.C.Wheeler and H. Martel, 2000).

*"Inhomogeneous Cosmologies with Adiabatic Evolution,"* Roberto Sussman and Mustapha Ishak (2000).

Developments in Mathematical and Experimental Physics, Volume A: Cosmology and Gravitation. Edited by Alfredo Macias, Francisco Uribe and Enrique Diaz. ISBN 0-306-47293-7. QC19.2 .M48 2001 530.15--dc21. Published by Kluwer Academic Publishers/Plenum Publishers, Dordrecht, The Netherlands, 2002, p.285.

*GRLite and GRTensorJ: Graphical User Interfaces to the Computer Algebra System GRTensorII,* Mustapha Ishak, Peter Musgrave, John Mourra, Jonathan Stern and Kayll Lake.

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). Paper also available at Los Alamos Archive Server as gr-qc/9911012

## **Selected talks, presentations, Seminars, or Colloquia:**

*"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 (AAS) #212, (St-Louis, 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, Meeting 209, Bulletin of the American Astronomical Society. Seattle, WA, (January, 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 3<sup>rd</sup> Oxford-Princeton Workshop on Cosmology, Princeton, NJ (March 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, University of British Columbia, Vancouver, BC, (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)

*"Perfect Fluid Cosmologies in Null (Observational) Coordinates,"* Talk given at the Annual Congress of the Canadian Association of Physicists, University of Quebec, QC, (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.