CURRICULUM VITAE February 28, 2014

Hu, Bei-Lok Bernard Professor of Physics, University of Maryland, College Park
胡悲樂 Founding Fellow, Joint Quantum Institute, Univ. Maryland and NIST
Founding Member, Maryland Center for Fundamental Physics, UMd.

I. PERSONAL DATA

Date and Place of Birth: October 4, 1947, Chungking, China. Citizenship: U.S.A.

Permanent Address: 4209 John S. Toll Building / 3153 Physical Sciences Complex
Department of Physics, University of Maryland,
College Park, Maryland 20742-4111
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UMd Physics webpage: http://umdphysics.umd.edu/people/faculty/153-hu.html

Research Groups:
- *Gravitation Theory (GRT) Group*:
http://umdphysics.umd.edu/research/theoretical/87gravitationaltheory.html
- *Quantum Coherence and Information (QCI) Theory Group*:
http://www.physics.umd.edu/qcoh/index.html

II. EDUCATION

Date	*School*	*Location*	*Major*	*Degree*
1958-64	Pui Ching Middle School	Hong Kong	Science	High School
1964-67	University of California	Berkeley	Physics	A.B.
1967-69	Princeton University	Princeton	Physics	M.A.
1969-72	Princeton University	Princeton	Physics	Ph.D.

III. ACADEMIC EXPERIENCE

Date	*Institution*	*Position*
June 1972- Jan. 1973	Princeton University Princeton, N.J. 08540	Research Associate Physics Department
Jan. 1973- Aug. 1973	Institute for Advanced Study Princeton, N.J. 08540	Member School of Natural Science
Sept.1973- Aug. 1974	Stanford University Stanford, Calif. 94305	Research Associate Physics Department

Sept.1974- Jan. 1975	University of Maryland College Park, Md. 20742	Postdoctoral Fellow Physics & Astronomy
Jan. 1975- Sept.1976	University of California Berkeley, Calif. 94720	Research Mathematician Mathematics Department
Oct. 1976- May 1977	Institute for Space Studies NASA, New York, N.Y. 10025	Research Associate Astrophysics
June 1977- Aug. 1979	University of California Santa Barbara, Calif. 93106	Research Physicist Physics Department
Aug 1980- Now	University of Maryland College Park, MD 20742	Assist, Assoc. & Full Professor of Physics

Visiting or Honorary Appointments:

Sept.1979- Aug. 1980	Harvard University Cambridge, Mass. 02138	Honorary Research Fellow Lyman Lab. of Physics
Jan. 1987- Aug. 1987	Institute for Advanced Study Princeton, New Jersey 08540	Member School of Natural Sciences
Jan. 1989- June 1990	Cornell University Ithaca, New York l4853	Professor of Physics and Research Fellow Newman Lab. of Nuclear Studies
April-May 1994	Newton Institute for Math. Sciences, Cambridge Univ.	Member Geometry and Physics Program
Sept.1994- Jan. 1995	Institute for Advanced Study Visiting Professor	Dyson Visiting Professor School of Natural Sciences
Mar-May 2008	Perimeter Institute of Theoretical Physics, Waterloo, Canada	Visiting Professor

Short-term Visitor or Lecturer:

July 1982	Nuffield Foundation, Univ. of Cambridge	Participant and Speaker at the Workshop on the Early Universe
Aug. 1982	Shanghai Normal Univ.	Visiting Professor
Sept. 1984	Erice Int'l School, Italy	Principal Lecturer
Nov. 1984	Raman Institute, India	Visiting Professor
July 1985	Chinese Academy of Sciences	Visiting Professor
Aug. 1985	Yukawa Institute, Kyoto, Japan	Visiting Professor
June 1986	Academia Sinica, Taiwan	Visiting Professor
May 1989	Erice Int'l School, Italy	Principal Lecturer

Dec. 1990	SILARG7, Mexico City	Principal Lecturer
Spring 1992	Institute for Theor. Physics Univ. Calif. Santa Barbara	Workshop on Phase Transition in the Early Universe (declined)
June 1992	Univ., Buenos Aires, Argentina	Visiting Professor
Aug. 1992	Waseda University, Tokyo Univ., and Yukawa Institute	Senior Fellow, Japan Society for the Promotion of Science
July. 1993	Instituto Superior Tecnico, Lisbon	Visiting Professor
Aug. 1993	CAP-NSERC, Summer Institute in Theoretical Physics, Banff, Canada	Principal Lecturer
Nov. 1994	Department of Physics University of Buenos Aires	Honorary Professor
Spring 1995 Spring 99,01	Dept. of Physics, Hong Kong University of Science and Technology	Visiting Professor
July 1995	Tubitak, Istanbul, Turkey	Visiting Professor
July 1995	University of Barcelona, Spain	Visiting Professor
Aug. 1995	Department of Mathematics University of Sydney	Visiting Professor
Aug. 1995	Institute for Mathematical Physics, University of Adelaide	Visiting Professor
Sept. 1995	Erice International School, Italy	Principal Lecturer
June 1997	Dept. of Mathematics Hong Kong University of Science and Technology	Visiting Professor
Jan. 1999	Institute for Theor. Physics Univ. Calif. Santa Barbara	Workshop on Nonequilibrium Quantum Fields
Nov. 1999	Institute for Nuclear Theory University of Washington	Workshop on Quantum Field Nonequilibrium Processes
May 2001	Erice International School, Italy	Principal Lecturer
Jan 2004	University of Queensland University of New South Wales	Visitor
2004-2007	Institute of Physics, Academia Sinica, Taiwan National Center for Theoretical Sciences, National Tsing Hua University Center for Information Sciences, National Cheng Kung University	Visiting Professor
Mar 2006	National University of Singapore	Visitor
June 2006	Gdansk University, Krakow University, Poland. Benasque Center, Spain	Visitor Workshop on Q. Decoherence and Information
July 2007	Institute of Physics, Institute of Theoretical Physics, Institute of Applied Mathematics and Systems Sciences, Academy of Science, Beijing, China	
Aug. 2007	Lorentz Center, University of Leiden, Holland Condensed Matter meets Gravity	Workshop on
Sept.2007	Center of Excellence Interdisciplinary Program, Waseda University, Japan	
Feb. 2008	Kavli Institute for Theoretical Physics, University of California, Santa Barbara, Program on Nonequilibrium Quantum Processes in Particle Physics and Cosmology	
Mar-June 2008	Perimeter Institute for Theoretical Physics, Waterloo, Canada. Visiting Professor	

Nov. 2008	Lecturer at the Inaugural Asher Peres International Physics School on Quantum Information: "Qubits: from photons to black holes" Macquarie University, Sydney, Australia
Jan. 2009	Lecturer in the International School/Workshop in Gravitation and Cosmology, Asia-Pacific Center for Theoretical Physics, Korea.
Mar. 2009	Kavli Institute for Theoretical Physics, Beijing, China. Invited Participant, Program on "Connecting Fundamental Physics with Observation".
Dec. 2010	Vision Speaker, International School on Quantum and Nano Computing Systems and Applications (QANSAS) Dayalbagh Educational Institute. Agra, India.
Feb. 2011	Visiting Fellow, Macquarie University, Sydney University
April 2011	Kavli Institute for Theoretical Physics, Beijing, China. Coordinator (with Ting Yu) Program on "Quantum Open Systems: Decoherence, Entanglement and Control"
May 2011	Visiting member, Institute for Advanced Studies, Tsing Hua University, Beijing, China
Feb-July 2012	Senior Visiting Fellow, Institute for Advanced Study, Hong Kong University of Science and Technology, Hong Kong, China
Feb 2013	C N Yang Visiting Professorship, Chinese University of Hong Kong, China

IV. PROFESSIONAL ACTIVITIES

Member,	International Society for General Relativity and Gravitation
Trustee,	Association of Members of the Institute for Advanced Study (1984-1990)
Council,	Chinese Society on *Gravitational Physics and Relativistic Astrophysics* (1979-85)
Council,	Overseas Chinese Physics Association (1990-94, 1998-09) Division of Gravitation and Cosmology

International Advisory Committee for
- the Third Marcel Grossmann Meeting, Shanghai, China, 1983
- the Instructional Conference on *Gauge Theory, Gravitation and the Early Universe,* Bangalore, India, 1984

Local Organizing Committee of
- the 13th International Colloquium on *Group Theoretical Methods in Physics,* College Park, U.S.A., 1984
- the First International Conference on the *Physics of Phase Space,* College Park, U.S.A., 1986.

International Scientific Organizing Committee for
International Conference on *Gravitation and Cosmology*, Goa, India, 1987.

Technical Program Committee for the Workshop on *Entanglement and Quantum Decoherence* (EQD) organized by the Optical Society of America January 28-30, 2007 in Nara, Japan

International Organizing Committee, Relativistic Quantum Information RQI-N2014 Seoul, Korea June 2014

Discussant at the annual University of Maryland Symposium on *Foundations of Physics*

International Advisory Committee for
Workshops on *Thermal Field Theories and their Applications*,
First Meeting: Cleveland,U.S.A.,Oct.,1988;
Second Meeting: Tsukuba, Japan, July, 1990;
Third Meeting: Banff, Canada, August, 1993;
Fourth Meeting: Dalian, China, August 1995.

International Advisory Committee for the annual *Peyresq Physics Meetings* on Gravitation, Cosmology and Quantum Physics France. 1999 – now

International Advisory Board for the DICE Meetings on *Foundational Issues of Gravity, Quantum Mechanics, Statistical Mechanics & Quantum Information.* Piombino, Italy. 2006, Castello Pasquini (Castiglioncello, Tuscany), 2008, 2010, 2012, 2014

International Advisory Committee, *Conceptual and Technical Challenges for Quantum Gravity* 2014, University of Rome- Sapienza, September 8 -12, 2014

International Advisory Committee for the International School/Workshop on *Gravitation and Cosmology*, Puhang, Korea 2008 sponsored by the Asia Pacific Center for Theoretical Physics (APCTP), Korea and the National Center for Theoretical Science, Taiwan (NCTS)

Scientific Advisory Committee for International Association of *Relativistic Dynamics* (IARD) 2008, 2010, 2012, 2014

Founder and Advisory Committee for the *International Society for Relativistic Quantum Information (ISRQI) founded in Hualien, Taiwan, June 2010.*

Member, NSF Panel for the review of proposals for *Frontier Centers* of Creativity
NSF Panel for the review of proposals for *gravitational physics*
NASA Panel for the review of proposals for *gravity and relativistic physics*

Chair, Scientific and Organizing Committees, International Symposium on *Directions in General Relativity*, College Park, USA, May, 1993

Co-Chair, International Symposium on *Quantum Classical Correspondence*, Drexel University, Philadelphia, U.S.A., Sept., 1994

Editor, *International Journal of Modern Physics*, A, D, *Modern Physics Letters* A
International Journal of Quantum Information
Quantum Information Processing

V. HONORS AND AWARDS

*Fellow, American Physical Society
*Fellow, Joint Quantum Institute, University of Maryland and NIST Gaithersburg
*Senior Fellow, Japan Society for the Promotion of Science
* Dyson Visiting Professor (1994) Institute for Advanced Study, Princeton
* C N Yang Visiting Professor (2012) Chinese University of Hong Kong, Hong Kong
*General Research Board Award (1994, 2007) University of Maryland Graduate School
*Teaching Excellence Award (1996) Univ. of Maryland, Dean for Undergraduate Studies
* Princeton National Fellow (1967) Princeton University Graduate School
*NSF Exceptional Undergraduate Traineeship (1965-67) Univ. of California, Berkeley
Biographic Listing in: American Man and Women of Science (USA)

Who's Who in Science and Engineering (USA)
Who's Who in Frontiers of Science and Technology (USA)
Who's Who in the World (USA)
Marquis Who's Who (USA)
Men of Achievement (UK)
Who's Who among Asian Americans (USA)
Huaxia Haiwai Keji Jingying (China)
Reference Asia (India), etc.

VI. GRANTS AND CONTRACTS

Gravitation and Cosmology, Quantum Field Theory:

Principal Investigator on individual (no sponsoring institution) NSF grant,
"Research in General Relativity and Relativistic Cosmology"

Sept. 1979-1980 (at Harvard) $25,000
Sept. 1980-1981 (at Maryland) $27,750

Principal Investigator on NSF Grant PHY-81-07387 to the University of Maryland:
"Research in General Relativity and Relativistic Cosmology" (3 year grant)

1981-1983 $39,043
1983-1984 $38,817

Principal Investigator on NSF Grant PHY-84-18199 to the University of Maryland:
"Gravitation, Quantum Field Theory and Relativistic Cosmology" (3 year grant)

1984-1985 $44,300
1985-1986 $45,000
1986-1987 $50,000

Principal Investigator on NSF Grant PHY-87-17155 to the University of Maryland:
"Gravitation Quantum Field Theory and Relativistic Cosmology" (4 year grant)

Nov. 1987 - Nov. 1988 $63,000
Dec. 1988 - Nov. 1989 $69,644
Dec. 1989 - Nov. 1990 $85,346
Dec. 1990 - Nov. 1991 $63,000

Principal Investigator on NSF Grant PHY-91-19726 to the University of Maryland:
"Gravitation, Quantum Statistical Fields, and Relativistic Cosmology" (3 year grant)

Jan. 1992 - Dec. 1992 $ 76,184
Jan. 1993 - Dec. 1993 $117,679
Jan. 1994 - Dec. 1994 $122,400

Principal Investigator on NSF Grant PHY94- 21849 to the University of Maryland:
"Gravitation, Quantum Statistical Fields and Relativistic Cosmology" (3 year grant)

Feb. 95 - Aug. 98 $346,677

Principal Investigator (Joint with Dr. T. Jacobson) on NSF Grant 98-00967 to the University of Maryland: "Gravitation and Quantum Fields" (3 year grant)
April 1, 1998 - March 31, 1999 (Year 1) $215,336
April 1, 1999 - March 31, 2000 (Year 2) $214,695
April 1, 2000 - March 31, 2001 (Year 3) $221,173
Creativity renewal for 2 years (Year 4) $226,495
April 1, 2002 – March 31, 2003 (Year 5) $235,378

Principal Investigator (Joint with Dr. T. Jacobson) on NSF Grant PHY03-00710 to the University of Maryland: *"Towards the Microscopic Structure of Spacetime*"
(3 year grant) July 1, 03- June 30, 2006 $665,000

Principal Investigator on NSF Grant PHY-0601550 to the University of Maryland: *"Quantum Field and Gravitational Waves in Black Holes and the Early Universe"*
(2 year grant) July 1, 06 - June 30, 2008 $80,000

Principal Investigator on NSF Grant PHY-0801368 to the University of Maryland: "Black Holes, Gravitational Waves and the Early Universe: Quantum Fluctuations, Backreaction, Information and Structure
(3 year grant) July 1, 08 - June 30, 2011 $120,000

Perimeter Institute for Theoretical Physics, Waterloo, Canada
Individual grant, March 1-May 31, 2008 $31, 822 (overhead exempt)

Quantum Coherence Phenomena, Quantum Control, AMO and Superconducting Quantum Computer Theory

PI on **ARDA** Contract MDA90401/C0903, on *Decoherence and Basic Issues in Quantum Computers* for three years May 1, 2002-April 30, 2005. $300K

PI on **LPS** grant for support of my graduate student, Nick Cummings for five years, February 2005 –December 2010 $129,537/3 yrs + 2 yrs increment

PI on **NIST** Grant: *Quantum Information Processing with Neutral Atoms*
July 1, 2002-June 30, 2005. $271,430

PI on **NIST** Grant: *Quantum Information Science: From Nanomechanical Resonators to Neutral Atoms Quantum Computing*
July 1, 2005-June 30, 2008. $217,440

co-PI on **NSF** Grant PHY-0426696 *"ITR: Distributive Quantum Information"*
(PIs: Steven Rolston, Bei-Lok B. Hu, Carl J. Williams, Luis A. Orozco, Wendell T. Hill.)
Sept., 04- Aug., 2009 $1.65M

(evenly divided by 5 PIs translates to) per PI amount:

Sept 2004 –Aug 2005	$ 50K
Sept 2005-2006	$ 40K
Sept 2006-2007	$100K
Sept 2007-2008	$100K
Sept 2008-2009	$100K

Co-PI (with Joe Eberly and Ting Yu) on **DARPA** grant in the QuEST program:
Entanglement Dynamics of Qubit Systems **DARPAHR0011-09-1-0008**
5 year grant (Jan 2009 – Dec. 2010) $184K

International Cooperative Research Grants:

Principal Investigator (joint with Prof. E. Calzetta) "US -Argentina Cooperative Research on Statistical Field Theory in Gravitation and Cosmology" NSF INT95-09847
Sept. 1995 - Aug. 1997 $23,092

Principal Investigator (joint with Professors Denjoe O'Connor and Chris Stephens) (U.S.-Mexico Workshop: "The Renormalization Group at the Turn of the Millennium", Jan 1999, Taxco, Mexico NSF INT-9813918 Sept. 30, 1998 - Feb. 28, 1999 $10,150

Travel Grants for the benefit of participants of international conferences:
Principal Investigator NSF Grants for International group travel

1982 $38,750 Third Marcel Grossmann Meeting (with D.R. Brill)
1983 $50,000 Tenth General Relativity and Gravitation (with D. R. Brill)
1988 $25,000 Fifth Marcel Grossmann Meeting (MG5) (with D.R. Brill and H. J. Paik)

Conference Grants for participants:
Principal Investigator (with T. A. Jacobson) for an International Symposium on "Directions in General Relativity" held at University of Maryland, May 1993 $5,000

Principal Investigator (with D. H. Feng) for an International Symposium on "Quantum Classical Correspondence" held at Drexel University, September 1994 $5,000

VII. TEACHING EXPERIENCE

1. **Regular courses** taught:

Freshman-Sophomore *Introductory Physics for Physical Sciences*,
Engineering and Biosciences Majors (Physics 122, 262, 263, 270)
Introductory Physics for Physics Majors (Phys. 272/272H)
Junior-Senior Courses for Physics Majors:
Modern Physics (Physics 421-422)
Modern Physics for Engineering Majors (Physics 420)
Thermal Physics (404)
Undergraduate Physics Research: Physics 389
Independent Study Seminar: Physics 398
Graduate Physics *Core Course: Statistical Mechanics* (Physics 602)
Topical Courses: *General Relativity* (Physics 675/875)
Topical Courses: *Advanced Gravitation Theory* (Phys. 776)
Special Topics Courses (Physics 879: see below)
Interdisciplinary Courses (Physics 889: see below)
Seminar: *Gravitation Theory*: Physics 779A
Seminar: *Quantum Coherence and Information*: Physics 779B
Special Problems in Advanced Physics: Physics 798
Master's Thesis Research: Physics 799
Ph.D. Dissertation Research: Physics 899

2. Innovations: **New courses** designed and taught:

"*Quantum Processes in the Early Universe*" Physics 889 (Fall 1983)
"*Quantum Field Theory in Curved Spacetime*" Physics 879 (S'84, S'86, S'92)
"*Geometric Methods in Physics*" Physics 798B (S'88)
"*Particles and the Universe*" Physics 889 (S'88):
taught jointly with Professors Pati and Eichler
"*Statistical Field Theory: Problems in Gravitation Cosmology and Nuclear- Particle Physics,*" Physics 889 (S'91, S'97)
"*Advanced Gravitation Theory*" Physics 776 Designed this new course
and taught (S'93, S'96, S'02 S'04)
"*Statistical Field Theory: Quantum and Atom Optics*", Physics 889 (S'98)
"*Black Holes and the Early Universe*", Physics 499G (S'99), Physics 140 (S'01) @ Hong Kong University of Science and Technology (HKUST). Physics 4054 (S2012)
"*Introduction to Astrophysics: General Relativity, Black Holes and New Cosmology*"
"*Nonequilibrium Quantum Field Theory: Dynamics of Bose Einstein Condensate and Advanced Topics*", Physics 889 (S'03)
"*Gravitational Wave Physics and New Cosmology*" Physics 776 (S '04)
"*AMO Research*" Physics 726. Individual student supervision on current topics (since 2005 as the education component of NSF-ITR grant on quantum information)
"*Nonequilibrium Quantum Field Theory:* Physics 889 (F'10)

3. Supervised **independent research** or reading course to undergraduates

1983-1986	Chairman of Physics Honors Committee
Spring 1983	Dallas Kennedy, David Wasson, Selman Herschfield
1993-1994	Steve Sabian
1995-1996	Veronika Hubeny
1999-2000	Nick Cummings

4. *Master of Science* Students

James T. Wheeler, May 1981
Liam M. Healy, December 1981
Joseph Shanks, May 1982
Laura Mersini, May 1997

VIII. *Doctor of Philosophy* Students Supervised and *Postdoctoral Research Associates*

A. *Doctor of Philosophy* Students

1. Tsung-Chen Shen, Oct. 1985
"Quantum Effects on Non-Maximally Symmetric Spaces"

2. Dennis Joseph O'Connor, Oct. 1985
"Quantum Field Theory in Curved Spacetime: Phase Transition and Finite Size Effect"

3. Christopher Rhodes Stephens (joint with Prof. Charles W. Misner), Oct. 1986
"On Some Aspects of the Relationship between Quantum Physics, Gravity and Thermodynamics"

4. Salman Habib, Sept. 1988
"Quantum Fields in Curved Spacetime: Kinetic Theory"

5. Yuhong Zhang, Dec. 1990
"Stochastic Properties of Interacting Quantum Fields"

6. Aris Stylianapoulos, Dec. 1990
"Finite Temperature Quantum Field Theory in Curved Spacetime"

7. Roberto Camporesi, May 1991
"Geometrical Representation of Propagators and Quantum Effects in Spacetimes with Symmetry"

8. Sukanya Sinha, May 1991 "Semiclassical Limit of Quantum Cosmology"

9. Andrew Matacz (joint with Prof. Paul Davies, Univ. of Adelaide), May 1994
"Quantum Statistical Processes in Cosmology and Gravity"

10. Don Koks (joint with Prof. Paul Davies, Univ. of Adelaide), May 1996
Decoherence, Entropy and Thermal Radiance Using Influence Functionals

11. Alpan Raval, Dec. 1996
"Stochastic Properties of Particle Detector and Quantum Field Interactions"

12. Stephen A. Ramsey, Dec. 1997
"Nonequilibrium Dynamics of Quantum Fields in Inflationary Cosmology"

13. Kazutomu Shiokawa, May 1998
"Coherence in Quantum Chaos, Stochastic Spacetimes and Collective Phenomena"

14. Nicholas G. Phillips, May 1999
"Fluctuations of the Quantum Stress Tensor in Curved Spacetimes via Generalized Zeta Functions and Point Separation"

15. Philip Johnson, Dec. 1999
"Nonequilibrium Dynamics of Particle Field Interaction"

16. Gregory Stephens, Aug. 2000
"Nonequilibrium Dynamics of Defect Formation in the Early Universe"

17. Sanjiv Shresta, Oct. 2003
"Coherent Quantum Dynamics of Atom- Quantum Field Interaction"

18. Ana Maria Rey, Dec. 2004 (joint with Prof. Theodore Kirkpatrick, IPST, and Dr. Charles Clark, NIST) "Ultra-cold Bosonic Atoms in an Optical Lattices"

19. Guido Pupillo, Aug. 2005 (joint with Dr. Carl Williams, NIST)
"Confined Ultracold Bosons in One Dimensional Optical Lattices"

20. Andrew Skinner Aug. 2006 (joint with Dr. Bruce Kane, LPS)
"Hydrogenic Spin Quantum Computing in Silicon and Damping and Diffusion in a Chain-Boson Model"

21. Ardeshir Eftekharzadeh May, 2007
"Topics in Gravitational Radiation Reaction and Black Hole Fluctuations"

22. Chad R. Galley, December 2007
"Stochastic and Effective Field Theory Approach to Gravitational Radiation Reaction"

23. Ryan Behunin September 2010 "Nonequilibrium Quantum Fluctuation Forces"

24. Anzi Hu, Nov. 2010 (Jointly with Drs. Carl Williams and Charles Clark, NIST)
"Quantum many-body phenomena in ultra-cold atoms in optical lattices"

25. Nick Cummings, April 2011
"Quantum Entanglement Dynamics in Atom-Field Interactions"

26. Chris Fleming, April 2011
"Open Quantum Systems: Properties of Stochastic Equations and Their Solutions"

27. Stephen Kwan-yuet Ho 2012 (Joint with Prof. Ted Kirkpatrick, IPST)
"Studies on 2D Bose Gas Vortices and Dzyaloshinsky-Moriya Magnets"

28. Yigit Subasi October 2013
"Nonequilibrium Quantum Systems: Fluctuations and Interactions"

29. Kanupriya Sinha 2014 (expected)
"Atom-Field-Mirror Entanglement and Atom Trapping by Fluctuation Force"

30. Rong Zhou 2014 (expected?)
"Quantum Entanglement Dynamics: Boundary and Nontrivial Topology Effects"

Ph.D. external examiner:

James Anglin, University of Montreal, Canada 1994
Lorenzo Sindoni, SISSA, ICTP, Trieste, Italy. Sept, 2009
Tommaso Demarie, Macquarie University, Sydney, Australia. Dec. 2013

B. *Postdoctoral Research Associates* and their current position, if available, probably needs updating (Supported under my own grant, joint or group grants at UMCP)

Rafael Sorkin (Perimeter Institute, Waterloo, Canada)
Ping Yip,
A. Sen,
Esteban Calzetta (University of Buenos Aires, Argentina)
Henry Kandrup (deceased),
Arlen Anderson, (left physics)
Kristen Schleich (Univ British Columbia, Vancouver, Canada)
Iannis Bakas (University of Crete, Greece)
Atsushi Higuchi, (University of York, UK)
Juan Pablo Paz, (Univ. Buenos Aires, Argentina; Fellow, Santa Fe Institute, USA)
Jonathan Simon, (University of Maryland, USA)
Joseph Romano, (University of Texas, Brownsville, USA)
Jorma Louko, (Nottingham University, UK)
Charis Anastopoulos, (University of Patras, Greece)
Stefano Liberati, (ICTP, Trieste, Italy)

Albert Roura (University of Ulm, Germany)
Kazutomu Shiokawa (National Center of Theoretical Sciences, Taiwan)
Chad Galley (Caltech, Pasadena)
Chun-Hsien Chou (National Cheng Kung University, Tainan, Taiwan)
Shih-Yun Lin (National Changhua University of Education, Taiwan)
Jen-Tsung Hsiang (National Donghua University, Taiwan)

IX. INVITED TALKS AT INTERNATIONAL MEETINGS

Speaker or Chairman at International Meetings or Visits (*indicates invited talks or lectures, - indicates invited participants, + indicates chairman of sessions,)

1971 Sixth International Conference on General Relativity and Gravitation, July, Copenhagen, Denmark

1972 Summer Institute on "The Physics of Black Holes" July, Les Houches, France
Sixth Texas Symposium on Relativistic Astrophysics, Dec., New York, U.S.A.
1974 Seventh Texas Symposium on Relativistic Astrophysics, Dec., Dallas, U.S.A.

1976 Eighth Texas Symposium on Relativistic Astrophysics, Dec., Boston, U.S.A.

1977 Eighth International Conference on General Relativity and Gravitation, Aug., Waterloo, Canada

1978 Summer Institute on "Quantum Gravity and Supergravity", July, Cargese, France

1979 +*Second Marcel Grossman Meeting in commemoration of **Albert Einstein's Centenary**, July, Trieste, Italy

1980 +***First Theoretical Particle Physics Conference**, Jan., Gaungzhou, China
Ninth International Conference on General Relativity and Gravitation, July, Jena, D.D.R.

1981 ***Workshop on the Interaction of Particle Physics and Astrophysics**, May, Santa Barbara, U.S.A.

1982 ***Nuffield Workshop on the Very Early Universe**, July, Cambridge, U.K.
*Imperial College, July, London, U.K.
***Third Marcel Grossmann Meeting** on Recent Developments of General Relativity, August, Shanghai, China
*Shanghai Teacher's University, August, Shanghai, China

1983 *Second **New Orleans Conference on Quantum Theory and Gravitation**
May, New Orleans, U.S.A.
Tenth International Conference on General Relativity and Gravitation, July, Padova, Italy

*__Workshop on Induced Gravity__ Oct., Erice, Italy

1984 *Inner Space/Outer __Space Conference on the Intersection of Particle Physics and Cosmology__, May, Fermilab, U.S.A.
*International Workshop on __Gauge Theory, Gravitation and the Early Universe__, Nov., Ahmedabad, India
*Raman Institute of Physics, Nov., Bangalore, India

1985 +*Conference on __Classical and Quantum Gravity__ April, Syracuse, U.S.A.
*__Fourth Marcel Grossman Meeting__ on the Recent Development of General Relativity, June, Rome, Italy
*International Symposium on __"Particles and the Universe"__
June, Thessaloniki, Greece
*Institute of Theoretical Physics, Academia Sinica,July, Beijing, China
*Research Institute of Fundamental Physics, Aug., Kyoto, Japan

1986 +Washington American Physical Society Meeting, Session on Gravitation Physics, April, Washington, D.C, U.S.A.
+First International Conference on the __Physics of Phase Space__, May, College Park, U.S.A.
+Workshop on __Approaches to Quantum Gravity__, June, Santa Barbara, U.S.A.
+__NATO Workshop on Superfields__, July, Vancouver, Canada
*New York State __American Physical Society Meeting__ on Cosmology and Elementary Particles, Oct., Syracuse, U.S.A.

1987 *__Quantum Cosmology Workshop__, May, Fermilab, U.S.A.
*__CAP-NSERC Summer Institute Theoretical Physics__, July, Edmonton, Canada
*__International Conference on Gravitation and Cosmology__, Dec., Goa, India

1988 *__Third Asia-Pacific Physics Conference__ June, Hong Kong
*Academia Sinica, June, Taipei, Taiwan
*+__Fifth Marcel Grossmann Meeting__ on the Recent Development of General Relativity, August, Perth, Australia
*First International Workshop __on Thermal Field Theories__ and Applications, Oct., Cleveland, U.S.A.

1989 *Eleventh International School on Cosmology and Gravitation, __"Quantum Mechanics in Curved Spacetime__," May, Erice, Italy
*Workshop on Quantum Field Theory in Curved Spacetime, at the Twelfth International Conference on __General Relativity and Gravitation__, July, Boulder, Colorado, U.S.A.

1990 *CIAR-CITA Workshop on __Quantum Cosmology__ and Workshop on __Inflation and Exotic Cosmic Structure Formation__, May, Vancouver, Canada
*Second International Workshop on the Theory and Application of __Thermal Fields__, July, Tsukuba, Japan

*University of Tokyo & Waseda University Joint Seminar, July, Tokyo, Japan
*Seventh **Latin American International Symposium on General Relativity**, Dec., Mexico City, Mexico

1991 *Workshop on the **Physical Origin of Time-Asymmetry**, Sept., Heulva, Spain
*Universidad Autonoma de Barcelona, Spain, August

1992 *International Conference on the **Origin of Structure in the Universe**, April, Chateau de Pont d'Oyle, Belgium
***Journees Relativiste**, May, Amsterdam, Holland
*Third International Workshop on **Quantum Nonintegrability**, May, Drexel Univ., Philadelphia, U.S.A.
*Institute for Astrophysics and Space Sciences, June, Buenos Aires, Argentina
*Fifth Asia-Pacific Physics Conference, August, Genting, Malaysia
*International Conference on **Quantum Physics and the Universe**, August, Waseda University, Tokyo, Japan
*University of Tokyo and Yukawa Institute, August, Kyoto, Japan

1993 +International Symposium on **Directions in General Relativity**, May, College Park, U.S.A.
*Instituto Superior Tecnico, July, Lisbon, Portugal
*Third International Workshop on **Thermal Field Theory** and Applications, August, Banff, Canada
*International Workshop on **Fluctuations and Order**, Sept., Los Alamos, U.S.A.
*Institute for Astrophysics and Space Sciences, Nov., Buenos Aires, Argentina
***Lanczos Centenary International Conference**, Symposium on Decoherence and Foundation of Quantum Mechanics, Dec., Raleigh, N.C., U.S.A.

1994 ***Newton Institute, Program for Geometry and Gravity**, April-May, Cambridge, U.K.
***Journee Cosmologie**, June, Observertoire de Paris, France
***Quantum Concepts of Space and Time**, July, University of Durham, U. K.
***Heat Kernel Techniques and Quantum Gravity**, August, Univ. of Winepeg, Canada
*International Symposium on **Quantum Classical Correspondence**, Sept., Drexel University, Philadelphia, U.S.A.
*Institute for Astrophysics and Space Studies, Nov., University of Buenos Aires, Argentina

1995 *19th **International Conference on Statistical Physics**, July, Xiamen, China.
*4th International Workshop on Thermal Field Theory and its Applications, August, Dalian, China,.
***International School on Astro-fundamental Physics**, Sept. Erice, Italy.

1996 ***Second International Sakharov Conference**, Lebedev Physical Institute, Moscow, Russia, May, 1996

*International Workshop on **Non-equilibrium Phase Transitions**, Santa Fe, New Mexico July, 1996
*University of Alberta, Edmonton, August 1996
*Imperial College, London, Nov. 1996

1997 *International Symposium on **Gravitation and Cosmology**, Soochow University, Taipei, Taiwan, June 1997
*International Symposium on **Macroscopic Quantum Coherence**, Northeastern University, Boston, July 1997
***Cosmology/Topology Workshop**, Case Western Reserve University, Cleveland,
October 1997
*Imperial College, London, U.K., November 1997
*University of Cardiff, Wales, U.K., November 1997
*Korean Institute for Advanced Study, Seoul, December 1997
*Institute for Theoretical Sciences, Tsing Hua University, Hsing chu, Taiwan, December, 1997

1998 *Second International Symposium on **Quantum Gravity** in the Southern Cone", Centro Atomico, Bariloche, Argentina, January 1998
*Third Peyresq Meeting on **Quantum Cosmology**, Peyresq, France, June 1998
***Nonequilibrium Quantum Fields and Relativistic Heavy Ion Physics**, Brookhaven National Laboratory, October 1998

1999 *Workshop on **Nonequilibrium Quantum Fields**, Institute for Theoretical Physics, UC Santa Barbara, January 1999
*The **Renormalization Group** 2000, Taxco, Mexico, January 1999
***Black Holes II**: Theory and Mathematical Aspects, Val Morin, Quebec, Canada, June, 1999
*Fourth Peyresq Meeting on **Quantum and Stochastic Gravity**, String Cosmology and Inflation. Peyresq, France, June 1999
*Workshop on **Quantum Field Theory of Nonequilibrium Processes** , Institute for Nuclear Theory, University of Washington, Seattle. Nov. 1999

2000 *Fifth Peyresq Meeting on **Stochastic Gravity and Quantum Cosmology**, Peyresq, France, June 2000
*International Conference in Honor of E. Fradkin, Moscow, June 2000 (declined)
*International Conference on **Mechanisms of Decoherence** , Utrecht, Netherland, June 2000 (declined)
*Minisymposium in Honor of Leonard Parker, Oakland University, Oct. 2000
*Second International Workshop on **Quantum Aspects of Beam Physics**, Capri, Italy, Oct. 2000

2001 * Lectures on **Quantum and Gravity Physics** at the Erice International School**,** Italy; May 2001.
***Black Holes** III: Theory and Mathematical Aspects, Banff, Canada, May, 2001

*Sixth Peyresq Meeting on **Quantum and Stochastic Gravity**, **String and Brane Cosmology.** Peyresq, France, June 2001
* Workshop on **Mechanisms for Decoherence**-Theory and Applications to Nanotechnology and Quantum Information Science held at IC2, University of Texas, Austin, October 2001

2002 + Session on New Approaches to Quantum Gravity in the Workshop on **New Directions in the Foundations of Physics** May 3-5, 2002. AIP, College Park
* IXth International Conference on **Quantum Optics**
Raubichi, BELARUS, May 14-17, 2002. ICQO'2002 (declined)
* Third International **Sakharov Conference** on Physics, Lebedev Institute Moscow June 24-28. (declined)
*Seventh Peyresq Meeting on Quantum and Stochastic Gravity, **Brane and String Cosmology** Peyresq, France, June 23-28, 2002
*Santa Fe **Cosmology Summer Workshop**, July 8-27, 2002
*Dynamics Days Asia-Pacific: Second International Conference on **Nonlinear Science** (DDAP2) Hangzhou, China. August 8-12, 2002. (declined)
*Workshop on **Quantum Control** at MIT, October 14-18, 2002

2003 *International Workshop on **Quantum Aspects of Beam Physics**.
Hiroshima, January 2003 (declined)
*APS Topical Group: **Analog Models of Gravity**, Philadelphia, April 2003
(paper presented by co-author E. Calzetta)
+2nd annual New Directions in the **Foundations of Physics**. AIP, U Maryland, College Park. May 2-4, 2003
*First International Conference on **Noise and Fluctuations** in **Photonics and Quantum Optics**", Santa Fe, USA, 1-4 June (Program comm.& Invited speaker)
*Workshop on "The **Early Universe**, **Inflation and CMB Fluctuations**" Peyresq, France June 22-26, 2003
*Santa Fe **Cosmology Summer Workshop**, July 7-25, 2003 (declined)
*Sixth International Workshop on **Quantum Field Theory** under the Influence of External Conditions (QFEXT03), Univ.of Oklahoma, Norman, Sept. 15-19, 2003

2004 +3rd annual **New Directions in the Foundations of Physics conference**, AIP, Univ. Maryland, College Park. April 30 - May 2, 2004
*Second International Conference on **Noise and Fluctuations**, Canary Islands, May 26-28. Program committee member and Invited speaker in **Photonics and Quantum Optics** (declined)
*7th Capra Meeting on **Gravitational Radiation Reaction**, Brownsville, Texas May 29-31, 2004 (declined)
*Biennial conference of the International Association for **Relativistic Dynamics**, Saas Fee, Switzerland 12-19 June 2004
*Workshop on "**Macro and Micro Structures of Spacetime**" Peyresq, France June 22-26

*Second International Workshop (DICE 2004) on **Decoherence, Gravity, Cosmology and Extensions of Quantum Theory**, Tuscany, Italy. Sept. 1-4
- International Workshop on **RHIC physics**. Brookhaven National Laboratory. Dec. 16-17, 2004

2005 *International Conference on **Theoretical Physics** dedicated to the **70th Anniversary of the Tamm Theory** Department, Lebedev Institute, Moscow, April 11-16 (declined)
***Quantum Physics of Nature** (QUPON), Vienna, Austria, May 22-26
*10th Peyresq Workshop on "**Macro and Micro Structures of Spacetime II**", Peyresq, France, June 18-24
*Santa Fe **Cosmology Summer Workshop**, Santa Fe, New Mexico. July 5-23 (declined)
-Quantum Control Summer School, Caltech, Pasadena, Aug. 8-14 (declined)
***Quark-Gluon-Plasma** Thermalization, Vienna, Austria, August 10-12, 2005 (declined)
*14th International Conference on **Fluid Dynamics in Complex Systems**. Kyoto University, Japan, Aug. 22-26 (declined)
- 6th International Conference **Renormalization Group 2005** (RG2005) at the University of Helsinki, August 30 - September 3, 2005 (declined)
*Asia-Pacific Conference on **Gravitation and Cosmology** – in celebration of the 90th anniversary of the publication of the Theory of General Relativity, National Central University, Taiwan. Nov 23-26.

2006 *Winter School on **Quantum Information Science**, National Cheng Kung University, Sun Moon Lake, Taiwan, Jan 5-7
***National University of Singapore**, Physics Department and Center for **Quantum Information Science**, March 30-April 3
*National Center for Theoretical Science, Taiwan April 6-8; Institute of Physics, Academia Sinica, Taiwan May 13-23
* International Conference on **Nonlinear Science**, Hong Kong May 24-26
* **Quantum Entanglement & Geometry**, Toruń, Poland June 4-7, 2006
* Jagiellonian University, Krakow, Poland June 12-13
*11th Peyresq Workshop on "**Macro and Micro Structures of Spacetime IV**", Peyresq, France, June 17-23
* Workshop on **Quantum - Classical Transition and Quantum Information**, June 18-30 Benasque
* Santa Fe **Cosmology Summer Workshop**, Santa Fe, New Mexico. July 3-21
* Workshop on NonGaussianity in **Cosmology**, ICTP Trieste, Italy July 24- 28 (both declined)
* DICE2006 International Workshop: **Quantum Mechanics between Decoherence and Determinism**: new aspects from particle physics to cosmology Castello di Piombino (Tuscany) Italy, September 11-15, 2006

2007 *Third Workshop on **Quantum Information Science and Technology**, National Center for Theoretical Sciences, Tainan, Taiwan, Jan 5- 11

*Tainan Workshop on **Gravitation and Cosmology**, Jan 13-15, Tainan, Taiwan
*National Center for Theoretical Science, National Tsing Hua University, National Cheng Kung University; Institute of Physics, Academia Sinica, Taiwán
*Workshop: "From **Quantum to Emergent Gravity**: Theory and Phenomenology" Trieste, Italy. June 11-15
*12th Peyresq Workshop on "**Macro and Micro Structures of Spacetime III**", Peyresq, France, June 16-22
*International Conference on **Quantum Gravity "LOOPS '07** Morelia, Mexico June 25 - 30
*Summer School on "**Nonequilibrium Dynamics and Quantum Coherence Phenomena**" National Center for Theoretical Sciences, Taiwan, July 4-6
*The **Chinese Academy of Sciences**, Beijing, China: Institute of Physics, Institute of Theoretical Physics, and Academy of Mathematics and Systems Sciences, July 23-27
*Workshop on "**Condensed Matter meets Gravity**", Lorentz Center, University of Leiden, Holland, August 27-31
*Symposium on **New Directions in Interdisciplinary Research** in the 21 Century, Japanese Government sponsored **Center of Excellence program**, Waseda University, Tokyo. Sept 13-14. Seminar at **Research Center for Early Universe**, Tokyo University, Sept 12

2008 *Taitung Winter School of **Gravitation and Cosmology** Jan 7-10, Taiwan.
* KITP program on **Nonequilibrium Phenomena** in Cosmology and Particle Physics **a**nd invited speaker at the Conference. Feb 4-29
* **Foundations of Physics** Symposium, U. Maryland, College Park. April 24-27
* Perimeter Institute, Waterloo, **Quantum Gravity** April 3, **Cosmology** May 26; CITA, University of Toronto, April 18; Canadian Atlantic **General Relativity** Meeting, University of New Brunswick, Canada, May 10-11
* 13th Peyresq Workshop on "**Macro and Micro Structures of Spacetime**", Peyresq, France, June 21-27.
* International Association of **Relativistic Dynamics** (IARD) 2008, Thessaloniki, Greece, June 22-26.
* Chinese Society of **Gravitation & Relativistic Astrophysics**, Lanzhou July 19-23
* Workshop on **Cosmology and Condensed Matter** as part of ULT2008: Frontiers of Low Temperature Physics International conference, at Royal Holloway, University of London, August 14-17. (politely declined)
*Workshop on "**Emergent Gravity**", MIT, August 25-29
*Benasque Workshop on **Quantum Coherence and Decoherence**, Spanish Pyrenees, Sep 13-21
* DICE2008 – **From Quantum Mechanics through Complexity to Gravity** September 22-26 at the Castello Pasquini (Castiglioncello), Tuscany, Italy.
*Xiangshan Meeting on **Gravity Experiments in Space**, Beijing, . Oct 26-28
* Invited Lecturer in the Inaugural Asher Peres **International Physics School on Quantum Information:** "Qubits: from photons to black holes"

Macquarie University, Sydney, Australia, Nov. 17-22

2009 * Invited Lecturer in the International School/Workshop in **Gravitation and Cosmology**, Asia-Pacific Center for Theoretical Physics, Korea. Jan. 16-20
* KITP Beijing China "**Connecting Fundamental Physics with Observation**. Program: Feb 16 - Apr 30. Attendance Mar 8-22.
*Invited talk at the 4th **International Sakharov Conference** on Physics, Moscow, Russia, May 18—23 (politely declined)
* Meeting on Mathematical Relativity, **Instituto Superior Tecnico, Lisbon**. June 15-19
* 14th Peyresq Workshop on "**Macro and Micro Structures of Spacetime**", Peyresq, France, June 20-26.
* Loop Quantum Gravity 2009. August 2-8, Beijing, China (politely declined)
*OCPA6, **Lanzhou, China**. Organizer of sessions on gravitation and cosmology.
*3rd International workshop on **Relativistic Quantum Information**, Dec 10-11.
Visit to **Center for Quantum Information, University of Queensland**, Brisbane, Australia Dec 12-15
* **Center for Quantum Information and Technology, Macquarie University**, Sydney, Australia, Dec 16-19

2010 ***Quantum Gravity and the Foundations of Physics** Rosario, Argentina. March 17-19th
*International workshop on **Relativistic Quantum Information** RQI-N (northern hemisphere) May 28-30, Hualien, Taiwan – Chief architect in the establishment of the **International Society of Relativistic Quantum Information** (**ISRQI**)
* International Association of **Relativistic Dynamics** (IARD) 2010
May 30- June 2, Hualien, Taiwan
***Zhejiang University**, Hangzhou, Mathematics Department and **Fudan University**, Shanghai, Physics Department, China June 10-18
*15th Peyresq Workshop on "**Macro and Micro Structures of Spacetime**", Peyresq, France, June 19-25.
*The Fifth International Workshop DICE2010 on **SPACE-TIME-MATTER** - CURRENT ISSUES IN QUANTUM MECHANICS AND BEYOND
Castello Pasquini (Castiglioncello, Tuscany), September 13-17
***Nanjing University**, Physics and Astronomy, Nanjing, and **University of Science and Technology**, Physics Department, Hefei, China October 25-29
*4th Int'l workshop on **Relativistic Quantum Information**, Nov. 22-24. Center for Quantum Information, **University of Queensland**, Australia (declined)
*International School on Quantum and Nano Computing Systems and Applications (**QANSAS**) Dayalbagh Educational Institute. Agra, India. Dec. 2-5.

2011 *Visiting Research Professor, National Center for Theoretical Sciences (south), National **Cheng Kung University**, Tainan, Taiwan, January, May
*Senior Visiting Fellow, **Macquarie University**, **Sydney**;
***University of Queensland**, Brisbane, Australia, Feb 9-Mar 16

*Coordinator, Program on **Decoherence, Entanglement and Control**, **KITPC**, Institute of Theoretical Physics, **Chinese Academy of Sciences, Beijing,** China
*Institute for Advanced Study, **Tsing Hua University**, Beijing, China, April-May
* The 5th Asia-Pacific Workshop on **Quantum Information Science**, Institute of Advanced Studies, **Nanyang Technological University**, **Singapore.** May 25-28
*16th Peyresq Workshop on "**Macro and Micro Structures of Spacetime**", Peyresq, France, June 18-24.
***European Science Foundation** (ESF) International Exploratory Workshop on "**Gravity as Thermodynamics:** Towards the microscopic origin of geometry" SISSA/ISAS, Trieste, Italy. Sept 5-8
*International Conference on **Self-Organization and Emergence**: **Emergent Quantum Mechanics** (EmerQuM11) Heinz von Foerster Centenary. November 10th–13th Vienna, Austria.

2012 *Guest Senior Professor, Public Lectures, **National Changhua University of Education, Taiwan,** Dec-Jan
* Senior Visiting Fellow, **Institute for Advanced Study**, **Hong Kong University of Science and Technology**, Hong Kong, China Jan-July.
*Visiting Professor, **Peking University**, Beijing, China, March 9-12
* Visiting Professor, **Lanzhou University**, Lanzhou, China, May 3-6
* Plenary Speaker, XXXV *Encontro Nacional de Fisica da Materia Condensada* the **Brazilian Physical Society**, Aguas de Lindoia, Sao Paulo, Brazil, May 14-18
***kTLog2**: **Quantum Fluctuations and Information**" Cuenca, Spain, May 24-26
*Vitaly **Ginzburg Conference** on Physics, Lebedev Physical Institute, Moscow, May 28-June 2
***International Association of **Relativistic Dynamics** (IARD) 2012 Conference The **Galileo Galilei Institute for Theoretical Physics** (GGI) Florence, Italy. May 29 - June 1. (Declined)
* 3th International Workshop on **Quantum Decoherence, Entanglement and Control**, Shanghai University, Shanghai, China June 13-15
*17th Peyresq Workshop on "**Macro and Micro Structures of Spacetime**", Peyresq, France, June 16-22
*Visiting Professor, **Fudan University**, Shanghai, China, June 11- 15 -27.
*The sixth International Workshop **DICE2012** Castiglioncello, Tuscany, Italy September 17 -21
*Colloquium on the **Philosophy of Science**: Recent Progress and Remaining Problems in Quantum Gravity, Boston University, Oct. 15, 2012

2013 *Workshop on *"**Probing the Microscopic Origin of Gravity**: Interaction between Theoretical and Experimental Efforts"* National Tsing Hua Univ. Taiwan Jan 27
*Invited Speaker, Div. Astronomy, Gravitation and Cosmology, Annual Meeting, Taiwan Physical Society, National Dong Hua University, Hualien, Taiwan Jan 30
***C N Yang Visiting Professorship**, Chinese University of Hong Kong. February
*Visiting Research Professor, National University of Singapore, March
*Senior Research Fellow, Institute of Physics, Academia Sinica, Taiwan, April

*Visiting Professor, Dalian University of Technology, Dalian, China April
*Visiting Professor, Fudan University, Shanghai, China, April –June
* Pacific Institute of Theoretical Physics, **"Intrinsic Decoherence in Nature"**, Galiano island, Vancouver, Canada 22-25 May 2013
*18th Peyresq Physics on "**Macro and Micro Structures of Spacetime**", Peyresq, France, June 15-21
*International Workshop on **Relativistic Quantum Information and Metrology**, University of Nottingham, UK, June 24-26
***Emergence in Curved Spacetime**, BIRS workshop, Banff, Canada, Sept 22-27
* Second International Conference on **Emergent Quantum Mechanics**, Austrian Academy of Sciences, Vienna, Austria. Oct. 3-6.
*Visiting Professor, **Raman Research Institute**, Bangalore, India, Nov 25-30

X. RESEARCH SCOPES (needs updating) Publication No.

1. Laser Physics and Molecular Kinetics	A1
2. General Relativity: homogeneous anisotropic cosmology, group-theoretical methods in perturbation theory, wave equations in curved space	A2, 3, 6
3. Relativistic Cosmology and Astrophysics: gravitational wave physics, radiation reaction and galaxy formation	A8, 11, 17, 58
4. Thermodynamics and Cosmology: noise, fluctuation, irreversibility and structure	B26, 27, 29, 31
5. Particle Physics and Cosmology, Cosmology as `Condensed Matter' Physics, Semi-classical gravity and mesoscopic physics, general relativity as hydrodynamics	B2, 15, 18, 24, 34, 37
6. Quantum Field Theory in Curved Spacetime:	
a) Canonical Formalism: canonical quantization, adiabatic regularization, trace anomaly	A4, 5, 7, 12, 13
b) Path-integral Formalism: Feynman propagator in curved space, effective action method, interacting field theory, renormalization group equations, quasi-local approximation, closed-time path formalism	A14,15,35, 65
7. Quantum Effects in the Early Universe: particle creation in cosmological spacetimes and backreaction on the structure and dynamics of the early universe	A9,10,14,16 18,31,37 B1,17,19,25
8. Symmetry Breaking of Quantum Systems in Curved Spacetime: effects of spacetime curvature, topology and field coupling on the symmetry behavior; finite size effect and dimensional reduction, infrared behavior and phase transition	A23,25,34,38,39,40 B7,9,12
9. Inflationary Cosmology and Phase Transition in the Early Universe: phase transitions and reheating, thermal and quantum gravitational effects on Planck scale process	A27,28,47,66,68 B10,11,12,13,16
10. Quantum Cosmology and Semiclassical Gravity: Validity of minisuperspace approximation; Noise, decoherence and backreaction, Fluctuations and validity of semi-classical gravity	A43, 45,52,55 B14, 21,24,25

11. Higher-Dimensional Unified Theories, Propagators in Symmetric Spaces: Kaluza-Klein theory and cosmology, classical and quantum dynamical effects, vacuum stability, gauge coupling constants — A6,29

12. Finite Temperature Quantum Field Theory in Curved Spacetime: criteria for thermal equilibrium and finite temperature theories in curved spacetimes, real and imaginary time thermal Green function, adiabatic expansion, quasi-local effective Lagrangian — A18,19,22,26.32,40 B3,4,5,7

13. Statistical Thermodynamics of Quantum Fields in Gravitational Systems:entropy of fields, subdynamics analysis, entropy generation in quantum cosmological processes, vacuum viscosity, gravitational entropy — A20,21,30,33,41,70 B6,26, C

14. Non-Equilibrium Statistical and Kinetic Field Theories in Curved Spacetime: effective action methods in quantum statistical theory, Wigner function and quantum kinetic theory, dissipation in semiclassical theories, transport phenomena — A35,36,43,72,77,78 B14

15. Quantum Open Systems and Stochastic Field Theory quantum Brownian motion, influence functional method, coarse-grained effective action, decoherence and quantum to classical transition, uncertainty principle and squeezed states, quantum dynamics of correlations, applications to atomic physics, quantum optics and mesoscopic systems — A46,49,52,56,57,63,64,82 B26-34

16. Effective Field Theory — A61

17. Stochastic Semiclassical Gravity — A53, 54, 55, 69,74,79,80,81,85 B54

18. Structure and Defect Formation in the Early Universe — A58, 71,83

19. Black Hole Fluctuations and Backreaction, Phase Transitions — A64, 73, C4

20. Stochastic Theory of Thermal Radiance in Detectors, Black Holes and Cosmology — A59-62,67

21. Relativistic Particles Moving in a Quantum Fields — A84, B50,51,52

22. Atom-Field Interaction, Bose Einstein Condensation — A75,76,86

Mathematical Physics: (sampling only, needs updating and adding contents)

Inasmuch as the objects of investigation are motivated by physical problems, the methods used in most of the research above bear on various branches of mathematics. In addition to the obvious relation of differential geometry with general relativity and gauge theory, and Lie groups with symmetric spaces, the following arise in the contexts of quantum field theory and statistical mechanics in curved spacetimes:

a) Scalar and Tensor Wave Equations in Curved Manifolds:
Separation by group theory methods

b) Harmonic Analysis on Homogeneous Spaces:
Geometric Representation of Feynman Propagators,
Kaluza-Klein theories with non-maximally symmetric internal spaces

c) Quantum Field Theory in Curved Spacetimes:
Path-Integral quantization, proper-time representations,
Heat Kernel techniques and zeta-function regularizations

d) Symmetry Breaking and Phase Transition:
Curvature, topological and finite size effects,
Spectral analysis, infrared behavior, dimensional reduction

e) Thermal Field Theory
Finite temperature field theory in spacetimes with Euclidean sections,
Thermal Green functions, Adiabatic expansions in dynamic spacetimes

f) Quantum Kinetic Theory
Wigner functions, Weyl transform, Riemann normal coordinate expansion of propagators, quantum transport of quasiparticles;
Boltzmann equation and BBGKY hierarchy, Quantum transport and dynamics of correlation functions. Nonequilibrium dynamics of strongly correlated systems, BEC atoms in optical lattices

g) Stochastic Field Theory
Quantum Brownian motion, non-Markovian processes,
Influence functional method: nonlocal dissipation and colored noise,
Functional Langevin equations, Fokker-Planck equations.

h) Quantum Coherence and Information
Decoherence mechanisms in condensed matter and superconductivity based quantum computer schemes. Entanglement dynamics in many qubit systems. Quantum trajectory applied to dissipative tunneling. Quantum backaction, feedback and control.

A. Papers Published in Refereed Journals:

Physics and Astronomy Research

1. "VIBRATIONAL ENERGY TRANSFER IN CO2 LASERS"
C. B. Moore, R. E. Wood, B. L. Hu and J. T. Yardley
Journal of Chemical Physics 46, 4222 (1967).

2. "PERBURBATIONS ON THE MIXMASTER UNIVERSE"
B. L. Hu and T. Regge, Physical Review Letters 29, 1616 (1972).

3. "SCALAR WAVES IN THE MIXMASTER UNIVERSE I. Helmholtz Equation in a Fixed Background", Physical Review D8, 1048 (1973).

4. "QUANTIZED SCALAR FIELDS IN a CLOSED ANISOTROPIC UNIVERSE'
B. L. Hu, S. A. Fulling and L. Parker, Physical Review D8, 2377 (1973)
.

5. "SCALAR WAVES IN THE MIXMASTER UNIVERSE II. Particle Creation" Physical Review D9, 3263 (1974).

6. "SEPARATION OF TENSOR EQUATIONS IN A HOMOGENEOUS SPACE BY GROUP THEORETICAL METHODS"
Journal of Mathematical Physics 15, 1748 (1974).

7. "CONFORMAL ENERGY-MOMENTUM TENSOR IN CURVED SPACETIMES: Adiabatic Regularization and Renormalization"
S. A. Fulling, L. Parker and B. L. Hu, Physical Review D10, 3905 (1974).

8. "NUMERICAL EXAMPLES FROM PERTURBATION ANALYSIS OF THE MIXMASTER UNIVERSE" Physical Review D12, 1551 (1975).

9. "EFFECT OF GRAVITON CREATION IN ISOTROPICALLY EXPLANDING UNIVERSES" B. L. Hu and L. Parker, Physics Letters 63A, 217 (1977).

10. "ANISOTROPY DAMPING THROUGH QUANTUM EFFECTS IN THE EARLY UNIVERSE"
B. L. Hu and L. Parker, Physical Review D17, 933 (1978).

11. "GRAVITATIONAL WAVES IN A BIANCHI TYPE I UNIVERSE"
Physical Review D18, 969 (1978).

12. "CALCULATION OF TRACE ANOMALY OF CONFORMAL TENSOR ENERGY- MOMENTUM IN KASNER SPACETIME BY ADIABATIC REGULARIZATION" Physical Review D18, 4460 (1978).

13. "TRACE ANOMALY OF THE ENERGY-MOMENTUM TENSOR OF QUANTIZED SCALAR FIELDS IN ROBERTSON-WALKER SPACETIME" Physics Letters 71A, 169-173 (1979)

14. "QUANTUM EFFECTS IN THE EARLY UNIVERSE I. Influence of Trace Anomalies on Anomalies on Isotropic, Classical Geometries" M. V. Fischetti, J. B. Hartle and B. L. Hu, Physical Review D20, 1757 (1979).

15. "QUANTUM EFFECTS IN THE EARLY UNIVERSE II. Effective Action for Scalar Fields in Homogeneous Cosmologies with Small Anisotropy" J. B. Hartle and B. L. Hu, Physical Review D20, 1772 (1979).

16. "QUANTUM EFFECTS IN THE EARLY UNIVERSE III. Dissipation of Anisotropy by Scalar Particle Production" J. B. Hartle and B. L. Hu, Physical Review D21, 2756 (1980).

17. "THE INFLUENCE OF COSMOLOGICAL GRAVITATIONAL WAVES ON A NEWTONIAN BINARY SYSTEM" B. Mashhoon, B. J. Carr and B. L. Hu, Astrophysical Journal 246, 569 (1981).

18. "EFFECT OF FINITE TEMPERATURE QUANTUM FIELDS ON THE EARLY UNIVERSE" Physics Letters 103B, 331 (1981).

19. "FINITE TEMPERATURE QUANTUM FIELDS IN EXPANDING UNIVERSES" Physics Letters 108B, 19 (1982).

20. "VACUUM VISCOSITY DESCRIPTION OF QUANTUM PROCESSES IN THE EARLY UNIVERSE" Physics Letters 90A, 375 (1982).

21. "QUANTUM DISSIPATIVE PROCESSES AND GRAVITATIONAL ENTROPY OF THE UNIVERSE" Physics Letters 97A, 368 (1983).

22. "FINITE TEMPERATURE EFFECTIVE POTENTIAL FOR PHI4 THEORY in ROBERTSON-WALKER UNIVERSES" Physics Letters 123B, 189 (1983).

23. "SYMMETRY BEHAVIOR IN THE EINSTEIN UNIVERSE: Effect of Spacetime Curvature and Arbitrary Field Coupling" D. J. O'Connor, B. L. Hu and T. C. Shen. Physics Letters 130B, 31 (1983).

24. "EFFECTIVE LAGRANGIAN FOR Phi4 THEORY IN CURVED SPACETIME WITH VARYING BACKGROUND FIELDS: Quasi-Local Approximation" B. L. Hu and D. J. O'Connor, Physical Review D30, 743 (1984).

25. "SYMMETRY BEHAVIOR IN THE STATIC TAUB UNIVERSE: Effect of Curvature Anisotropy" T. C. Shen, B. L. Hu and D. J. O'Connor, Physical Review D31, 2401 (1985).

26. "FINITE TEMPERATURE ENERGY DENSITY AND EFFECTIVE QUASI-POTENTIAL IN ANISOTROPIC UNIVERSES"
L. F. Chen and B. L. Hu, Physics letters 160B, 36 (1985).

27. "INFRARED BEHAVIOR AND FINITE SIZE EFFECTS IN INFLATIONARY COSMOLOGY"
B. L. Hu and D. J. O'Connor, Physical Review Letters 56, 1613 (1986).

28. "MIXMASTER INFLATION"
B. L. Hu and D. J. O'Connor,
Physical Review D (Rapid Comm.) 34, 2535 (1986).

29. "WEAK ANGLE FROM KALUZA-KLEIN THEORY WITH DEFORMED INTERNAL SPACE"
B. L. Hu and T. C. Shen, Physics Letters B180, 373 (1986).

30 "INTRINSIC MEASURES OF FIELD ENTROPY AND COSMOLOGICAL PARTICLE CREATION"
B. L. Hu and D. Pavon, Physics Letters B180, 329 (1986).

31. "CLOSED TIME-PATH FUNCTIONAL FORMALISM IN CURVED SPACETIME: Application to Cosmological Backreaction Problems"
E. Calzetta and B. L. Hu, Physical Review D35, 495 (1987).

32. "FINITE TEMPERATURE QUANTUM FIELD THEORY IN CURVED SPACETIME: Quasi-Local Effective Lagrangians"
B. L. Hu, R. Critchley and Aris Stylianopoulos,
Physical Review D35, 510 (1987).

33. "ENTROPY GENERATION IN COSMOLOGICAL PARTICLE CREATION AND INTERACTIONS: A Statistical Subdynamics Analysis"
B. L. Hu and H. E. Kandrup, Physical Review D35, 1776 (1987).

34. "SYMMETRY BEHAVIOR IN CURVED SPACETIME: FINITE SIZE EFFECT AND DIMENSIONAL REDUCTION"
B. L. Hu and D. J. O'Connor, Physical Review D36, 1701 (1987).

35. "NON-EQUILIBRIUM QUANTUM FIELDS: CLOSED TIME-PATH EFFECTIVE ACTION, WIGNER FUNCTION AND BOLTZMANN EQUATION" E. Calzetta and B. L. Hu, Physical Review D37, 2878 (1988).

36. "QUANTUM KINETIC FIELD THEORY IN CURVED SPACETIME WIGNER FUNCTION AND LIOUVILLE EQUATION"
E. Calzetta, S. Habib and B. L. Hu, Physical Review D37, 2901 (1988).

37. "QUANTUM EFFECT OF INTERACTING FIELDS IN THE EARLY UNIVERSE" B. L. Hu and Y. H. Zhang, Physical Review D37, 2151 (1988).

38. "SYMMETRY BEHAVIOR IN COSMOLOGICAL SPACETIME: Effect of Slowly-Varying Background Fields" S. Sinha and B. L. Hu, Physical Review D38, (1988) 2422-2433.

39. "ON FINITE SIZE SYSTEMS" D. J. O'Connor, C. R. Stephens and B. L. Hu, Annals of Physics (N.Y.) 190, (1989) 310-353.

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Jason Doukas, S. Y. Lin, B. L. Hu and R. Mann, JHEP **11** (2013) 119 [arXiv:1307.4360]

167. Gravitational Decoherence, Alternative Quantum Theories and Semiclassical Gravity Second International Conference on Emergent Quantum Mechanics, Austrian Academy of Science, Vienna, October 3-6, 2013

J. Phys. Conf. Ser. [arXiv:1402.6584]

Submitted for Publication:

Quantum Teleportation between Moving Dectectors in a Quantum Field Shih-Yuin Lin, Kazutomu Shiokawa, C. H. Chou and B. L. Hu, [arXiv:1204.1525]

Macroscopic Quantum Phenomena from the Coupling Pattern and Entanglement Structure Perspective
C. H. Chou, Y. Subasi and B. L. Hu, Physica A [arXiv:1308.4225]

To be submitted for publication:

Problems with the Newton-Schrödinger Equations
C. Anastopoulos and B. L. Hu, Class. Quant. Grav.

Newton-Schrödinger Equations are not derivable from General Relativity + Quantum Field Theory C. Anastopoulos and B. L. Hu [arXiv:1402.3813] Comments on H. Yang et al, Phys. Rev. Lett. 110, 170401 (2013)

Thermal Graviton Bath left from the Early Universe? Unlikely.
B. L. Hu and Enric Verdaguer, Comments on M. Blencowe, Phys. Rev. Lett. 111, 021302 (2013)

Entanglement Dynamics in a Ring Cavity
C. H. Chou, S. Y. Lin, Rong Zhou and B. L. Hu

Quantum Brownian motion of multipartite systems and their entanglement dynamics C. H. Fleming, Albert Roura, B. L. Hu, [arXiv:1106.5752]

Entanglement Structure of an Open Quantum System of N Coupled Oscillators I. Field-Induced Coupling N=3
Rong Zhou and B. L. Hu, Ann Phys. (N.Y.)

Entanglement Structure of an Open Quantum System of N Coupled Oscillators II. Strong Disparate Couplings N=3
J. T. Hsiang, Rong Zhou and B. L. Hu, Ann Phys. (N.Y.) [arXiv:1306.3728]

Preprints: (Unpublished)

Bose-Novae as Squeezing of the Vacuum by Condensate Dynamics

Esteban Calzetta and B. L. Hu [cond-mat/0208569]

Thermalization of an Interacting Quantum Field in the CTP-2PI Next-to-leading-order Large N Scheme E. Calzetta, B. L. Hu [hep-ph/0205271]

Gauge-Invariant Effective Action for the Dynamics of Bose-Einstein Condensates with a fixed number of atoms
E. Calzetta and B. L. Hu, [cond-mat/0508240]

Quantum Entanglement under Non-Markovian Dynamics of Two Qubits Interacting with a Common Electromagnetic Field,
C.. Anastopoulos, S. Shresta and B. L. Hu, arXiv:quant-ph/0610007

Exact analytical Solutions to Master Equations of Quantum Brownian Motion in a General Environment with External Force
C. H. Fleming, B. L. Hu and A. Roura [arXiv: 0705.2766]

New analytical methods for gravitational radiation and reaction in binaries with arbitrary mass ratio and relative velocity
Invited talk at IARD Conference, Aristotle University, Thessaloniki, Greece, 22-26 June 2008. C. R. Galley and B. L. Hu [arXiv:0906.0968]

Protecting and Dynamically Generating Entanglement in a Two-Atom Two-Field-Mode Model K. Sinha, N. Cummings and B. L. Hu, arXiv:1004.1834

Autangle: A case of Quantum Narcissism?
Rong Zhou, R. Behunin, S. Y. Lin and B. L. Hu **arXiv:1201.0541**

B. Papers Presented at Scientific Meetings:

1. Invited Papers

1. "QUANTUM FIELD THEORIES AND RELATIVISTIC COSMOLOGY
Plenary talk given at the 2nd Marcel Grossmann Meeting on *Developments in General Relativity*, Trieste, Italy, July, 1979. Published in the Proceeding edited by R. Ruffini (North-Holland Publishing Co., Amsterdam, 1982).

2. "ELEMENTARY PARTICLE PHYSICS AND COSMOLOGY"
Plenary talk given at Guangzhou Conference on Particle Physics, January 1980, Guangzhou, China. Published in the Proceedings edited by Hu Ning (Science Press, Beijing, China, 1980).

3. "EFFECT OF FINITE TEMPERATURE QUANTUM FIELDS IN THE EARLY UNIVERSE" Invited talk at the Workshop on the Interaction of Particle Physics and Astrophysics, May 1981, Santa Barbara.

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4. "SYMMETRY BEHAVIOR AT FINITE TEMPERATURE IN DYNAMIC " Invited talk given at the Nuffield Workshop on the Very Early Universe, Cambridge, England, July 1982. Published in "The Very Early Universe", edited by G. W. Gibbons, S. W. Hawking and S. Siklos (Cambridge University Press, Cambridge, 1983).

5. "FINITE TEMPERATURE QUANTUM PROCESSES IN THE EARLY UNIVERSE" Invited talk given at the 3rd Marcel Grossmann Meeting on Recent Developments in General Relativity, August 1982, Shanghai, China. Proceedings edited by Hu Ning (Science Press, Beijing, 1983).

6. "ON THE DISSIPATIVE NATURE OF QUANTUM GRAVITATIONAL PROCESSES" Invited talk given at the Second New Orleans Conference on Quantum Theory and Gravitation, May l983, New Orleans.

7. "SPACETIME DYNAMICS AND FINITE TEMPERATURE EFFECTS ON SYMMETRY RESTORATION" Invited talk at the Workshop on the Early Universe at the 10th International Conference on General Relativity and Gravitation, Padova, July 1983. Proceedings edited by B. Bertotti, F. deFelice and A. Pascolini.

8. "QUASI-LOCAL EFFECTIVE LAGRANGIAN IN CURVED SPACETIME" Invited talk given at the Induced Gravity Workshop, Oct. 1983, Erice, Italy.

9. "NOTES ON COSMOLOGICAL PHASE TRANSITIONS" Invited talk at the Inner Space/Outer Space Conference, Fermi Lab, May 1984. Published in the Proceedings edited by E. Kolb et al (University of Chicago Press, Chicago, 1986). pp 479-483.

10. "CAN QUANTUM GRAVITATIONAL EFFECTS PREVENT INFLATION?" Invited talk given at the International Workshop on Gauge Theory, Gravitation and the Early Universe, Nov. 1984, Ahmedabad, India, and at the Raman Institute of Physics, Bangalore, India.

11. "QUANTUM GEOMETRIC EFFECTS AND INFLATIONARY COSMOLOGY" Invited talk given at the Workshop on "Classical and Quantum Gravity" May 1985, Syracuse, New York.

12. "GEOMETRIC EFFECTS IN COSMOLOGICAL PHASE TRANSITION"

Invited talk given at the "Particle and the Universe" International Symposium, Thessaloniki, Greece, June 1985. Proceedings edited by G. Lazarides and Q. Shafi, (Elsevier Science Publishing Co., N.Y. l986).

13. "PHASE TRANSITIONS IN THE EARLY UNIVERSE: Geometric Effects" Plenary talk given at the 4th Marcel Grossmann Meeting on Recent Developments in General Relativity, Rome, Italy, June 1985. Published in Proceedings edited by R. Ruffini (North-Holland Publishing Co., Amsterdam, 1986).

14. "WIGNER FUNCTION AND QUANTUM LIOUVILLE EQUATION IN CURVED SPACETIME" E. Calzetta and B. L. Hu.
Invited talk given at the First International Conference on the Physics of Phase Space, College Park, Maryland, May 1986. Proceedings edited by Y. S. Kim and W. W. Zachary, (Springer-Verlag, Berlin 1986)

15. "THE EARLY UNIVERSE AND PARTICLE PHYSICS".
Invited talk at the New York State American Physical Society Meeting on Cosmology and Particle Physics, Oct. 1986, Syracuse.

16. "DYNAMICAL FINITE SIZE EFFECT, INFLATIONARY COSMOLOGY AND THERMAL PARTICLE PRODUCTION"
Invited talk given at the CAP-NSERC Summer Institute in Theoretical Physics, Edmonton, Canada, July 1987. Proceedings edited by K. Khanna, G. Kunstatter and H. Umezawa (World Scientific Publishing Co., Singapore, 1988).

17. "QUANTUM THEORIES OF THE EARLY UNIVERSE: A Critical Appraisal" Invited talk given at the International Conference on Gravitation and Cosmology, Dec. 1987. Goa, India.
Proceedings edited by B. Iyer and C. V. Vishveshwara
(Cambridge University Press , Cambridge 1989).

18. "COSMOLOGY AS `CONDENSED MATTER' PHYSICS"
Invited talk given at the Third Asia-Pacific Physics Conference, Hong Kong,
June 1988. Proceedings edited by K. Young
(World Scientific Publishing Co., Singapore, 1989). [gr-qc/9511076]

19. "THE ROLE OF GRAVITY IN QUANTUM PROCESSES IN CURVED SPACE" Invited talk given at the Fifth Marcel Grossmann Meeting, Perth, Australia, August 1988. Proceedings edited by D. Blair and M. J. Buckingham (World Scientific Publishing Co., Singapore, 1989).

20. "ON THE NATURE OF DISSIPATION IN SEMI-CLASSICAL GRAVITATIONAL THEORIES"

Invited talk given at the Workshop on Thermal Fields and Applications, Cleveland, October 1988. Proceedings in Physica A158 (1989).

21. "QUANTUM EFFECTS OF SUPERSPACE COSMOLOGY"
Invited lectures at the 11th Course of the International School on Cosmology and Gravitation, Erice, Italy, May 1989. Published in Quantum Mechanics in Curved Space-Time, edited by J. Audretsch and V. de Sabbata (Plenum, London 1990).

22. "COARSE-GRAINED EFFECTIVE ACTION AND INFLATIONARY COSMOLOGY" B. L. Hu and Yuhong Zhang
Invited talk at the Quantum Field Theory in Curved Space-Time Workshop in GR12, Boulder, Colorado, July 1989.

23. "MINISUPERSPACE COSMOLOGY AS THE INFRARED LIMIT OF QUANTUM GRAVITY" B. L. Hu and Sukanya Sinha
Invited talk at the Quantum Field Theory in Curved Space-Time Workshop in GR12, Boulder, Colorado, July 1989.

24. "STATISTICAL MECHANICS AND QUANTUM COSMOLOGY"
Invited talk given at the 2nd International Workshop on Thermal Fields and Applications, Tsukuba, Japan, July, 1990. Proceedings appeared as Thermal Field Theories, edited by T. Ezawa et al (North-Holland, Amsterdam 1991). gr-qc/9511079.

25. "COARSE-GRAINING AND BACKREACTION IN INFLATIONARY AND MINISUPERSPACE COSMOLOGY,"
Invited Lectures at the Seventh International Latin-American Symposium on General Relativity (SILARG VII). Proceeding appeared as Relativity and Gravitation: Classical and Quantum, edited by J. D'Olivio et al (World Scientific, Singapore, 1991).

26. "FLUCTUATION, DISSIPATION AND IRREVERSIBILITY IN COSMOLOGY" Invited Talk at the Workshop on The Physical Origin of Time-Asymmetry, Huelva, Spain, Oct. 1991. Proceedings edited by J. J. Halliwell, J. Perez-Mercader and W. H. Zurek (Cambridge University, Cambridge, 1994). gr-qc/9302021.

27. "QUANTUM ORIGIN OF NOISE AND FLUCTUATION IN COSMOLOGY"
Invited Talk at the International Conference on the Origin of Structure in the Universe, Chateau de Pont d'Oye, Belgium April, 1992.Proceedings edited by E. Gunzig, P. Nardonn (NATO ASI Series, Kluwer, Dordrecht, 1993) gr-qc/9512049.

28. "QUANTUM AND THERMAL FLUCTUATIONS, UNCERTAINTY PRINCIPLE, DECOHERENCE AND CLASSICALITY"

Invited Talk at the Third International Workshop on Quantum Nonintegrability, Drexel University, Philadelphia, May, 1992. Published in "Quantum Dynamics of Chaotic Systems," edited by J. M. Yuan, D. H. Feng and G. M. Zaslavsky (Gordon and Breach, Philadelphia, 1993) gr-qc/9302029.

29. "QUANTUM NOISE IN GRAVITATION AND COSMOLOGY"
Invited Talk at the Workshop on Fluctuation and Order, Los Alamos National Laboratory, Sept. 1993. Proceedings published in the Santa Fe Institute Series, ed. M. Millonas (Springer-Verlag, Berlin, 1994) astro-ph/9312012.

30. "QUANTUM STATISTICAL FIELD THEORY IN GRAVITATION AND COSMOLOGY"
Invited Lectures at the Third International Workshop on Thermal Fields and Applications, Banff, Canada, Aug. 1993. Proceedings ed. R. Kobe, G. Kunstatter (World Scientific, 1994) gr-qc/9403061.

31. "NONEQUILIBRIUM QUANTUM FIELDS IN COSMOLOGY: Comments on Current Selected Topics"
Invited Talk at the Second Paris Cosmology Colloquium Observatorie de Paris, Paris, June 2-4, 1994. Proceedings edited by H. de Vega and N. Sanchez (World Scientific, Singapore, 1995) gr-qc/9409053.

32. "CORRELATIONS, DECOHERENCE, DISSIPATION AND NOISE IN QUANTUM FIELD THEORY"
E. Calzetta and B. L. Hu, Invited Talk at the International Workshop on Heat Kernel Techniques and Quantum Gravity, University of Winnipeg, Canada, August 1994. Proceedings published as Discourses in the Mathematics and Its Applications No. 4, edited by S. A. Fulling (Texas A & M University Press, College Station, 1995) hep-th/9501040.

33. "ENVIRONMENT-INDUCED EFFECTS IN QUANTUM CHAOS: DECOHERENCE, DELOCALIZATION AND IRREVERSIBILITY"
K. Shiokawa and B. L. Hu
Invited Talk at the International Symposium on Quantum Classical Correspondence, Drexel University, Philadelphia, Sept. 1994, Proceedings eds D. H. Feng and B. L. Hu (International Press, Boston, 1997).

34. "SEMICLASSICAL GRAVITY AND MESOSCOPIC PHYSICS"
Invited Talk at the International Symposium on Quantum Classical Correspondence, Drexel University, Philadelphia, Sept. 1994, Proceedings eds D. H. Feng and B. L. Hu (International Publishers, Boston, 1997) g-qc/9511077.

35. "HAWKING-UNRUH EFFECT AS RELATIVISTIC EXPONENTIAL SCALING OF QUANTUM NOISE"

Invited talk at the 4th International Workshop on Thermal Field Theory and Applications, Dalian, China, August 1995, Proceedings edited by Y. X. Gui and F. C. Khanna (World Scientific, Singapore, 1996) gr-qc/9606973

36. "CORRELATION DYNAMICS OF QUANTUM FIELDS AND BLACK HOLE INFORMATION PARADOX"
Invited talk at the International School of Astro-fundamental Physics, Sept. 1995. Peoceedings edited by N. Sanchez and Zichichi, Physics, Sept. 1995. (Kluwer Publishers, Dordrecht, 1996) gr-qc/9511075

37. "GENERAL RELATIVITY AS GEOMETRO-HYDRODYNAMICS"
Invited talk at the Second Sakharov International Conference Lebedev Physical Institute, May, 1996. Proceedings to appear (World Scientific, Singapore, 1997) gr-qc/9607070.

38. "NONEQULIBRIUM PHASE TRANSITIONS IN THE EARLY UNIVERSE"
Invited talk at the International Workshop on Nonequilibrium Phase Transitions July 1996, Santa Fe, New Mexico

39. "QUANTUM STATISTICAL FIELDS IN GRAVITATION AND COSMOLOGY
Invited Talk at the International Conference on Gravitation and Cosmology June 1997, Soo Chow University, Taiwan

40. "COHERENCE AND FLUCTUATIONS IN THE INTERACTION BETWEEN A MOVING ATOM AND A QUANTUM FIELD"
B. L. Hu and Alpan Raval, Invited talk at the International Symposium on Macroscopic Quantum Coherence, Northeastern University, Boston, July 1997 (World Scientific, Singapore, 1998) quant-phys/9710061.

41. "FINITE-SIZE COSMOLOGY"
Invited Talk at the International Workshop on Topology and Cosmology, Case Western University, Cleveland, Oct. 1997

42. "BLACK HOLE FLUCTUATIONS AND BACKREACTION"
B. L. Hu, Invited talk at the International Conference on quantum Gravity in the Southern Cone, Barioloche, Argentina, January 1998.

43. "STOCHASTIC GRAVITY"
B. L. Hu, Invited talk at the Third Peyresq Meeting on Quantum Cosmology, Peyresq, France, June 1998.

44. "NON-EQUILIBRIUM DYNAMICS OF A THERMAL PLASMA IN A GRAVITATIONAL FIELD
Invited Talk at the International Workshop on Non-equilibrium Quantum Fields in Relativistic Heavy Ion Physics, Brookhaven National Laboratory, L. I., Oct. 1998.

45. "NONEQUILIBRIUM QUANTUM FIELDS IN BLACK HOLES AND THE EARLY UNIVERSE"
Invited Talk at the International Workshop on Nonequilibrium Quantum Fields, Institute for Theoretical Phyiscs, University of California, Santa Barbara, Jan 1999.

46. "RENORMALIZATION GROUP THEORY IN CURVED SPACETIMES AND COSMOLOGY: Scaling, Coarse-Graining and Backreaction"
Invited Talk at the International Conference on Renormalization Group Theory —RG2000 Taxco, Mexico, Jan. 1999

47. "FLUCTUATIONS OF VACUUM ENERGY IN BLACK HOLE SPACETIMES" Invited Talk at the Fourth Peyresq Meeting on Quantum Cosmology, Peyresq, France, June 1999

48. "NOISE FROM QUANTUM FIELD THEORY" Invited talk at the Workshop on Quantum Field theory of Nonequilibrium Processes at the Institute for Nuclear Theory , University of Washington, Seattle. Nov. 1999

49. "FLUCTUATIONS OF VACUUM ENERGY AND VALIDITY OF SEMICLASSICAL GRAVITY"
Invited Talk at the Fifth Peyresq Meeting on Quantum Cosmology Peyresq, France, June 2000

50. **Is there emitted radiation in Unruh effect?**
B.L. Hu, Alpan Raval, Invited Talk at the Capri Workshop on Quantum Aspects of Beam Physics, Oct. 2000 . Proceedings edited by Pisin Chen.(World-Scientific, Singapore, 2001) quant-ph/0012134

51. **Beyond Unruh Effect: Nonequilibrium Quantum Dynamics of Moving Charges** B.L. Hu, Philip R. Johnson, Invited Talk at the Capri Workshop on Quantum Aspects of Beam Physics, Oct. 2000. Proceedings edited by Pisin Chen. (World-Scientific, Singapore, 2001) [quant-ph/0012132]

52. "**Worldline Influence Functional: Abraham-Lorentz-Dirac-Langevin Equation from QED**" Philip R. Johnson, B.L. Hu , in Proceedings of the Capri Workshop on Quantum Aspects of Beam Physics, Oct. 2000. Edited by Pisin Chen (World-Scientific, Singapore, 2001) [quant-ph/0012135]

53. **Recent Advances in Stochastic Gravity: Theory and Issues**
B. L. Hu and E. Verdaguer , Invited Lectures at Erice School, May 2001, in *Advances in the Interplay between Quantum and Gravity Physics* edited by P. Bergmann and V. De Sabbata, (Kluwer, 2002) [gr-qc/0110092]

54. **"Vacuum Energy Fluctuations in Minkowski and Casimir Spaces"** Invited Talk at the Sixth Peyresq Meeting: Stochastic Gravity and Quantum Cosmology, Peyresq, France, June 2001

55. "**Decoherence in Two Level Systems and Brownian Motion**" Invited Talk at the Workshop Mechanisms for Decoherence-Theory and Applications to Nanotechnology and Quantum Information Science held at IC2, University of Texas, Austin October 2001. Proceedings published in *Chaos, Solitons and Fractals*, (2003)

56. **"Teacup Cosmology –Particle Creation and Structure Formation in the Early Universe from BEC Collapse "** Invited Talk at the Seventh Peyresq Meeting, Peyresq, France, June 2002

57. **Quantum Noise and Fluctuations in Gravitation and Cosmology** B. L. Hu, Albert Roura, Sukanya Sinha, E. Verdaguer Invited Talk given by BLH at the *First International Symposium on Fluctuations and Noise* Sponsored by SPIE, 1-4 June 2003, Santa Fe, New Mexico. Paper number 5111-46. [gr-qc/0304057]

58. **What can we learn from BEC about Quantum Gravity?** Invited Talk at the Eighth Peyresq Meeting, Peyresq, France, June 2003

59. **Moving Charges, Detectors and Mirrors in a Quantum Field with Backreaction** Chad Galley, B. L. Hu and Philip R. Johnson in Proceedings of the Third International Symposium on Quantum Field Theory under the influence of External Conditions, Oklahoma City, Sept. 2003, edited by Kimball Milton (Rinton Press, 2004) [quant-ph/0402002]

60. "**Stochastic Theory of Relativistic Charges and Atoms in a Quantum Field**", IARD04 conference, Saas Fee, Switzerland, June 2004. Proceedings published in Foundations of Physics (2005)

61. "**Black Hole Backreaction – difference between the Bekenstein Model and Stochastic Gravity Predictions**" Invited Talk at the Nineth Peyresq Meeting, Peyresq, France, June 2004

62. "**Black Hole Backreaction in the Moving Mirror Analog"**, with Chad Galley, Invited Talk at the Nineth Peyresq Meeting, Peyresq, France, June 2004

63. "**Stochastic Gravity: From Macro to Micro Structures of Spacetime"** invited talk at the DICE04 meeting, Piombino, Italy, September 2004

64. "**The Universe as an Ultimate Macroscopic Quantum Phenomenon**" invited talk at the *Quantum Physics of Nature* (QUPON) Conference, Vienna, Austria, May 2005.

65. "**Black hole fluctuations and dynamics from back-reaction of Hawking radiation: Current work and further studies based on stochastic gravity**" **B. L. Hu, Albert Roura,** Invited talk at the VII Asia-Pacific International Conference on Gravitation and Astrophysics – On the Occasion of the 90th anniversary of the publication of the Theory of General Relativity, National Central University, Taiwan. Nov. 2005 *Proceedings edited by J. M. Nester, C-M Chen and J-P Hsu (World Scientific Singapore, 2006)* p. 236

66. **Uniformly Accelerated Detectors in (3+1) D spacetime: From Vacuum Fluctuations to Radiation Flux**. S. Y. Lin and B. L. Hu, Invited talk delivered by S Y Lin at the VII Asia-Pacific International Conference on Gravitation and Astrophysics – On the Occasion of the 90th Year of General Relativity, National Central University, Taiwan. Nov. 2005 *Proceedings edited by J. M. Nester, C-M Chen and J-P Hsu (World Scientific Singapore, 2006)* p.191

67. **"Stochastic Gross-Pitaevsky Equation from Coarse-Grained Effective Action",** in International Conference on **Nonlinear Science**, Hong Kong Baptist University
May 24-26, 2006 Publication A119

68. **"Quantum Decoherence and Entanglement between two qubits in a common electromagnetic field"** in ***Conference on Quantum Entanglement & Geometry***,
Toruń University, Poland, June 4-7, 2006

69. **"Nonequlibrium Dynamics of cold atoms in an optical lattices".**
Jagiellonian University, Krakow, Poland. June 12-13, 2006

70. **"Intrinsic and Fundamental Decoherence"**, 11th Peyresq Workshop on "***Macro and Micro Structures of Spacetime III***", Peyresq, France, June 17-23, 2006 Publication A121

71. **"Exact Master Equation and Decoherence of Two Harmonic Oscillators Brownian Motion in a General Environment"**
Workshop on ***Quantum - Classical Transition and Quantum Information***, June 18-30, 2006 Benasque, Spain

72. **"Decoherence in Quantum Gravity: Issues and Critiques"**
DICE2006 International Workshop*:* ***Quantum Mechanics between Decoherence and Determinism****:* new aspects from particle physics to

cosmology Castello di Piombino (Tuscany) Italy, September 11-15, 2006. Publication A120

(5 yrs in between, details of invited talks omitted ...)

100. Gravity and Thermodynamics: What do we really want? ESF International Exploratory Workshop on "Gravity as Thermodynamics: Towards the microscopic origin of geometry" SISSA/ISAS, Trieste, Italy. Sept 5-8, 2011.

101. Vienna Nov 2011
102 HKUST Feb 2012, 103. Peking University (2 talks) March 2012
104. Lanzhou University (2 talks) May 2012
105. Brazilian Physical Society Plenary Talk, May 2012
106. kTlog 2, Cuena Spain, May 2012
107. Ginzburg Conference, Moscow, June 1, 2012
108. ITP, Beijing, June 4, 2012
109. Peyresq Meeting, *Fluctuation Theorem for Gravitating Systems*, France June 21, '12
110. Entanglement Decoherence & Quantum Control Workshop, Shanghai, June 12,2012

-- Stopped enumerating.

C. Books or contributions to edited Books:

Books Published

"DIRECTIONS IN GENERAL RELATIVITY" Volume 1-- Misner Festschrift edited by B. L. Hu, M. P. Ryan, and C. V. Vishveshwara (Cambridge University Press, Cambridge, 1993).

"DIRECTIONS IN GENERAL RELATIVITY" Volume 2-- Brill Festschrift edited by B. L. Hu and T. A. Jacobson (Cambridge University Press, Cambridge, 1993).

"QUANTUM CLASSICAL CORRESPONDENCE"
edited by D. H. Feng and B. L. Hu (International Press, Boston, 1997).

"NONEQUILIBRIUM QUANTUM FIELD THEORY"
E. Calzetta and B. L. Hu (Cambridge University Press, Cambridge, 2008).

Books contracted:

"SEMICLASSICAL AND STOCHASTIC GRAVITY"
B. L. Hu and E. Verdaguer (Cambridge University Press, Cambridge, 2014)

Invited Contributions (in addition to items in proceedings of conferences listed above)

1. "VACUUM VISCOSITY AND ENTROPY GENERATION IN QUANTUM GRAVITATIONAL PROCESSES IN THE EARLY UNIVERSE"
in Advanced Series in Astrophysics, Vol. l
edited by L. Z. Fang and R. Ruffini (World Scientific ,Singapore, 1983).

2. "MINISUPERSPACE AS A QUANTUM OPEN SYSTEM"
B. L. Hu, J. P. Paz and S. Sinha in Misner Festschrift (1993) pp. 145-165.

3. "DECOHERENCE OF CORRELATON HISTORIES"
E. Calzetta and B. L. Hu in Brill Festschrift (1993) pp. 38-65.

4. "FLUCTUATION, DISSIPATION AND IRREVERSIBILITY IN COSMOLOGY"
in The Physical Origin of Time-Asymmetry,
edited by J. J. Halliwell, J. Perez- Mercader and W. H. Zurek
(Cambridge University, Cambridge, 1994). [gr-qc/9302021]

5. "NOTES ON BLACK HOLE FLUCTUATIONS AND BACKREACTION
B. L. Hu, A. Raval, and S. Sinha in "Black Holes, Gravitational Radiation and The Universe: Essays in honor of C. V. Vishveshwara", eds B. Iyer and B. Bhawal (Kluwer Academic Publishers, Dordrecht, 1998.) gr-qc/9901010

6. "Quantum Gravity and the Origin of the Universe – an Ephemeralist's view"
in *Why are we here? -- on the Origin of the Universe* (Book in Chinese)
(Commercial Press, Hong Kong 2007)
-- A collection of essays based on public talks given by Stephen Hawking, Bei-Lok Hu, Robert Laughlin, Henry Tye and others in Hong Kong, May-June 2006 [gr-qc/0611058]

7. New View on Quantum Gravity: Micro-Structure of Spacetime and Origin of the Universe (English version of 6) collected in PHYSICS OF SELF-ORGANIZATION SYSTEMS Proceedings of the 5th 21st Century COE Symposium held in Wasada University, *Tokyo, Japan 13 - 14 September 2007,* edited by Shin'ichi Ishiwata & Yasushi Matsunaga. (World Scientific Press 2008).

8. Invited guest editor, with Ting Yu, co-editor, for the Special Issue on Quantum Decoherence and Quantum Entanglement in *Quantum Information Processing* (December 2009)