

wandering planets, falling apples, curving spaces,
whirling stars: how unraveling the mysteries of gravity has taught us about the universe

This talk uses the history of understandings about gravity as a template for talking about how science works. It shows how our understanding is driven forward by the interweaving of threads that arise in observations and in theory building. I stress the importance of seeking consistent interpretations of apparently inconsistent ideas or observations as a key to progress in science.

THE MYSTERY OF THE MISSING ANTIMATTER

The laws of physics for matter and antimatter are very, very similar. Yet we live in a universe where matter dominates over antimatter by many orders of magnitude. When and how did this imbalance occur? This is a question at the root of our existence, but one for which, as yet, we do not have a satisfactory answer. I will review the physics of this problem, and the possible answers that are suggested by our current understanding of the history of the universe and of the differences between the behavior of matter and antimatter, known as CP violations.

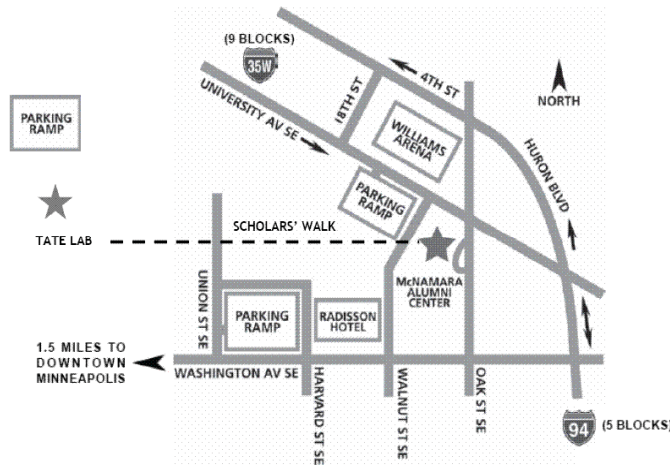


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The William I. Fine Theoretical Physics Institute at the University of Minnesota is proud to host the Irving and Edythe Misel Lecture Series.

Mr. Fine's bold vision and generous gift to the University, inspired by his genuine interest in physics, were instrumental in the establishment of the Institute and its successful development over the past two decades.

The Misel Lecture Series is endowed by a generous gift from Irving and Edythe Misel. The Series honors the life-long friendship between Irving and Edythe Misel, their family, and William and Bianca Fine.



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4th annual
THE IRVING AND EDYTHE
MISEL family
LECTURE



SPEAKER:
HELEN QUINN
STANFORD UNIVERSITY, SLAC

Public Lecture
Wandering planets, falling apples,
whirling stars: How unraveling
the mysteries of gravity has
taught us about the universe

October 6, 2009 7:00p.m.
Memorial Hall, McNamara Alumni Center

Physics and Astronomy Colloquium
The Mystery of the Missing
Antimatter
October 7, 2009

4th annual
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program

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OCTOBER 6, 2009 7:00 p.m.
MEMORIAL HALL, MCNAMARA ALUMNI CENTER

welcoming remarks.....STEVEN CROUCH
dean, INSTITUTE OF TECHNOLOGY

introduction.....MIKHAIL VOLOSHIN
director, FINE THEORETICAL PHYSICS INSTITUTE

speaker.....HELEN QUINN

refreshments to follow in atrium

THE MYSTERY OF THE MISSING
ANTIMATTER

OCTOBER 7, 2009
ROOM 131, TATE LAB OF PHYSICS
PHYSICS AND ASTRONOMY COLLOQUIUM

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HELEN QUINN

is a leading expert in theoretical high energy physics – the part of physics that studies elementary particles, their structure and their interactions. This area of scientific research deals with the most fundamental laws of nature at the micro-, macro- and mega- scales – the laws of physics which underlie the properties of matter, the kinds and sources of energy, the evolution of stars and of the universe as a whole.

Professor Quinn is credited with many outstanding achievements in advancing our knowledge of the material world. Some of her works are truly the highest points in the development of the field. In a 1974 paper written in collaboration with Howard Georgi and Steven Weinberg she laid the foundation for all subsequent studies of the so-called Grand Unification – a unified theory of the strong, electromagnetic and weak interactions. They showed how these interactions, that manifest themselves so very differently in observable phenomena, can in fact be parts of a single unified force. Her work with Enrico Poggio and Steven Weinberg was crucial in understanding the so-called quark – hadron duality - the relation between the fundamental processes involving quarks and the observable properties of strongly interacting particles that contain them. This concept of quark – hadron duality is the cornerstone of modern studies of the fundamental interactions of quarks by means of observing processes with strongly interacting particles. In collaboration with Roberto Peccei she suggested the existence of a new approximate symmetry of nature, universally called the Peccei-Quinn symmetry, that shields the strongly-interacting particles from an unacceptably large asymmetry between matter and antimatter. One of the consequences of their scheme is the existence of an as-yet-unseen particle, called the axion, that is now being sought in numerous experiments, and that may be present in the dark matter in the universe.

Over the past two decades, Helen Quinn has devoted much effort to providing a theoretical guidance for the major experiment known as BaBar at the B factory at the Stanford Linear Accelerator Center (SLAC). The B factory and the BaBar experimental setup were built as a dedicated facility for studies of the B mesons, containing a very heavy b quark. The main goal of these studies was to reveal the mechanism of the observed weak asymmetry between the matter and antimatter, and this goal has been

successfully achieved. This experiment ended its decade of data-taking last year; ongoing data analyses are still producing new results.

Helen Quinn is a native of Victoria, Australia. She started her university studies at the University of Melbourne and later transferred to Stanford University, completing a BS there in 1963. She received her Ph.D. from Stanford in 1967 and then worked at the Deutsches Elektronen Synchrotron laboratory in Hamburg, Germany and at Harvard before returning to Stanford where she is now a professor and chair of the Department of Particle Physics and Astrophysics at the SLAC National Accelerator Laboratory.

She is a member of the National Academy of Sciences, and the American Philosophical Society, and a Fellow of the American Academy of Arts and Sciences. She was an elected President of the American Physical Society. Her awards include the 2000 Dirac Medal of the International Center for Theoretical Physics, Trieste, Italy, Honorary Officer of the Order of Australia, and the 2008 Oscar Klein Medal from the University of Stockholm and the Royal Swedish Academy of Sciences.

Professor Quinn also spends much of her time publicizing and promoting science. She works with elementary and high school teachers in California on enhancing the teaching of physics and science to students. She has given numerous public lectures to audiences in many countries.

We at the William I. Fine Theoretical Physics Institute are delighted to welcome Professor Helen Quinn as a distinguished speaker.

Misha Voloshin
Director, Fine Theoretical Physics Institute

