The William I. Fine Theoretical Physics Institute at the University of Minnesota is proud to host the 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.


I will talk about the search for a unified theory of the laws of physics including quantum mechanics, which governs the very small, and general relativity, which governs the very large. Stephen Hawking showed 40 years ago that these theories make conflicting predictions near black holes. This ignited a battle that continues to this day: either quantum mechanics must break down, or our understanding of spacetime must be wrong. The latest wrinkle is the ‘firewall’ paradox: if quantum mechanics is to be saved, then an astronaut falling into a black hole will have an experience very different from what Einstein’s theory predicts. This has led to many new ideas that may lead to the unification of these two great theories.

ABSTRACT

SPACETIME VERSUS THE QUANTUM

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JOSEPH POLCHINSKI (JOE)
received his BS in Physics from the
California Institute of Technology in 1975,
and his PhD in Physics from UC Berkeley
in 1980. After two-year stints as a
research associate at the Stanford Linear
Accelerator (SLAC) and at Harvard, he
joined the faculty at the University of Texas
at Austin in 1984. He moved to UC Santa
Barbara in 1992, where he is a Professor
of Physics and a Permanent Member of the
Kavli Institute for Theoretical Physics.

Polchinski’s contributions to theoretical
physics include a modern formulation
of renormalization theory, some of the
original work on the string landscape,
and most recently the ‘firewall’ paradox
in black holes. He is best known for
his discovery of D-branes, extended
structures that appear to be central to
the mathematics and physics of string
theory. He is also the author of a widely
used two-volume text on string theory.

Polchinski held a Hertz Graduate Fellowship
from 1975 to 1980, and NSF Postdoctoral
Fellowship from 1980 to 1982, and an
Alfred P. Sloan Fellowship from 1985
to 1989. He was elected a fellow of the
American Physical Society in 1997, a
member of the American Academy of Arts
and Sciences in 2002, a member of the
National Academy of Sciences in 2005,
and a fellow of the American Association
for the Advancement of Science in 2012.
He has recently been awarded the 2007
Dannie Heineman Prize in Mathematical
Physics of the American Physical Society,
the 2008 Dirac Medal of the International
Center for Theoretical Physics, Trieste, and
the 2013 and 2014 Physics Frontiers Prizes.