past, present and future

6-7 MAY 2016
Jadwin Hall, Room 407
Our dream was for a place that brings together outstanding young talents across a wide range of natural sciences and engineering to spend their postdoctoral period in an environment where they learn from one another and pursue whatever questions they wish, and to make this same place a hub where, through workshops and other activities, scientists and engineers from diverse disciplines meet to share ideas, brainstorm, debate, discover, challenge paradigms, identify new directions, meet old friends and make new ones. Through the guidance of a fantastic cadre of Faculty Fellows and supporters across the campus, we have been improving each year in achieving this dream.

Ten great years are past, but the best is yet to come.

— Paul J. Steinhardt, Director
### Friday, May 6, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Talk</th>
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<tbody>
<tr>
<td>10:00-10:05 am</td>
<td><strong>Welcome and Introductions, Paul Steinhardt</strong></td>
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<tr>
<td>10:05-10:35</td>
<td><strong>David Limmer</strong>&lt;br&gt;Driving structural change with light</td>
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<tr>
<td>10:35-11:00</td>
<td><strong>Antonello Scardicchio</strong>&lt;br&gt;Breakdown of statistical mechanics due to quantum effects</td>
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<tr>
<td>11:00-11:25</td>
<td><strong>Mariangela Lisanti</strong>&lt;br&gt;Searching for dark matter in the Milky Way</td>
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<td>11:25-11:50</td>
<td><strong>Timothy Merlis</strong>&lt;br&gt;Do hurricanes and organized convection affect the global climate sensitivity?</td>
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<tr>
<td>12:00-1:15 pm</td>
<td><strong>Lunch at PCTS, Jadwin Hall, Fourth Floor</strong></td>
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<td></td>
<td><strong>Afternoon Session #1</strong></td>
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<tr>
<td>1:15-1:45</td>
<td><strong>Titus Neupert</strong>&lt;br&gt;Bosons that cannot condense</td>
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<td>1:45-2:10</td>
<td><strong>Jean-Luc Lehners</strong>&lt;br&gt;Classically smooth</td>
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<td>2:10-2:35</td>
<td><strong>Sabetta Matsumoto</strong>&lt;br&gt;Phytomimetic 4D printing</td>
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<td>2:35-3:00</td>
<td><strong>Dmitry Abanin</strong>&lt;br&gt;Ergodicity, entanglement, and many-body localization</td>
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<td>3:00-3:30</td>
<td><strong>Coffee break</strong></td>
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<td><strong>Afternoon Session #2</strong></td>
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<tr>
<td>3:30-4:00</td>
<td><strong>Timothy Berkelbach</strong>&lt;br&gt;A couple coupled-cluster stories</td>
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<tr>
<td>4:00-4:25</td>
<td><strong>Adam Brown</strong>&lt;br&gt;Computational complexity and black holes</td>
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<td>4:25-4:50</td>
<td><strong>B. Andrei Bernevig</strong>&lt;br&gt;New fermions</td>
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<td>4:50-5:15</td>
<td><strong>Alexander Tchekhovskoy</strong>&lt;br&gt;The “hole” story</td>
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## Saturday, May 7, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>8:45-9:15 am</td>
<td>Coffee and Continental Breakfast</td>
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<tr>
<td></td>
<td><strong>Session #1</strong></td>
<td><strong>Chair: Mark Mezei</strong></td>
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<tr>
<td>9:15-9:45</td>
<td>Yi Li</td>
<td>Monopole harmonic cooper pairing</td>
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<td>9:45-10:10</td>
<td>Daniel Harlow</td>
<td>How to cut a gauge theory</td>
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<td>10:10-10:35</td>
<td>Masahito Yamazaki</td>
<td>QFT 4.0</td>
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<tr>
<td>10:35-11:00</td>
<td>Marco Schiro</td>
<td>The importance of being a photon: quantum phases of light and matter far from equilibrium</td>
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<td>11:00-11:15</td>
<td>Coffee break</td>
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<tr>
<td></td>
<td><strong>Session #2</strong></td>
<td><strong>Chair: Curtis Callan</strong></td>
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<tr>
<td>11:15-11:45</td>
<td>Ian Abel</td>
<td>Between the abstract and the applied: using theoretical physics to advance fusion energy</td>
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<tr>
<td>11:45-12:10 pm</td>
<td>Matthew Reece</td>
<td>What is the weak gravity conjecture?</td>
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<tr>
<td>12:10-12:35</td>
<td>Bryan Clark</td>
<td>Quantum coloring</td>
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<tr>
<td>12:35-1:00</td>
<td>Rahul Nandkishore</td>
<td>Many body localization and thermalization: insights from the entanglement spectrum</td>
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<tr>
<td>1:00-2:00</td>
<td>Lunch at PCTS with friends and family</td>
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</tbody>
</table>
PROGRAM ORGANIZERS

Michael Aizenman
Nima Arkani-Hamed
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Hantao Ji
Jeremy Kasdin
Vedika Khemani
Justin Khoury
Matthew Kunz
Laura Landweber
Paul Langacker
Elliot Lieb
PROGRAMS

2006-2007
Physics at Large Hadron Collider
Packing Problems, Classical Ground States and Glasses

2007-2008
Quantum Computing

2008-2009
PCTS—OFFICIAL OPENING, RECEPTION AND DINNER
The Big Bang and Beyond
Iron-based High Temperature Superconductors
Physical Principles in Biological Networks
Fundamental Problems in Climate Dynamics

2009-2010
Rare Fluctuations and Large Disorder in Quantum Systems
Anti-de Sitter/Conformal Field Theory: New Developments and Applications
Nucleation Phenomena -- Rare Events
Computational Relativistic Astrophysics
Rare Events in Biology
Understanding Cancer via the Theoretical Sciences
Rare Events—Random Events

2010-2011
Low Dimensional Systems
Electronic Properties of Graphene
Rare Events in Computational, Financial and Physical Sciences
Topological Insulators and Superconductors
Dark Matter Detection
Structure & Dynamics of Water & Aqueous Solutions in Materials Science
Challenges for Inflationary Cosmology
Seismology of Earth and Stars
Differential Rotation in Stars
BOOST 11 - CERN
First Annual PCTS Lecturer, Sir Michael Berry

2011-2012
Low Dimensional Systems (cont’d.)
Towards Unifying Concepts in the Physics of Aperiodic Systems
Exact Methods in Gauge/String Theories
Applied Topology
Quantum Statistical Mechanics & Quantum Computation
Non Equilibrium Phenomena in Ultra-cold Atoms & strongly Interacting Photons
Connecting the Electromagnetic and Gravitational Waves Skies in the Era of Advanced Laser Interferometer Gravitational-Wave Observatory
Hot Topics at Colliders: Exploring Hints of New Physics
Second Annual PCTS Lecturer, Leo Kadanoff
2012-2013
Discovery of the Higgs Boson
Bridging the Gap Between the Geosciences and Mathematics, Statistics, and Computer Science
Higgs Physics After Discovery
Entanglement in Discrete & Continuous Quantum Systems
Nonequilibrium Physics with Strongly Interacting Quantum Matter and Light
Through the Looking Glass
Origins of Life
Geostrophic Turbulence & Active Tracer Transport in Two Dimensions
Revealing Radiative Processes Near Black Holes
Cosmology in the Planck Era
Third Annual PCTS Lecturer, Ignacio Cirac

2013-2014
Astrophysics Focused Telescope Asset Space
Coronography for Exoplanet Imaging
Living with a Star: Past Accomplishments and Future Promise
The US-Italy Physics Program at Laboratori Nazionali del Gran Sasso
The Dark Matter Paradigm: Current Status and Challenges
CMS* Exotic Physics (*Compact Muon Solenoid experiment at the Large Hadron Collider)
Bulk Microscopy from Holography
“Toy Models”, Director’s Lecture
Effective Field Theory for Large Scale Structures
Symmetry in Topological Phases
Many Body Localization and Related Phenomena
The Origin of Biological Homochirality
Searching for Simplicity
Fourth Annual PCTS Lecturer, Michael Peskin

2014-2015
Kuncik/LaFleur Public Lecture: Quantum Universe
Open Questions in String Cosmology and Inflation
Majorana Zero Modes and Beyond
Higher Spin Symmetries and Conformal Bootstrap
Numerical Approaches to Nonadiabatic Dynamics
Plasma Processes in Astrophysics and Fusion Energy: A Workshop of the Max-Planck/Princeton Center for Plasma Physics
Accelerating Cosmic-Ray Comprehension
Intracellular Phase Transitions: RNA, Protein, Lipids and Beyond
Ice Nucleation
Topological and Strongly Correlated Phases in Cold Atoms
Fifth Annual PCTS Lecturer, Gavin Crooks

2015-2016
The Non-Equilibrium Quantum Frontier
Magnetic Fields in Laboratory High Energy Density Plasmas
Large Deviation Theory In Principle And Practice
The Dynamo Effect in Astrophysical and Laboratory Plasmas
Dirac and Weyl Fermions in Topological Semimetals
Exploring New Data from LHC Run-II
General Relativity in the Next 100 Years
Rethinking Cosmology
PCTS@TEN CONFERENCE AND CELEBRATION
Sixth Annual PCTS Lecturer, Michael Brenner
CURRENT FACULTY FELLOWS
B. Andrei Bernevig • Curtis Callan (Director, 2006-08) • Garnet Chan • Pablo Debenedetti • Eve Ostriker • Howard A. Stone • Herman Verlinde

POSTDOCTORAL FELLOWS
2006–09: B. Andrei Bernevig, Meera Parish, and Antonello Scardicchio
2007-10: Thomas Klose, Jean-Luc Lehners, Branson Stephens, and Aleksandra Walczak
2008-11: Dmitry Abanin, Lisa Manning, and Matthew Reece
2009-12: Benjamin Basso, Adam Brown, and Bryan Clark
2010-13: Mariangela Lisanti, Marco Schiro, Alexander Tchekhovskoy, and Masahito Yamazaki
2011-13: Timothy Merlis
2011-14: Yoav Kallus, Joseph Maciejko, and Elisabetta Matsumoto
2012-15: Daniel Harlow, Samuel Lee, and Rahul Nandkishore
2013-16: Ian Abel, Yi Li, David Limmer, and Titus Neupert
2014-16: Timothy Berkelbach
2014-17: Anna Iijas, Curt von Keyserlingk, Mark Mezei, and David Pinner
2015-18: Barry Bradlyn, Jennifer Cano, Bruno Le Floch, Zhiyuan Li, and Yaojun Zhang
2016-19: Anna Frishman, Daniel Lecoanet, Pierre Ronceray, and Pierfrancesco Urbani

EMERITUS FACULTY FELLOWS
Ravindra Bhatt • William Bialek • Adam Burrows • Roberto Car • David Huse • Shivaji Sondhi • David Spergel • Salvatore Torquato • Jeroen Tromp
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