Celebrating 50 years of SSI:
A personal recollection (the later years)

JoAnne Hewett
August 2022
JoAnne’s personal SSI history

Attended as a student in 1984

Organizing Cmtte 2003-2015

Lectured in

1993: Top ten models constrained by b to s gamma
1995: The role of top in heavy flavor physics
2012: Supersymmetry basics
2013: The vision ahead
What does it take to organize SSI?

We start meeting weekly in October

- Decide on topic
- Map out lecture series
- Invite Lecturers
- Design poster
- Start webpage
- Write blurb
- Map out topical conference
- Invite speakers
- Map out projects

- Mailing list
- Mail posters
- Budget, budget, budget
- Contest question
- Discussion questions
- Poster session
- Soccer games
- Reception/dinner
- Design the swag

Cmtte Members over the years

## SSI Topics over the years

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**Cosmic Connections**

XXXI SLAC Summer Institute
SSI2003 July 28 - August 8, 2003

**School Lectures:**
- Connections between the Big and Small
  John Ellis
- The Contents, Kinematics, and Dynamics of the Universe
  Roger Blandford
- Inflation
  Michael Turner
- The Cosmic Microwave Background
  TBA
- Formation of Galaxies and Large Scale Structure
  Avishai Dekel
- Dark Matter and Dark Energy
  Edward Kolb
- Galaxy Clusters and Cosmology
  J. Patrick Henry
- Searches for Dark Matter
  Harry Nelson
- The Cosmic X-Ray Background
  Steven Kahn
- High Energy Cosmic Rays
  Rene Ong
- SUSY and Cosmology
  Jonathan Feng

**Theme:**
The physics of the very large and the very small share deep connections. Particles and the forces that govern them have shaped the evolution and present state of the universe. A revolution in experimental cosmology has changed our picture of the universe in the last decade, and is sharpening important questions in particle physics. Cosmological questions such as what is the dark matter and dark energy, what is the underlying mechanism responsible for cosmic inflation, and is spacetime extra dimensional are being studied directly at laboratories.

The 2003 SLAC Summer Institute will explore these cosmological connections in a manner which is accessible to an audience with a particle physics background.

**Topical Conference:**
The Institute will conclude with a two-and-one-half day conference surveying the latest results in particle astrophysics, cosmology, and high energy physics.

**Contact:**
Eileen Brennan
SLAC, MS 58
2572 Sand Hill Road
Menlo Park, California 94025
ssl@slac.stanford.edu
650-926-2049

**Information / Registration:**
http://www-cosmic.sli.stanford.edu:

**Sponsorship:**
The SLAC Summer Institute is hosted by Stanford University and co-sponsored by the U.S. Department of Energy and the Stanford Linear Accelerator Center.
Kavli Institute for Particle Astrophysics and Cosmology, a joint institute between SLAC and Stanford, was founded in 2003

We wanted to showcase astrophysics and cosmology and KIPAC and aimed to teach cosmology to particle physicists

The physics of the very large and the very small share deep connections......a revolution in experimental cosmology has changed our picture of the universe in the last decade, ad is sharpening important questions in particle physics.

- Organizers: Hewett, Jaros, Kamae, Prescott – Kamae is first astrophysicist organizer
- Refreshing of institute practices: mailing list, question box, reception, wine
- 287 participants!
- First WMAP data had just been released (last minute poster change)

https://www.slac.stanford.edu/econf/C0307282/
Nature's Greatest Puzzles

XXXII SLAC Summer Institute
SSI2004 August 2 - 13, 2004

LECTURE:

What are the Basic Forces of Nature? Tad Dvorak, Rick Gabrieli

What is the Structure of the Universe? George Fuller, George Frontera, Carl Kogut, Toru Ishida

What are the Origins of Mass? Why is it that a spaceship can't generate mass? Weizhen Han, Brian Warrick, Ramesh Muzaffar, Michael Polchinski

The Nature of Superstrings? Konstantinos Mavromatos, Santis Tata

Why is Gravity so Weak? Steve Lidsey, Geraint Westmoreland, Tara Hoag

Why is the Universe Made of Matter and Not Anti-Matter?ANCEL DeRujula, Antonio Collado, Carlo Nappi


Did the Universe have a Big Bang? Marc Kuchnir, Andrew Linde

Overview and Special Presentations
Maria Abramowicz, Chris Hogan

THEME: Nature's Greatest Puzzles

Explaining the fundamental nature of matter, space, time, and energy has never been so exciting. There are goldilocks reasons to believe that we are not alone. Discovering these reasons explaining the basic forces of nature, detecting and producing the dark matter particles, understanding the birth of the universe, elucidating the fundamental nature of light and gravity, and discovering the nature of searchStringing and the place of cosmic accelerators on the horizon. Realizing these discovery opportunities will require new accelerators and observational methods. Accelerators are Also.

The 2004 SLAC Summer Institute will examine these questions and the tools with which they may be addressed. Each day will feature a special lecture and a session on the morning. The afternoons will feature a topical session as well as discussion sessions. The surrounding residents will be involved during the rest of the week.

TOPICAL SESSIONS

The institute will host a topical session every afternoon where the students present research related to the theme will be accepted.

INFORMATION / REGISTRATION:
https://www.slac.stanford.edu/ssi2004

CONTACT:
SLAC
2575 Sand Hill Road
Menlo Park, California 94025
415.993.3000

SPONSORSHIP:

The SLAC Summer Institute is hosted by the SLAC National Accelerator Laboratory and the Stanford Linear Accelerator Center.
2004: Nature’s Greatest Puzzles

One day, one puzzle. 10 puzzles in all

Exploring the fundamental nature of matter, space, time, and energy has never been so exciting....Realizing these opportunities will require both accelerators and telescopes in tandem

317 participants!

2 closing talks!!

Topical conf now held in afternoons

Week 1
Where and what is dark matter?
How massive are neutrinos?
What are the implications of neutrino mass?
What are the origins of mass?
Why is there a spectrum of fermion masses?

Week 2
Why is gravity so weak?
Is Nature supersymmetric?
Why is the universe made of matter and not anti-matter?
Where do ultra-high energy cosmic rays come from?
Did the universe inflate at birth?

https://www.slac.stanford.edu/econf/C040802/
In a decade or two, we can hope to...

| Understand electroweak symmetry breaking | Detect neutrinos from the universe |
| Observe the Higgs boson | Learn how to quantize gravity |
| Measure neutrino masses and mixings | Learn why empty space is nearly weightless |
| Establish Majorana neutrinos \((\beta\beta_{0\nu})\) | Test the inflation hypothesis |
| Thoroughly explore CP violation in \(B\) decays | Understand discrete symmetry violation |
| Exploit rare decays \((K, D, \ldots)\) | Resolve the hierarchy problem |
| Observe neutron EDM, pursue electron EDM | Discover new gauge forces |
| Use top as a tool | Directly detect dark-matter particles |
| Observe new phases of matter | Explore extra spatial dimensions |
| Understand hadron structure quantitatively | Understand the origin of large-scale structure |
| Uncover the full implications of QCD | Observe gravitational radiation |
| Observe proton decay | Solve the strong CP problem |
| Understand the baryon excess | Learn whether supersymmetry is TeV-scale |
| Catalogue matter and energy of the universe | Seek TeV-scale dynamical symmetry breaking |
| Measure dark energy equation of state | Search for new strong dynamics |
| Search for new macroscopic forces | Explain the highest-energy cosmic rays |
| Determine GUT symmetry | Formulate the problem of identity |

...learn the right questions to ask...

...and rewrite the textbooks!

C. Quigg
Announcing a Competition:

Nature’s Neglected Puzzles

The challenge: Propose a question not on the SSI2004 list, and explain briefly why it belongs in the pantheon of Nature’s Greatest Puzzles.

The reward for the Best Eleventh Question: A bottle of California’s finest sparkling wine and untold fame: an eleven-minute talk to present your question at the Wednesday, August 11, Discussion Session.

SSI Students may submit written entries until the close of the Monday, August 9, session.
Gravity influences everything. It controls how our universe evolves and affects particle physics at the smallest scales. Scientists are building upon Einstein's legacy and taking the exploration of gravity into the 21st century, from string theory to the discovery of dark energy and the observation of black holes.

The 2005 SLAC Summer Institute will focus on gravity and its role in particle physics, astrophysics, and cosmology. The morning lectures will cover the basics of general relativity, gravity waves, black holes, neutron stars, string theory and extra-dimensions. Topical talks on current research and discussion sessions will take place in the afternoons.

The painting in the upper left is by Ms. Dawn Neal Menner entitled "Kaluza-Klein (Invisible Architecture III)"
What were we thinking?? (We were embracing the Astro-physics focus)

Gravity influences everything...scientists are building on Einstein’s legacy and taking the exploration of gravity into the 21st century.

273 participants!

One of my favorite posters

Strong forward-looking lectures on gravity related experimentation, with experiments/results just being realized today

LIGO in the early days

LSST in the early days
What will be the first evidence to demonstrate that Einstein’s theory of General Relativity must be revised and when will that be found?

~ 6 weeks. Claire Craner, Washington (she is a member of the Washington Eotvos exp’t)
The SLAC Summer Institute Wine List:

Cosmic Variance | By JoAnne Hewett | Sep 13, 2005 4:41 PM

By popular demand, here is the wine list from the 2005 SLAC Summer Institute (SSI). One of my duties as SSI program co-director is to choose the wine that we serve with the Institute dinners. It's a tough job, but someone's gotta do it. It really isn't so easy. Honestly, we have a strict budget. I can't just order a case or two of Chateau Margaux! (Actually, I've never had the pleasure of tasting Chateau Margaux....sigh) I have to average around $6.00/bottle. And, I must admit, I know little about wines that cost $6.00/bottle. And, I can't serve just any everyday plonk - I have a reputation to maintain! So, to ensure quality, I taste. As I said, it's a tough job.. I start looking for bargains a few months in advance. Whenever I see something interesting, and cheap, I buy a bottle. I taste it immediately, and if it passes muster, I immediately return to buy a bunch. Good cheap wine sells out quickly and you gotta be fast. All in all, I usually taste about 2-3 cases worth. (Yes, at my own expense.) Sometimes I end up running to the sink to spit the stuff out. Sometimes I end up buying some bottles for myself. So...drumroll please...here is the 2005 list. Average cost $6.29/bottle. White: Meridian Chardonnay, Santa Barbara County - 2004, $5.99 Grand Cru Chardonnay - 2003, $4.99 Sartarelli Verdicchio - 2003, $4.99 Aranacio Grillo - 2003, $5.99 Kenwood Sauvignon Blanc - 2004, $8.99 Red: Charamba Duoro Tinto - 2000, $5.99 Bogle Old Vines Zinfandel - 2003, $8.98 Columbia Crest Merlot, Grand Estaters - 2001, $8.99 Deakin Shiraz - 2004, $6.99 Rosemount Estate Shiraz (Diamond Label) - 2003, $7.99 Marques de Riscal Tempranillo - 1999, $7.99
SCHOOL LECTURES
Welcome to the TeVscale
Theory of Proton-Proton Collisions
The Large Hadron Collider
TeV Colliders and the Cosmos
Higher Order QCD
Detectors at the LHC
Tracking Systems
Pixel Vertex Detectors
Electromagnetic Calorimetry
Hadron Calorimetry
Muon Detectors
Triggering
LHCb Physics and Detector
How to Find the Higgs
How to Discover SUSY
Top and Precision EW Physics
Beyond Higgs and SUSY
LHC and ILC
Cosmic Acceleration Mechanisms
LHC: The First Five Years

GUIDE ALFRETTI
James Stirling
Lyn Evans
Michael Peskin
Lance Dixon
Jos Engel
Guido Tonelli
Norbert Werner
Rem Yuan Zhu
Jim Proudfoot
Ferri Taylor
Pierre Spillane
Tatsuya Nakada
Chris Tully
Gaetano Polvetti
Tim Bill
Graham Krbs
Hitoshi Murayama
Don Ellison
Ian Hinchliffe

THEME
Exploration of physics at the TeV scale holds the promise of addressing some of our most basic questions about the nature of matter, space, time, and energy. The Large Hadron Collider at CERN will break into this new energy frontier when it begins operation next year and the LHC detectors will then begin their prospecting for gold.
The 2006 SLAC Summer Institute will focus on the physics and detectors of the LHC. In addition to the school lectures, there will be talks on recent results from particle and astroparticle physics, and poster and discussion sessions.

SPONSORSHIP
The SLAC Summer Institute is hosted by Stanford University and co-sponsored by the US Department of Energy and the Stanford Linear Accelerator Center.

CONTACT
The Linear Accelerator Laboratory, SLAC National Accelerator Laboratory, Stanford University, 2575 Sand Hill Road, Menlo Park, California 94025
slac@slac.stanford.edu, http://www.slac.stanford.edu/slac/
Time to get ready for the LHC and pan for gold!
The exploration of physics at the TeV scale holds both the promise of addressing some of our most basic questions about nature and the potential for major discovery.

LHC expected to have first collisions in 2007 and operate at 14 TeV in 2008.

Expectations were high!

Program focused on experimental design of LHC detector systems:

- General overview of detectors: Egelen
- Tracking: Tonnelli
- Pixels: Wermes
- EM Calorimetry: Zhu
- Hadron Calorimetry: Proudfoot
- Muons: Taylor
- Tiggering: Sphicas

References:

- "QCD and Collider Physics"
  RK Ellis, WJ Stirling, BF Webber
  Cambridge University Press (1996)
  Also
  "Handbook of Perturbative QCD"
  G Sterman et al (CTEQ Collaboration)
  www.phys.psu.edu/~cteq/

References:

- Trigger/Daq requirements/challenges
  - N (channels) = 0(10^6); >20 interactions every 25 ns
  - need large number of connections
  - need information super-highway
  - Calorimeter information should correspond to tracker info
  - need to synchronize detector elements to (better than) 25 ns
  - in some cases, detector signal times of flight > 25 ns
  - integrate more than one bunch crossing’s worth of information
  - need to identify bunch crossing...
  - Can store data at ~10^9 Hz
  - need to reject most interactions
  - It’s On-Line (cannot go back and recover events)
  - need to monitor selection
Dark Matter
FROM THE COSMOS TO THE LABORATORY

SCHOOL LECTURES
The Standard Cosmological Model
The Standard Cosmological Model
SUSY for Astrophysicists
SUSY for Astrophysicists
Observational Constraints on Dark Matter
Observational Constraints on Dark Matter
Alternatives to General Relativity
Alternatives to General Relativity
Structure Formation
Structure Formation
Direct Detection of Dark Matter
Direct Detection of Dark Matter
Collider Signatures for Dark Matter
Collider Signatures for Dark Matter
Observation of Large Scale Structure
Observation of Large Scale Structure
Indirect Detection of Dark Matter
Indirect Detection of Dark Matter
Gravitational Lensing
Gravitational Lensing
Constraints on the Baryon Density
Constraints on the Baryon Density
Dark Matter in Clusters
Dark Matter in Clusters
Cosmic Neutrinos
Cosmic Neutrinos
Axions/Thyse
Axions/Thyse
Axions/Experiment
Axions/Experiment
Exotic Dark Matter Candidates
Exotic Dark Matter Candidates
Where are the Missing Baryons?
Where are the Missing Baryons?
Putting the Dark Matter Puzzle Together
Putting the Dark Matter Puzzle Together

SPONSORSHIP
The SLAC Summer Institute is hosted by Stanford University
and co-sponsored by the US Department of Energy
and the Stanford Linear Accelerator Center.

CONTACT
Thanh Ly, SLAC, MS 58, 2575 Sand Hill Road
Menlo Park, California 94025
email: sss@sslac.stanford.edu

Morning lectures will cover all aspects of dark matter, from observational evidence for its existence, to its role in cosmic evolution and structure formation, to indirect and direct searches and attempts to produce it at colliders. In the afternoons, topical conference talks will alternate with discussion sessions, tours, and social events.

2007: Dark Matter

Dark Matter is now a topic on its own

We will cover all aspects of dark matter, from observational evidence for its existence, to its role in cosmic evolution and structure formation, to indirect and direct searches and attempts to produce it at colliders

252 participants

Program was given in an at-a-glance format

• Cosmology for Particle Physicists (Dodelson)
• Supersymmetry for Astrophysicists (Feng)
• Featured KIPAC faculty

We ceased publishing written proceedings
The Dark Matter Rap: Cosmological History for the MTV Generation by David Weinberg*

My name is Fritz Zwicky, I can be kind of prickly, This song had better start by giving me priority. Whatever anybody says, I said in 1933. Observe the Coma cluster, the redshifts of the galaxies imply some big velocities. They're moving so fast, there must be missing mass! Dark matter.

Dark matter: Do we need it? What is it? Where is it? How much? Do we need it? Do we need it? Do we need it? Do we need it?

The physics of nature’s cosmic accelerators

Black holes, neutron stars, pulsars, giant shock waves, and the high energy particles they create

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<td>Fundamental Processes</td>
<td>Vahe Petrosian (KIPAC, Stanford University)</td>
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<td>Acceleration Mechanisms</td>
<td>Luke Drury (Dublin Institute for Advanced Studies)</td>
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<td>Acceleration in Pulsars</td>
<td>Roger Romani (KIPAC, Stanford University)</td>
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<td>X-ray Observations of Cosmic Accelerators</td>
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<td>High Energy Cosmic Neutrinos</td>
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<td>Gamma Ray Observations of Cosmic Accelerators</td>
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<td>Acceleration in Large Scale Shocks</td>
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<td>Exotic Acceleration Mechanisms</td>
<td>Mark Trodden (Syracuse University)</td>
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<td>Ground-based VHE Gamma Ray Instruments</td>
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<td>Simon Swordy (University of Chicago)</td>
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REVOLUTIONS
ON THE HORIZON
A DECADE OF NEW EXPERIMENTS

XXXVII SLAC Summer Institute
August 3rd – August 14th, 2009, SLAC National Accelerator Laboratory

The Institute will focus on the theoretical motivations and experimental techniques that will enable exciting discoveries in the next generation of physics experiments in the energy, intensity and cosmic frontiers.

SCHOOL LECTURES:

Sponsorship:
The SLAC Summer Institute is supported by the SLAC National Accelerator Laboratory.

Contact:
slcf.stanford.edu/ssi/2009
2009: Revolutions on the Horizon

New wave of experiments!

Theoretical motivations and new experimental techniques will enable exciting discoveries in the generation of physics experiments in the energy, intensity, and cosmic frontiers

“Frontier” terminology has been adopted

183 participants

Hewett now chairs the org cmtte

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<td>Joe Incandela (UC Santa Barbara)</td>
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<td>Indirect Dark Matter Searches</td>
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<td>Direct Dark Matter Searches</td>
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<td>Neutrino Experiments</td>
<td>Michael Shweitz (Columbia University)</td>
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<td>Dark Energy Measurements</td>
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<td>Neutrinoless Double Beta Decay</td>
<td>Giorgio Gratia (Stanford)</td>
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<td>What Is To Be Done?</td>
<td>Michael Peskin (SLAC)</td>
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Poster sessions are lively
The year SSI almost died....
Neutrinos are coming into their own

Neutrinos are the least understood particle, yet are all around us and key to physics processes
HISTORY OF THE UNIVERSE

XXXVII SLAC SUMMER INSTITUTE

JULY 25 – AUGUST 5, 2011 – SLAC NATIONAL ACCELERATOR LABORATORY

WE HAVE MUCH KNOWLEDGE ABOUT THE EVOLUTION AND PRESENT STATE OF OUR UNIVERSE, YET MANY MYSTERIES REMAIN. FROM INFLATION TO BARYOGENESIS TO DARK ENERGY, THE INSTITUTE WILL EXPLORE THE VARIOUS EPOCHS RESPONSIBLE FOR THE DEVELOPMENT OF THE UNIVERSE. THE PARTICLES AND FORCES THAT SHAPED IT, AND THE EXPERIMENTAL METHODS WE USE TO EXPLORE IT. MATERIAL WILL BE PRESENTED IN A MANNER WHICH IS ACCESSIBLE TO AN AUDIENCE WITH A PARTICLE PHYSICS BACKGROUND. MORNINGS WILL CONSIST OF LECTURES AND IN THE AFTERNOONS, TOPICAL CONFERENCE TALKS WILL ALTERNATE WITH DISCUSSION SESSIONS, TOURS, AND SOCIAL EVENTS.
2011: History of the Universe

2011 is AWOL!!!
The **Electroweak Scale**: Unraveling the Mysteries at the LHC

Exploration of the TeV scale holds the promise of addressing some of our most basic questions about Nature. The Large Hadron Collider at CERN has begun to probe this new energy frontier and data is rapidly accumulating. Perhaps the most serious question for the LHC to address is the origin of electroweak symmetry breaking. The 2012 SLAC Summer Institute will focus on recent LHC results and their implications for the Electroweak scale and beyond. Mornings will consist of lectures and in the afternoons, topical conference talks will alternate with discussion sessions, tours, and social events.

**SCHOOL LECTURES:**

- Hadron Collider Environment
- LHC: The Machine
- LHC: The Detectors
- Higgs Searches
- Dark Matter Zoo
- Dark Matter Indirect Detection
- Dark Matter Direct Detection
- Dark Matter Properties at the LHC
- LHC Detector Upgrades
- Higgs at a Linear Collider
- The View Ahead

- Historical Perspective
- Statistical Methods
- EWBS Basics
- Higgs Searches
- SUSY Theory
- SUSY Searches
- Implications of Higgs Searches and Discovery

**CONTACT:**

SSI2012, SLAC, MS 81

2575 Sand Hill Road

Menlo Park, California 94025

**SPONSORSHIP:**

The SLAC Summer Institute is hosted by Stanford University and co-sponsored by the US Department of Energy and the SLAC National Accelerator Laboratory.

email: ssi@slac.stanford.edu

[Website](http://www-conf.slac.stanford.edu/ssi/2012)
"It was a great afternoon spent celebrating 40 years of the SLAC Summer Institute," said JoAnne Hewett, head of SLAC's Theory Group and SSI organizer. "SSI has become an integral part of our field. Everyone who’s anyone participated in a SSI early on in their career."
2012: The Electroweak Scale

The Higgs is Discovered!!!

Exploration of the TeV scale holds the promise of addressing some of our most basic questions about Nature. The LHC at CERN has begun to probe this new energy frontier and data is rapidly accumulating. Perhaps the most serious question for the LHC to address is the origin of electroweak symmetry breaking. (written before the discovery)

162 participants

Higgs discovery announced 19 days before the Institute!
What is the meaning of the discovery of the Higgs boson? If it is the “Higgs”, how would you name it?

The Meaning:
(1) To regular people, nothing
(2) To Dr. Peter Higgs, possibility of Nobel prize
(3) To students, no need to remember the various plots according to Higgs mass
(4) To professors, no need to teach the various plots according to Higgs mass
(5) To model builders, no need to produce parameter space to accommodate large range of Higgs mass.

The Name: I would name it `h’ because:
(1) It has been called “Higgs”
(2) It has been a “Hot” issue for so long time
(3) It has just said “Hello” to us
(4) It must by a “Hopeful” particle to peep into future new physics

– Doojin Kim
Journeys Through the Frontier

Planning for Future Facilities

We have much knowledge about the universe around us, yet many mysteries remain. Such questions are best pursued with a variety of approaches that are often characterized as exploration along the cosmic, energy, and intensity frontiers. The institute will focus on the theoretical motivations and experimental techniques that will enable exciting discoveries along these frontiers in the next generation of experiments. The institute will closely follow the 2013 “Snowmass” Community Summer Study and will serve as a means for young physicists to participate. Mornings will consist of lectures. Work on “Snowmass” related projects will take place in the afternoons, alternating with topical conference talks, discussion sessions, tours, and social events.

SCHOOL LECTURES:
Energy Frontier: The Big Questions
Exploring the Energy Frontier with Colliders
Instrumentation on the Energy Frontier
Accelerating Protons and Leptons
Advanced Accelerator Techniques
Flavor Physics: The Big Questions
Hadron and Lepton Facilities for Flavor Project X
Neutrino Physics: The Big Questions
Neutrino Detectors and Facilities
Neutrinoless Double Beta Decay
Cosmic Frontier: The Big Questions
Searching for Dark Matter in the Sky and Underground
Complementarity of Dark Matter Searches
Cosmic Particles
Instrumentation on the Cosmic Frontier
Exploring the Cosmic Microwave Background
The View Ahead

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SPONSORSHIP:
The SLAC Summer Institute is hosted by Stanford University and co-sponsored by the U.S. Department of Energy and SLAC National Accelerator Laboratory.
conf-slc.stanford.edu/ssi-2013
SSI 2013 was held just after the Snowmass Community Summer Study

We have much knowledge about the universe around us, yet many mysteries remain.....the institute will closely follow the 2013 “Snowmass” Community Summer Study and will serve as a means for young physicists to participate.

Google doc for questions, Indico for timetable https://indico.cern.ch/event/240480/

Lectures took a tour through the energy, intensity, and cosmic frontiers

Introduction of projects!!

Energy Frontier:
EF1: Under which circumstances is a fourth generation still allowed? If a 6-quark is discovered at 850 GeV, what experiment would you perform to study its properties?
EF2: Compare and contrast the Higgs coupling measurements at the ILC, LHC upgrades, and a potential muon collider. Describe the sensitivity to potential BSM effects in each Higgs coupling.
EF3: Compute the search reach at future colliders for a new heavy neutral gauge boson that has the same fermionic couplings as the Standard Model Z, taking into account experimental uncertainties. Which collider has the best reach and why?
EF4: If a signal is observed at the LHC that is consistent with a 750 GeV stop-squark decaying into a top-squark plus missing energy, what other experiments would you perform to determine its characteristics and the model from which it arises.

Cosmic Frontier:
CF1: If there is an ~8 GeV dark matter WIMP candidate, what follow up experiments would you perform to verify its existence and study it’s properties?
CF2: What experiment would you perform to clarify the situation of the 130 GeV gamma ray line? What is the prospect for studying this phenomena in the lab?
CF3: What experiments can be built to prove whether dark energy arises from the cosmological constant and how would you probe such models?

Intensity Frontier:
IF1: Compare the advantages and disadvantages between on-axis and off-axis experiments for measuring the mass hierarchy and delta, the CP violating parameter, in the neutrino sector?
IF2: How would you design an experiment to uncontroversially measure direct CP violation in charm decays at the sub-percent level?
IF3: If the presently observed deviation in the measurement of the anomalous magnetic moment of the muon persists, how can one quantify this with better precision? If this discrepancy were due to new physics, what BSM explanations can be observed by direct searches for new particles at a 1 TeV ILC or 14 TeV LHC?
Shining Light on DARK MATTER

The 2014 SLAC Summer Institute will focus on the quest for dark matter. Observations indicate that 95% of the mass in the universe is non-luminous and postulating the existence of cold dark matter particles, however, without evidence as to why it is based on dark matters gravitational signatures and implications to particle physics remain challenging. The development of a variety of probes to illuminate the nature of dark matter has made this one of the most vibrant frontiers. Morning lectures will cover all aspects of dark matter. Afternoon discussions will be used to explore evidence for and against dark matter, to discuss competing models of dark matter, and to discuss searches. In the afternoons, topical conference halls will alternate with discussion sessions, poster sessions, tours, and social events.

SCHOOL LECTURE:
Dark Matter and Why we believe it: Doug Finkbeiner (Harvard)
Cosmology: New Frontiers: Martin White
Astro Dark Matter: Kyle Wild (ANU)
Luminosity for Dark Matter at the LHC: Daniel Whiteson (UC Irvine)
Direct Detection: Dan Hooper (Chicago)
Direct Detection: Eric Spergel (Princeton)
Dark Matter in the Milky Way: Kappa MDM: Dima\nDark Matter in the Galaxy: Edward Witten (Princeton)
Dark Matter Experimental Follow-Up: Nima Arkani-Hamed
Dark Matter: The Role of Dark Matter: (Indiana)
Lectures on Dark Matter: (Theoretical Perspectives, Review, etc.)

CONTACT:
SSI 2014
August 4-15, 2014
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Shining Light on DARK MATTER

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Focus on the quest to identify dark matter

The development of a variety of probes to illuminate the nature of dark matter has made this one of the most vibrant frontiers today.

Experimental and cosmic probes of dark matter reach maturity

~50% of the lecturers were women

Showed “Particle Fever: The Movie

SSI on Facebook

2014: Shining Light on Dark Matter

https://www-conf.slac.stanford.edu/ssi/2014/
The 2015 SLAC Summer Institute will focus on the physics of neutrinos. Although they were discovered almost 60 years ago, neutrinos remain in some ways the most mysterious part of the Standard Model – we don’t even know their masses or whether they are their own anti-particles. The neutrino sector may be responsible for the baryon-antibaryon asymmetry of the universe and some form of neutrino might be the gravitationally observed Dark Matter. The development of a variety of probes to illuminate the detailed nature of the neutrino sector has made it one of the most exciting and global frontiers today. Inspiring a plethora of new experimental and theoretical efforts. Morning lectures will cover all aspects of neutrino physics. In the afternoons, topical conference talks will alternate with discussion sessions, student projects, tours, and poster sessions. SSI is especially targeted for graduate students and young physicists.
2015: The Universe of Neutrinos

LBNF/DUNE becomes first international facility to built in the U.S.

The development of a variety of probes to illuminate the detailed nature of the neutrino sector has made this one of the most exciting today, inspiring a plethora of new experimental and theoretical efforts.

Contest question: Given the existing and planned facilities to study them, what are we NOT doing that we should be to understand neutrinos better?

SSI Swag

Popular items over the years!
SLAC Summer Institute has a special place in high energy physics

SSI is part of our field's DNA

SSI provides a historical reference of progress in HEP

SSI educated generations of physicists who have gone on to do amazing things

SSI participants forged friendships and collaborations that last a lifetime

It was truly an honor to steward this summer school, with such a rich tradition in the community!!

• I have innumerable fond memories!

I look forward to the next 50 years!!

Congratulations to the current team for their outstanding stewardship during the COVID pandemic

• Virtual SSI with over 1000 participants over the last 3 yrs

• Truly spreading science knowledge worldwide!

Mark Convery, Lisa Kaufman, Grzegorz Madejski, Rich Partridge, Tom Rizzo, Su Dong, Charlie Young