

Welcome to the

SLAC Workshop on
Physics at a 100 TeV
Collider

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In the past three years, major studies around the world have contemplated the future of High Energy Physics.

Many important projects have been discussed for the near term. But we are also encouraged to think about the long term.

This has led to a revival of interest in the next step for pp colliders beyond LHC.

There are many technical problems associated with creating pp colliders at much higher energies than LHC.

However, there are also many physics questions. We thought it would be good to have a workshop that concentrated on the physics. We expected a small group of about 30 people

The senior organizers of this workshop -- Jay Wacker, Nima Arkani-Hamed, and I -- are very grateful to

Tim Cohen and **Mike Hance**

for assembling this very interesting program.

Here is some practical information for the meeting:

Internet:

SLAC has a Visitor Network, outside our firewall. You should be able to connect to it freely. (But, please don't run your LHC analyses during the sessions.)

Bus:

We are running a shuttle bus between SLAC and the Camino Inn and Suites.

The bus leaves the Inn at 8:00 am.

The bus leaves SLAC at 6:30 pm.

Coffee:

Coffee and snacks are provided in the back of this room.

Lunch:

At this time, SLAC has no cafeteria. For lunch, we recommend that you order from

Eat Club: <https://www.myeatclub.com/slac-cafeteria>

Click “Get Started”; choose the “100 TeV” location. Place your order **before 10:00 am**. You can order all three lunches today, if you wish.

If you miss the deadline, SLAC people can direct you to the **food trucks**. See “Lunch” on the [indico page](#).

Dinner:

There is no “conference dinner”. For Wednesday and Thursday evenings, we have made reservations for groups of 10 at a number of Palo Alto area restaurants. Please sign up at the registration desk.

A SLAC Theory member will host at each place. Three of our restaurants are near the Camino Inn, but we can ferry you there from other places.

Dinner reservations are for 7:30 pm.

I'll take a few more moments to talk about the “Big Questions” for this workshop.

In contemplating a 100 TeV pp collider, there are three types of questions, concerning

Physics, Experiment, Motivations

Physics:

We now have much experience with physics at 7-8 TeV.

Is physics at 100 TeV a simple extension of this, or do essential new phenomena come into play ?

3 possible examples:

top quark becomes a parton

electroweak Sudakov and radiative effects are
order 1

W, Z, top, Higgs are typically highly boosted

Experimental:

Detectors for 100 TeV are often discussed as scaled-up versions of the LHC detectors. **Do we need concepts with essential differences from the LHC detectors ?**

Some considerations include:

very high granularity calorimetry for jet substructure

difficulty of muon momentum measurement
above 5 TeV

large cross sections for very forward processes

need for very high luminosity and associated pileup

Motivation:

Everyone in this room believes that 100 TeV brings us to uncharted territory that must be explored. **Others will need more convincing.**

Can we argue, without the discovery of new physics at the LHC, that we must go to 100 TeV ?

If the case for 100 TeV is based on LHC discovery, how does the program build on that discovery ? Does this affect the experimental requirements ?

What target energy does our physics case point to ?

80 TeV ? 150 TeV ?

We will have much fun over the next few days -- and over years to come -- in debating these issues.

Enjoy the workshop !