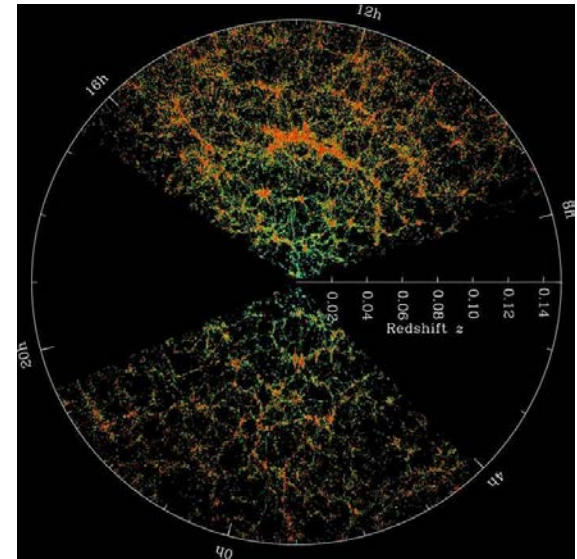# SciDAC PI Meeting 2013
High Energy Physics
Introduction

Lali Chatterjee

Program Manager

High Energy Physics (HEP)

HEP Mission

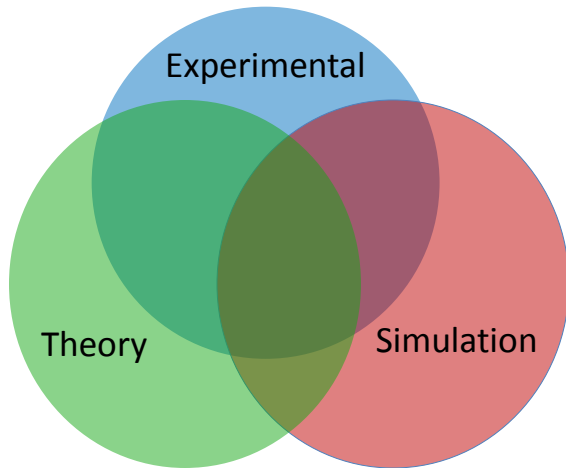To understand how our universe works at its most **fundamental level**… by discovering the most elementary constituents of matter and energy, exploring the basic nature of space & time… and probing the interactions between them.
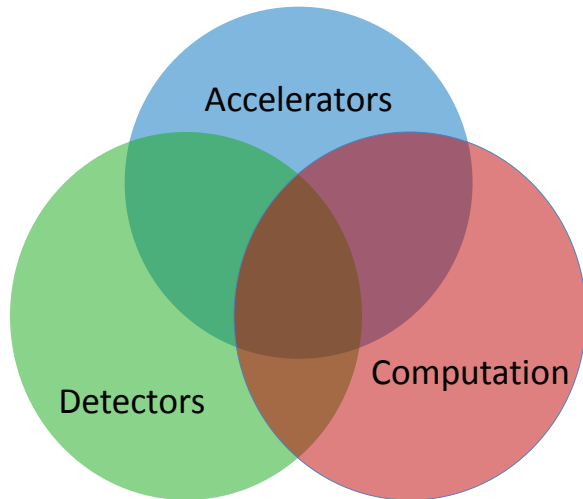

- Science is compute and data intensive
- Large scale international partnerships
- Inter-agency funded – DOE, NSF, NASA, and international funding agencies
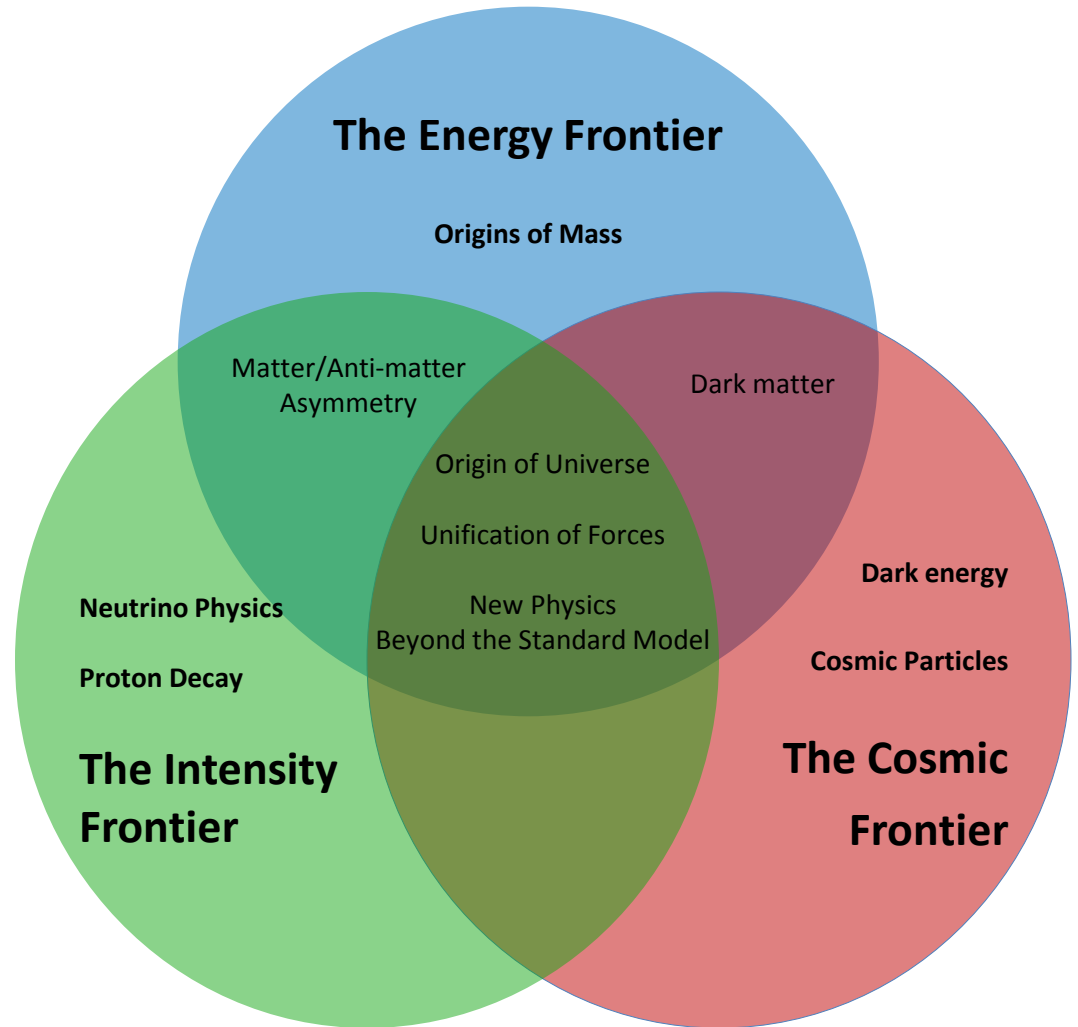- Extensive system of distributed computing

Open Science Grid (OSG)

Physics and Technology

Experimental

Theory

Simulation

Along Three Paths

Accelerators

Detectors

Computation

Enabled by
Advanced Technologies in:

The Energy Frontier

Origins of Mass

Matter/Anti-matter
Asymmetry

Dark matter

Origin of Universe

Unification of Forces

Neutrino Physics

New Physics
Beyond the Standard Model

Dark energy

Proton Decay

Cosmic Particles

**The Intensity
Frontier**

**The Cosmic
Frontier**

Physics Frontiers

3

From Deep Underground to the Tops of Mountains, HEP pushes the Frontiers of Research

RESEARCH AT THE ENERGY FRONTIER — HEP supports research where powerful accelerators such as the LHC are used to create new particles, reveal their interactions, and investigate fundamental forces, and where experiments such as ATLAS and CMS explore these phenomena.

RESEARCH AT INTENSITY FRONTIER — Reactor and beam-based neutrino physics experiments such as Daya Bay and LBNE may ultimately answer some of the fundamental questions of our time: why does the Universe seem to be composed of matter and not anti-matter?

RESEARCH AT THE COSMIC FRONTIER — Through ground-based telescopes, space missions, and deep underground detectors, research at the cosmic frontier aims to explore dark energy and dark matter, which together comprise approximately 95% of the universe.

THEORY AND COMPUTATION — Essential to the lifeblood of High Energy Physics, the interplay between theory, computation, and experiment drive the science forward. Computational sciences and resources enhance both data analysis and model building.

ACCELERATOR SCIENCE — New accelerator techniques such as plasma wake-field acceleration, researched at LBL's BELLA and SLACs' FACET facilities, may eventually lead to higher beam energies than ever before, opening up new realms for discovery.
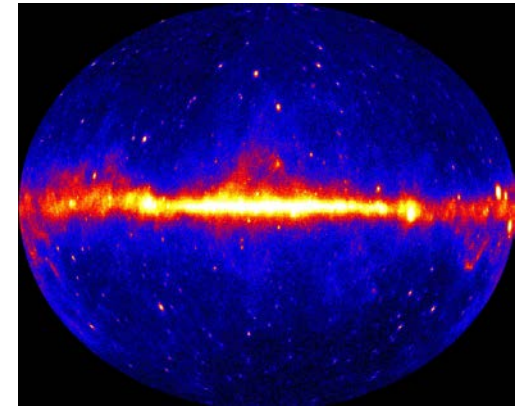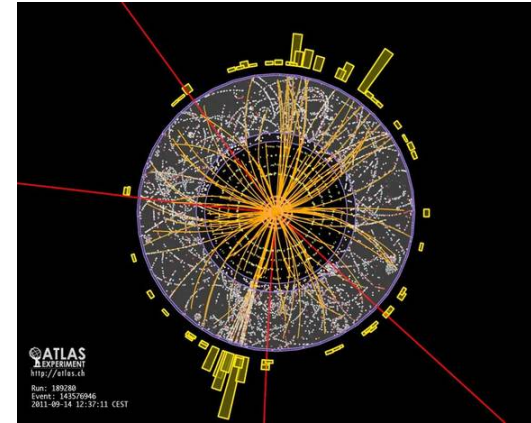
Computational HEP Program

HEP SciDAC focuses on partnership projects:

- SciDAC 3 Projects – (part of the Office of Science SciDAC Program)
  - In partnership with Office of Advanced Scientific & Computing Research (ASCR), DOE

- Transforming GEANT 4 to multicore systems –
  - A pilot project in partnership with ASCR Research Division

- Open Science Grid (OSG)
  - In partnership with National Science Foundation and Office of Nuclear Physics

- Other Pilot Projects with various partnerships including ASCR Facilities

Scientific Computing: Community Data Tools, codes, frameworks, Distributed Computing, networks, software, data workflow and analytics portals... includes pilot projects to help kick off specific activities like transitioning LHC software to HPC machines and data initiatives

SciDAC 3 Projects

Three SciDAC 3 Projects were funded in three topical areas in 2012 by HEP and ASCR via a joint Funding Opportunity Announcement

- Lattice Gauge Theory Research area:
    - Searching for Physics Beyond the Standard Model: Strongly Coupled Field Theories at the Intensity and Energy Frontiers

- Cosmic Frontier Scientific Simulations area:
    - Computation-driven Discovery for the Dark Universe

- Accelerator Science Modeling & Simulation category:
    - Community Project for Accelerator Science and Simulation (ComPASS-2)

All are multi-institutional projects in the SciDAC model. More details are available at http://www.scidac.gov/hep/hep.html and we will hear from the projects at this meeting.