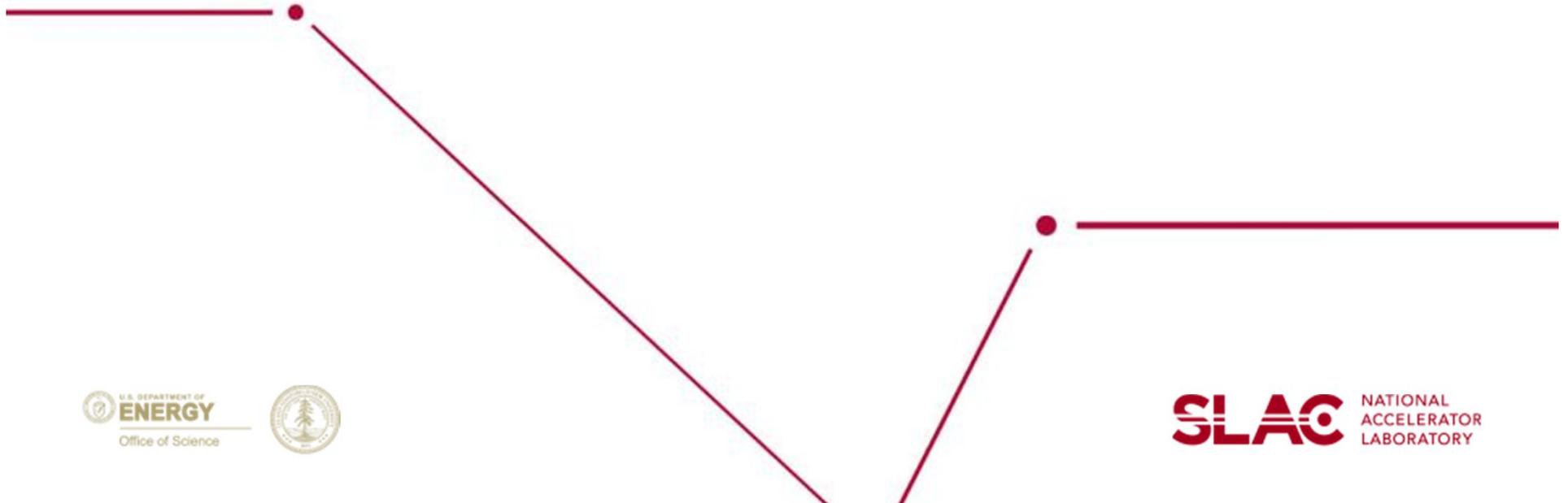


CPM 2012, Fermilab

The Snowmass process and SLAC plans for HEP

D. MacFarlane & N. Holtkamp



Questions for the Universe

- 1) Are there undiscovered principles of nature?
- 2) How can we solve the mystery of dark matter?
- 3) Are there extra dimensions of space?
- 4) Do all the forces become one?
- 5) Why are there so many kinds of particles?
- 6) What is dark matter? How can we make it in the lab?
- 7) What are neutrinos telling us?
- 8) How did the universe come to be?
- 9) What happened to the antimatter?

new symmetric
local



Overarching Principles for US planning

Particle physics and particle astrophysics is a global enterprise

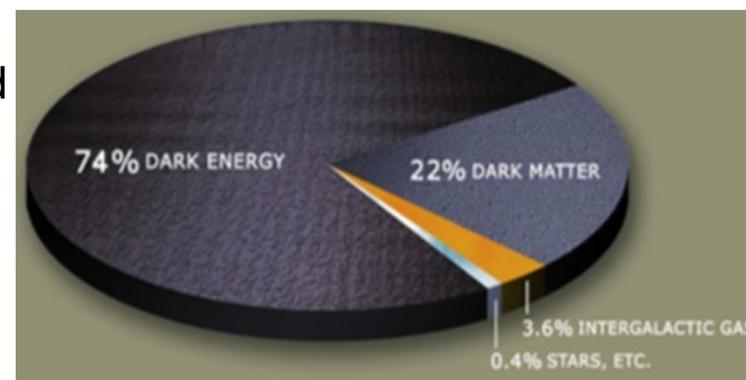
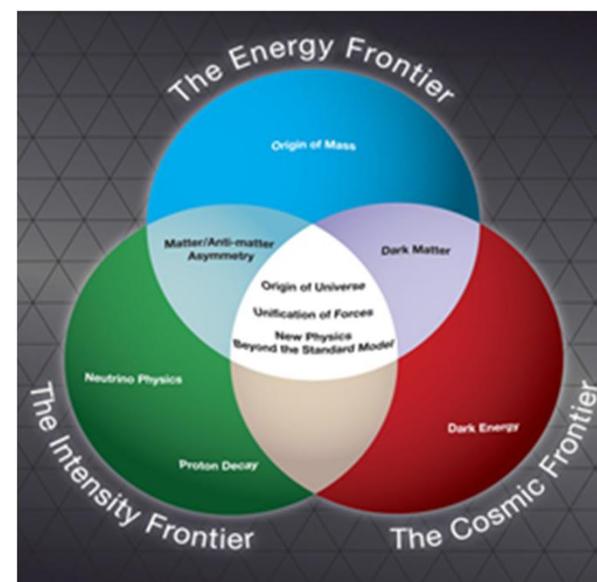
- US planning should recognize and integrate into a globally optimized plan
- Both our domestic program and our overall science program will be stronger as a result

US HEP needs a strong domestic foundation

- A healthy Fermilab with a strong physics program planned with the support of the other HEP Labs and Universities
- A strong domestic science program, centered on LBNE as the central component this decade, with international participation

Community needs to balance science opportunities with a reasonable appraisal of funding here and abroad

- Snowmass is about making the case for science opportunities, but should not lose sight of real world constraints
- At which frontier does the US want to lead - Where does the US contribute



Key issues for US planning process: Energy Frontier

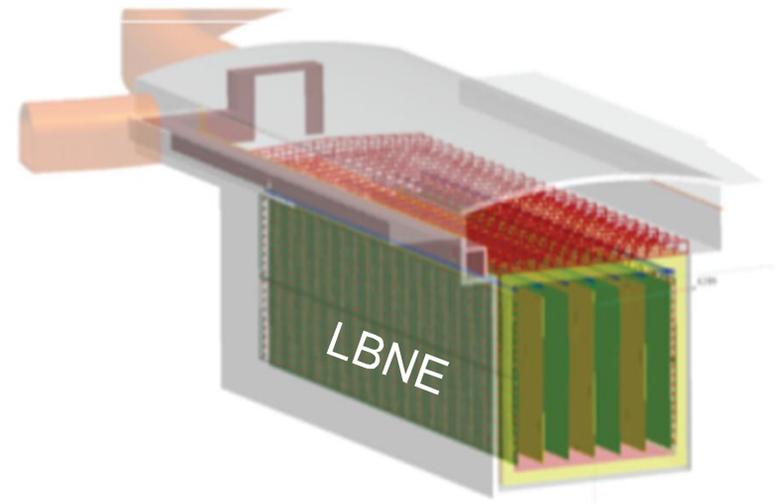
SLAC

- Future LHC program
 - » Expect LHC to be a cornerstone of the program through era of the planned high-luminosity upgrade
 - » Need to elucidate the physics case for the LHC upgrades
- Higgs Factory Opportunity
 - » Japan expressed willingness to host a 500-GeV ILC machine, beginning initially with a 250 GeV Higgs Factory
 - » International consensus about physics case and interest in participation is essential to evaluate whether a new project should go forward and the US contributes
 - » Essential to show the powerful combination of LHC discovery and ILC precision physics capabilities

Key issues for US planning process: Intensity Frontier

SLAC

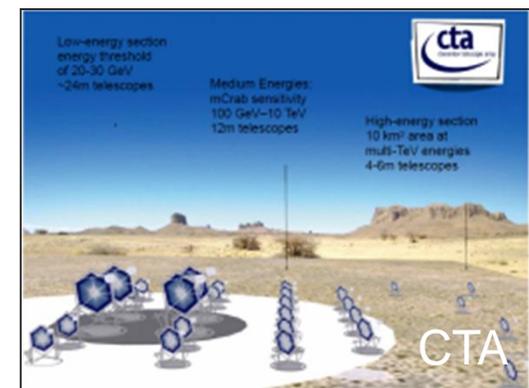
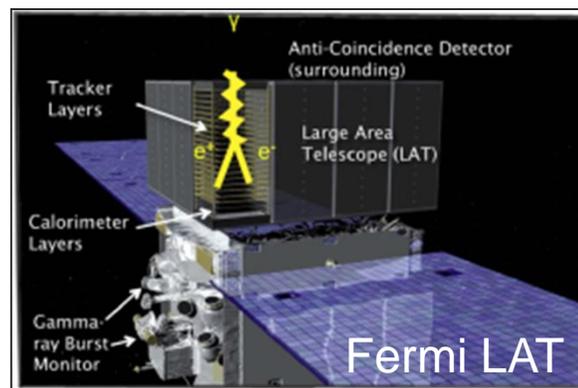
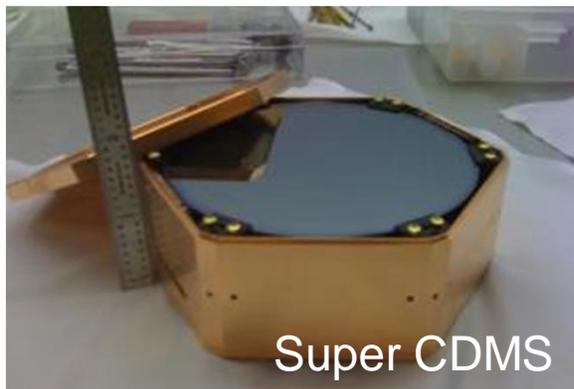
- The cornerstone in the US HEP program in the next decade:
 - » LBNE is the next important step for neutrino physics
 - » Elucidate an integrated long-term strategy for neutrino physics, including LBNE & $0\nu\beta\beta$, in a global context
 - » Articulate case for importance of precision tests and connections to other frontiers



Key issues for US planning process: Cosmic Frontier

SLAC

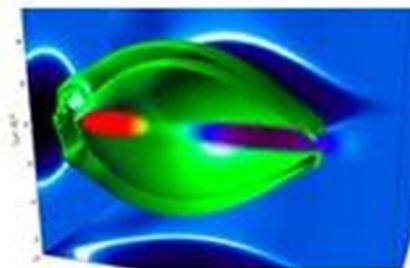
- US Leadership at the Cosmic Frontier:
 - » U.S. program should expand on its historical leadership in dark matter and dark energy
 - » Elucidate an overall strategy for dark matter searches, including LHC, indirect & direct searches
 - » Make the case for a broad suite of science opportunities in CMB, UHE cosmic rays, gravity dark matter and dark energy



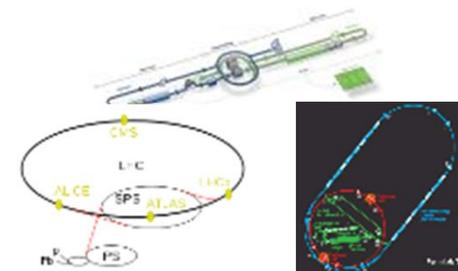
SLAC accelerator R&D plans

SLAC

- Push aggressively to advance accelerator physics and game-changing technologies
 - » Lattice Optics, Ultra-intense Beams, LLRF/Feedback, EM codes ...
 - » High gradient techniques: PWFA, DLA, HGRF,...
 - » Operate and exploit unique test facilities
 - *There is great synergy between BES and HEP programs*
- Maintain and sharpen key competencies in accelerator design
 - » LARP, MAP, ILC-related R&D, CLIC, ...
 - *Be prepared to engage in the future lepton collider*
- Accelerator Stewardship to broaden technology use
 - » Develop new applications for core R&D lines
 - » Facilitate industrial access to test facilities



Advanced Acceleration



Accelerator Design



HPRF Systems

Key issues for US planning process

- Snowmass should emphasize connections between Frontiers and the underlying science questions
 - » Big unknowns of dark matter and dark energy capture the public's imagination
 - » Discovery of the Higgs opens new windows into the fundamental question of mass and symmetry breaking
 - » Precision measurements and test of fundamental symmetries is a window into discoveries
 - » Instrumentation, scientific computing and accelerator technology are enabling factors with real world impact
- Snowmass report should explicitly address how individual programs deliver results for other Frontiers

SLAC particle physics plans

SLAC

- **Energy frontier: Higgs properties & search for new physics**
 - ✓ Search for TeV-scale physics with ATLAS through HL-LHC
 - ✓ Positioning community for future Lepton Collider
- **Intensity frontier: Nature of the neutrino**
 - ✓ Search for neutrinoless double beta decay with EXO
 - ✓ Neutrino oscillations & CP violation with LBNE
 - ✓ Potential new physics in flavor sector
- **Cosmic frontier: Search for dark matter and nature of dark energy**
 - ✓ Dark energy with DES and LSST
 - ✓ Dark matter with SuperCDMS, Fermi GST, CTA
 - ✓ Nature of inflation with G2 CMB experiment

Vision for 2020s and beyond

SLAC

- Aim is to construct a compelling vision for US program – Do we want to lead and at what Frontier?
- What should the program look like if?
 - » Supersymmetry is discovered at the LHC
 - » The Higgs sector turns out to be complex
 - » CP violation in neutrinos is discovered at LBNE
 - » Dark Matter is discovered in next generation experiments
 - » Precision cosmology shows that Dark Energy is not the cosmological constant
- How should we position the program for US leadership in the global program in the 2030s ?
 - » Develop technology for a terascale lepton collider on US soil or elsewhere?
 - » Develop the Intensity Frontier with a view to the Energy Frontier?
 - » Provide an answer to the Dark Energy/Dark Matter quest?

