SLAC HEP Program

Snowmass 2022

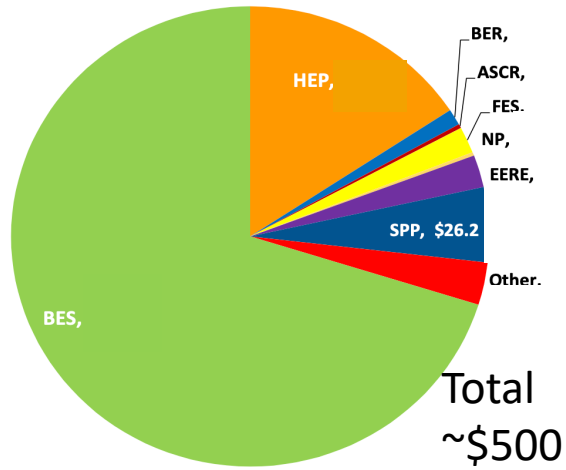
SLAC 60 YEARS

JoAnne Hewett, Associate Laboratory Director for Fundamental Physics
Chief Research Officer

Human capital

- 1,685 Full time equivalent employees
- 20 Joint faculty
- 235 Postdoctoral researchers
- 37 Undergraduate students
- 276 Graduate students
- 2,062 Facility users
- 12 Visiting scientists

FY 2021 Costs by funding source



Total
~$500M

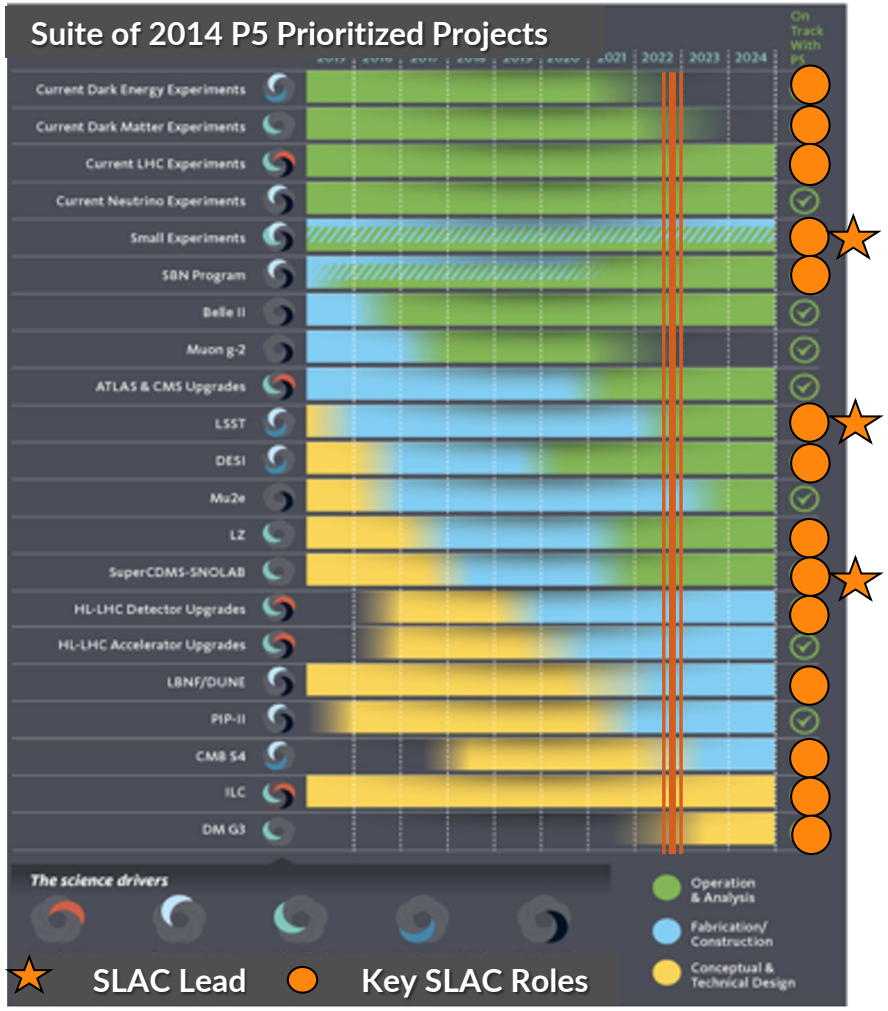
SLAC NATIONAL ACCELERATOR LABORATORY

Stanford University | U.S. DEPARTMENT OF ENERGY

SLAC is a key element of the national HEP program

HEP ecosystem vital to success of P5 program

- Takes advantage of multiple strengths across the system
- Diverse expertise & creativity
- Diagonalized core capabilities
- SLAC leadership of mid- & small-scale unique impactful experiments
- SLAC plays crucial role in broad set of P5 projects and leads design of innovative new concepts



Align lab core competencies and HEP needs: Multi-program centers of expertise

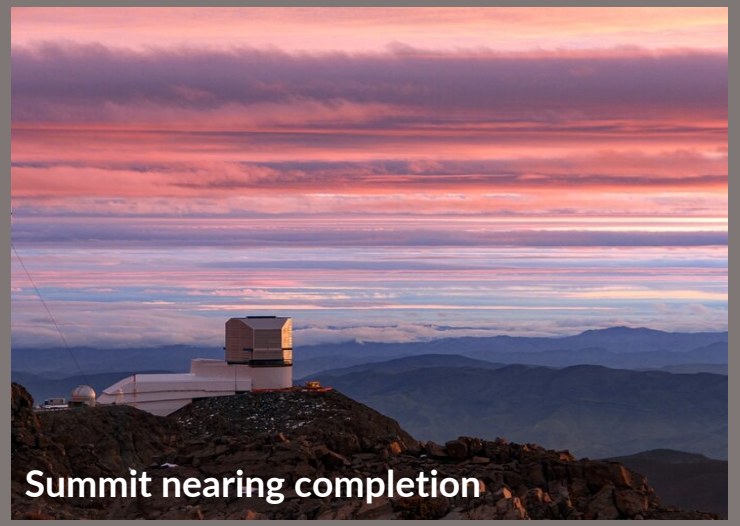
- Detectors/Instrumentation
- Accelerators
- Scientific computing
- Long-term strategic planning
- Leverage Stanford University
- Kavli Institute for Particle Astrophysics and Cosmology

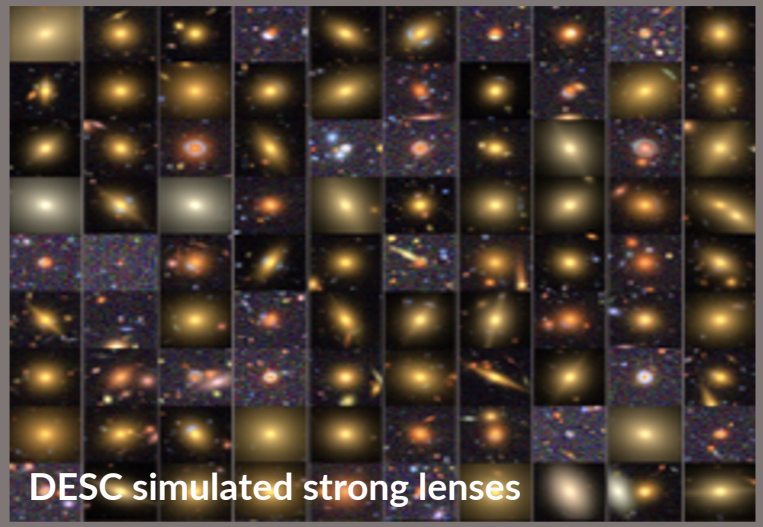
HEP benefits from SLAC and SLAC benefits from HEP

Vera C. Rubin Observatory Preparing for First Light!

Will perform the 10-year Legacy Survey of Space & Time (LSST)


LSST camera cryostat and utility truck recently attached to camera body


Summit nearing completion

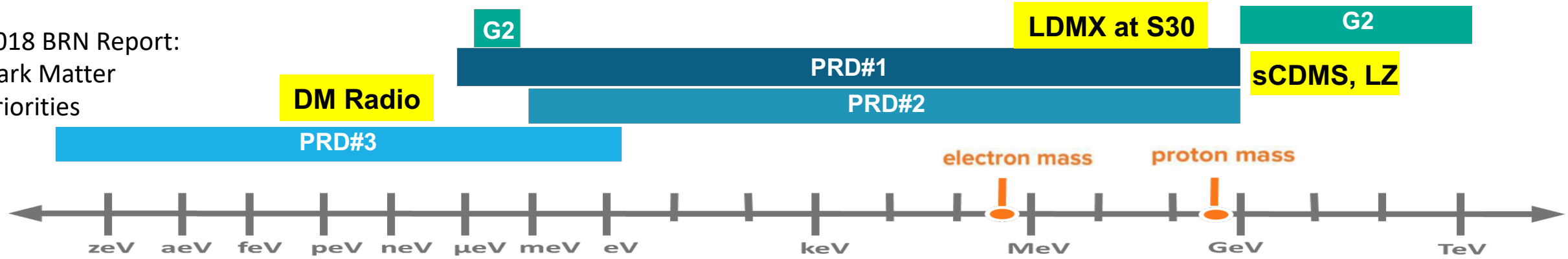

DESC simulated strong lenses

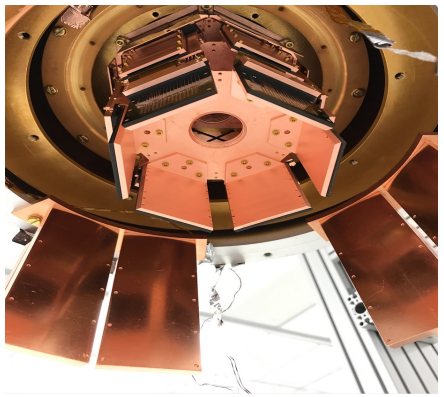
- Camera to record deep images of 10 billion galaxies to observe the nature of dark energy
- **SLAC-built LSST camera. CD-4 completed in fall 2021**
- Careful planning to ship camera to Chile in early 2023

- **SLAC named the host of U.S. Data Facility**
- Partner with NSF NOIRLab to manage Rubin operations
- Dark Energy Science Collaboration (DESC) performing mock data challenges – operations managed by SLAC

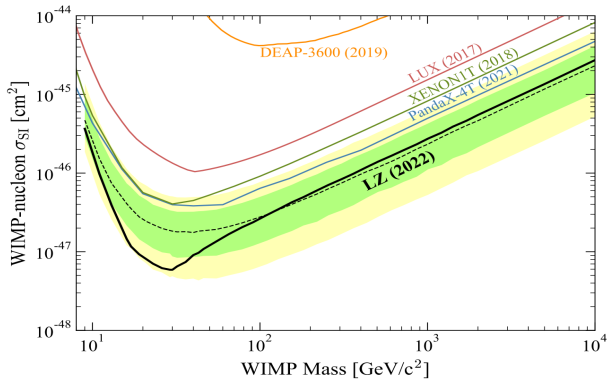
Dark matter exploration for WIMPS and beyond

2018 BRN Report:
Dark Matter
Priorities

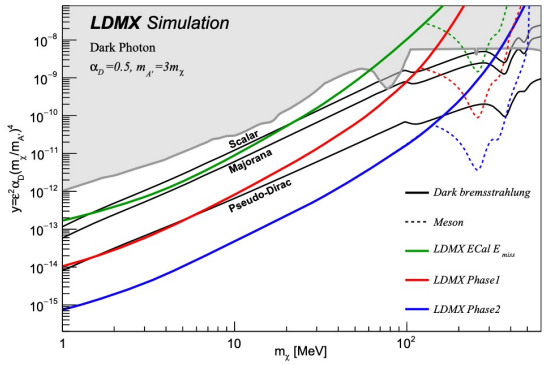




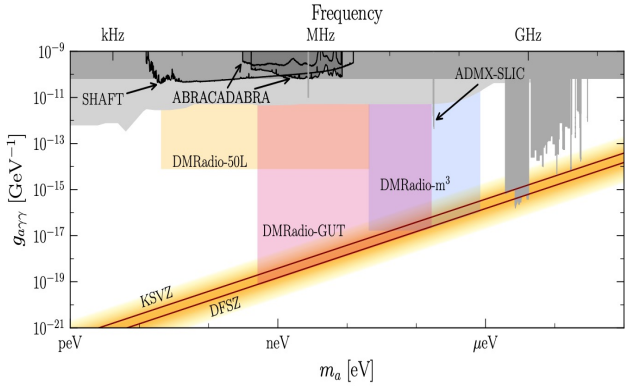
SuperCDMS-SNOLAB
SLAC-lead for low-mass WIMP search
Expect project completion in August



LZ
LBNL lead for high-mass WIMP search
Significant SLAC ops, technical, science role



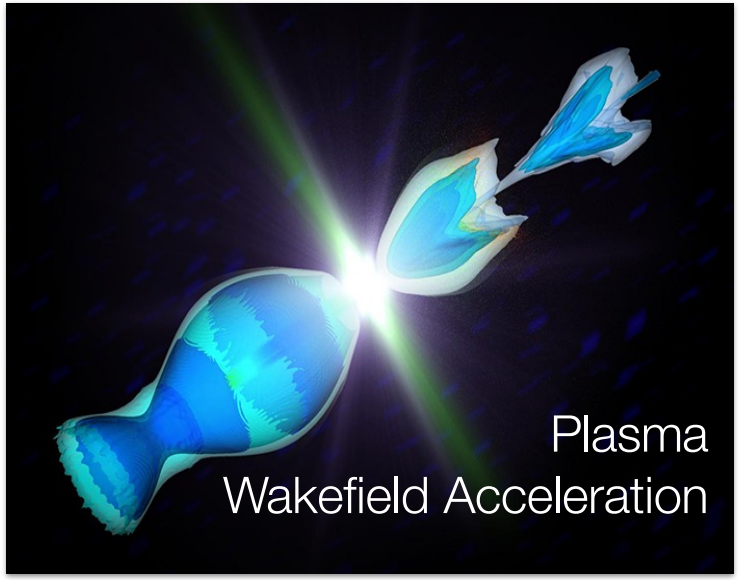
Light Dark Matter eXperiment will use LCLS-II beam for DM searches in Mev-GeV range



DM Radio
will reach predicted low frequency axion parameter space

SLAC

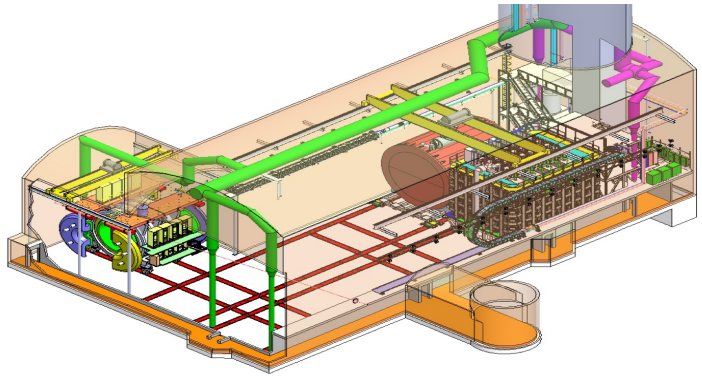
Advancing accelerator-based science



FACET-II

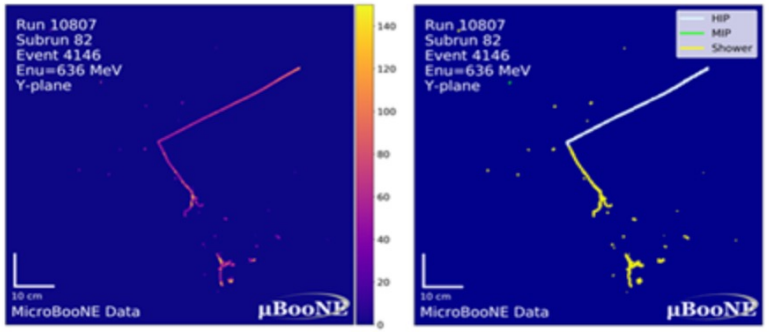
National user facility with broad user program based on 10 GeV beams and their interaction with lasers and plasmas

- Advances accelerator workforce development

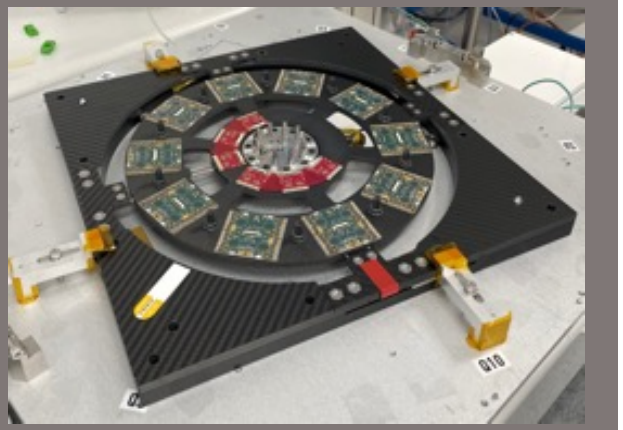


DUNE Near Detector

- Sub-project leadership
- ML data reconstruction
- Probe lepton-nucleon cross sections at new SLAC facility LDMX



First ITk ring prototype



U.S. ATLAS Pixel Lead

- Assembly site of Inner Tracker pixel detector
- Pioneering ML for future large data sets
- Leading role in defining Higgs self-couplings measurements

SLAC

Providing Technical Contributions and Leadership for Major Projects

Non-Accelerator physics

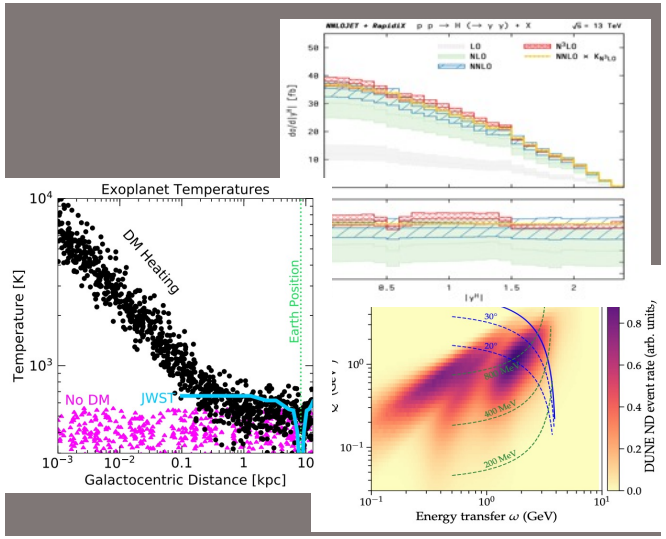
Expanding key roles in nEXO neutrinoless double beta decay program

- Determination of whether neutrinos are their own anti-particles
- Liquid Noble Test Facility to provide R&D platform

R&D facility for nEXO radioactive background control

Theoretical Physics

- Precision QCD
- Neutrino Physics
- Beyond the SM
- Dark Matter
- Dark Energy
- Inflation

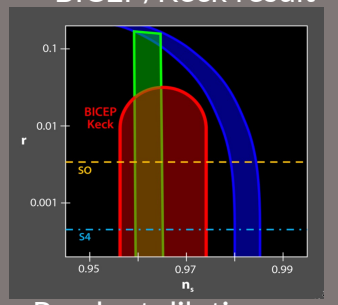


Measuring the Cosmic Microwave Background

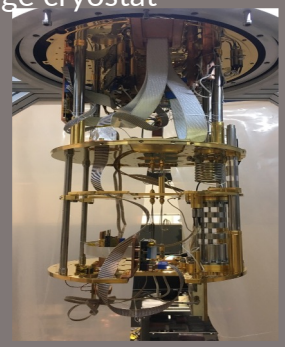
Multi-pronged CMB effort

- Best current inflation limit from BICEP/Keck
- Key roles in CMB-S4 to observe primordial gravitational waves and their effect on inflation
- CMB correlation studies with Rubin data

BICEP/Keck result



Readout dilution fridge cryostat



DMF

Detector Microfabrication Facility

- Funded by QIS Q-NEXT Center, SLAC, and Stanford and will fabricate CMB TES and SQUID detectors
- Beneficial June 2022 and full operations by 2024