P5-related Projects in the Division of Astronomical Sciences

HEPAP Meeting

Newport Beach, CA

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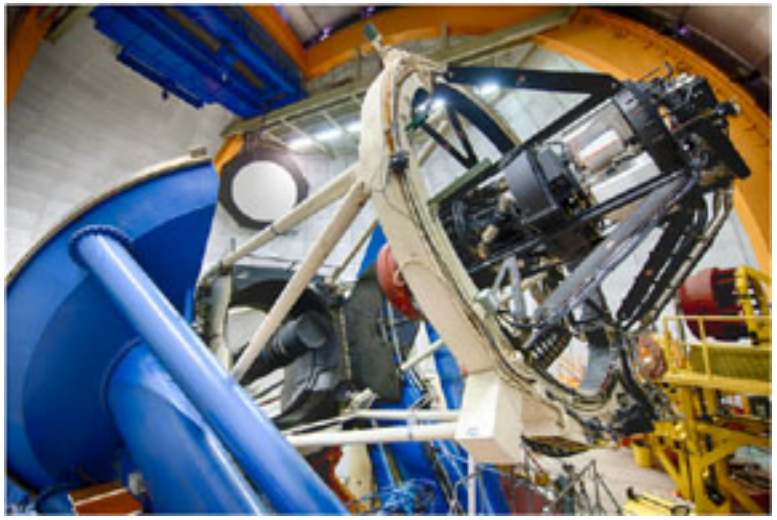
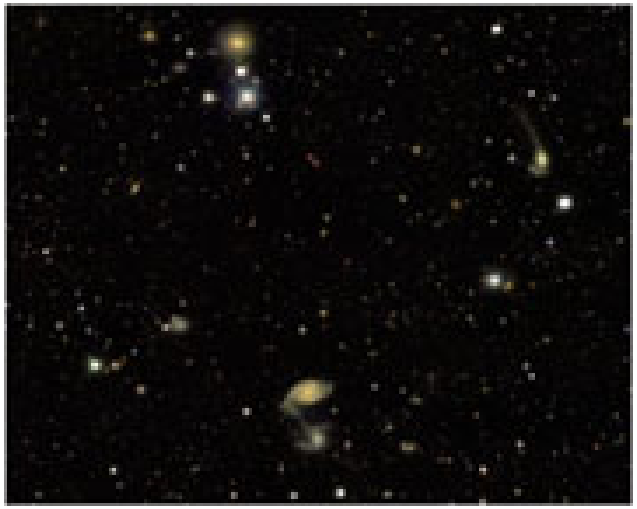
NSF/AST

Dark Energy Survey (DES)

Dark Energy Task Force (DETF) Stage III imaging experiment

The Dark Energy Camera (DECam) is a new 3 square degree field-of-view, 570-megapixel imager installed on NSF's Blanco telescope on Cerro Tololo, Chile





Five year DES started August 2013.

Two unprecedented imaging surveys: 1) a wide-area survey of 5000 square degrees of the South Galactic Cap in 5 optical-near infrared filters (grizY); images of 300 million galaxies. 2) a time-domain survey of 30 square degrees in 4 filters (griz) to discover & provide light curves for 3500 type Ia supernovae.

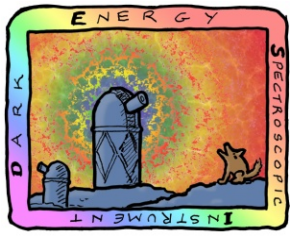
DOE – NSF Partnership

DOE lead: camera, DES science operations

NSF: telescope upgrade, telescope operations, data management system

Dark Energy Spectroscopic Instrument (DESI)

Dark Energy Task Force (DETF) Stage IV spectroscopic experiment



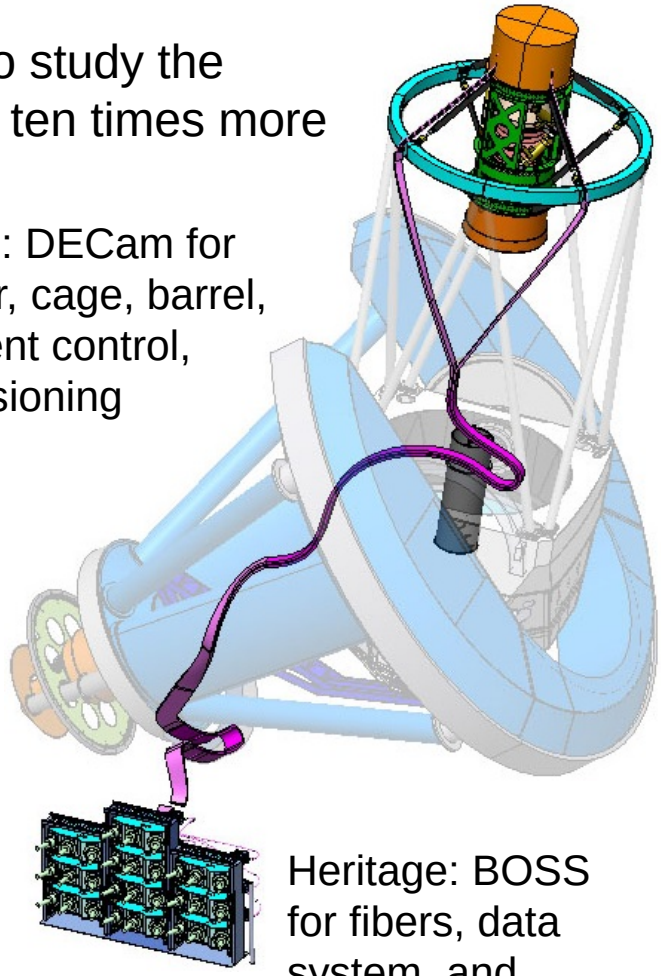
Will observe 14,000 deg^2 of the night sky to study the distribution of ~30 million distant galaxies - ten times more volume than BOSS (DETF Stage III)

A new instrument to be installed on NSF's Mayall Telescope at Kitt Peak, AZ

DOE-NSF MOA for transition assures DESI access; operations MOA in preparation.

Five year survey, start ~FY2020

Heritage: DECam for corrector, cage, barrel, instrument control, commissioning



DESI Collaboration has ~200 participants & 43 institutions

Heritage: BOSS for fibers, data system, and spectrographs

DOE lead: TPC ~$56M; CD-2 approval September 2015; NSF provides Mayall telescope + targeting survey; $17M in non-federal funds.

Large Synoptic Survey Telescope (summary)

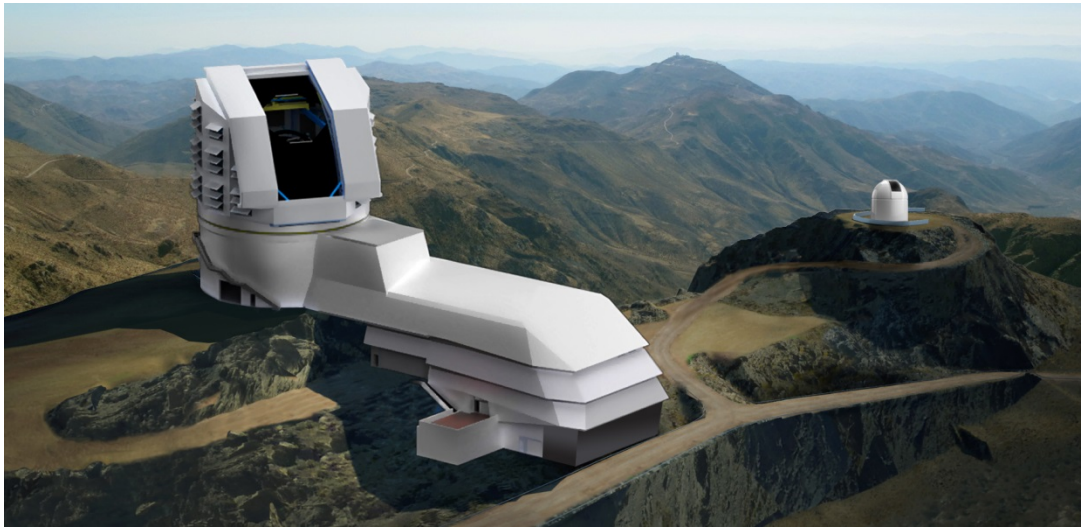
Massively parallel astrophysics - data enabled science
- very large datasets allow for precision statistical analysis and an automated search for very rare events

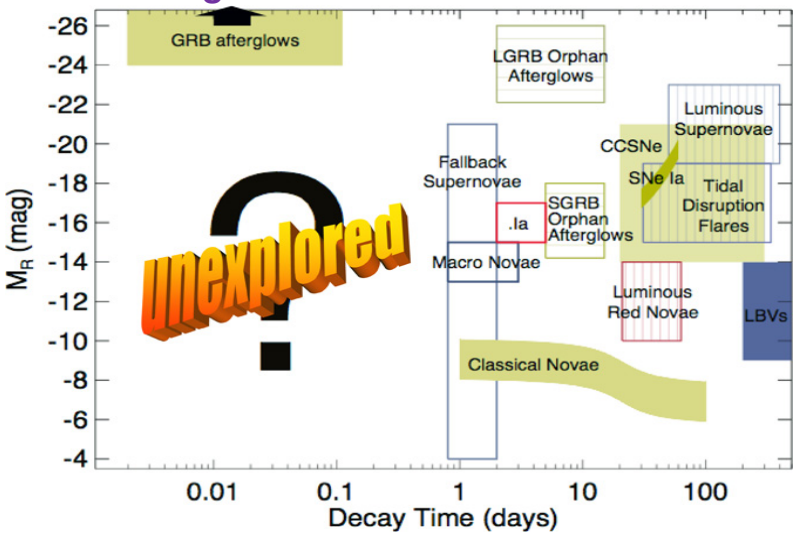
High dimensionality data exploration
- automated discovery
- automated data quality assessment

A new window on the Universe
- expect the unexpected

Transformative impact of sky surveys
- change in astronomical culture

A 10-yr survey of 20 billion objects in space & time





A unique discovery engine, transformative in science, in education & outreach, and in data-enabled science & cyberinfrastructure

- ***Probing dark matter and dark energy***
  - ***Order of magnitude improvement***
- ***Mapping the Milky Way***
  - ***Formation and structure***
- ***An Inventory of the Solar System***
  - ***Potentially hazardous asteroids***
- ***The Transient Optical Sky***
  - ***Opening the Time Domain***

Large Synoptic Survey Telescope (status)

Dark Energy Task Force (DETF) Stage IV imaging experiment

Large Synoptic Survey Telescope

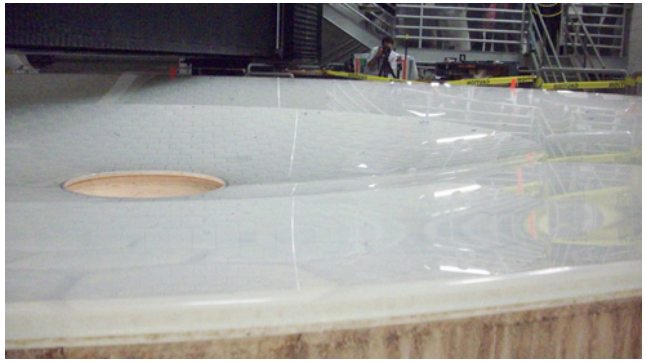
Summit facility construction well under way.

LSST conceived jointly by NSF & DOE communities.

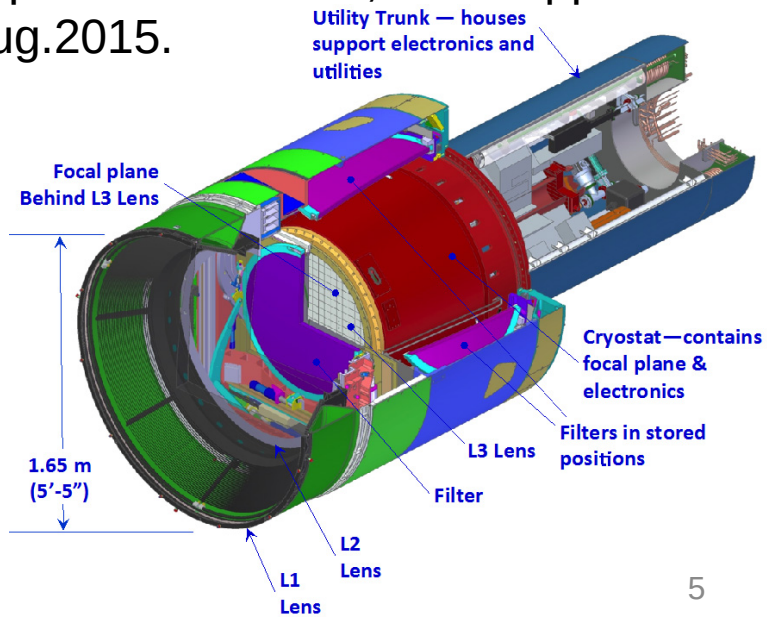
NSF lead - telescope, site, data management, education, public outreach. DOE/OHEP responsible for LSSTcam. DOE expected to support Dark Energy Science Collaboration.

NSF-DOE MOU 2012; weekly Joint Oversight Group meetings.

M1M3 innovative two-surface mirror polished & accepted



Massive camera – DOE scope – CD-2 approved Jan.2015; CD-3 approved Aug.2015.



Cosmic Microwave Background studies

Specific Current Projects

Atacama Cosmology Telescope (ACT)

ACTpol; Chile; NSF & other funding

PolarBear

Atacama Chile; NSF, DOE, other funding

South Pole Telescope (SPT)

SPTpol, SPT-3G; NSF, DOE, other funding

Other

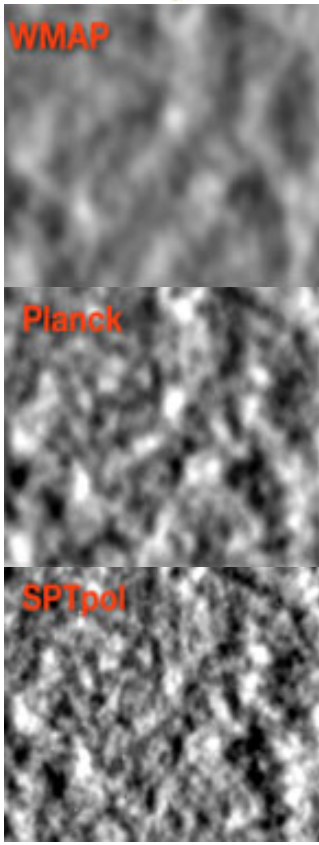
NASA sub-orbital experiments

NSF logistics in Antarctica

BICEP[2|3], KECK, ABS, CLASS

Are there too many projects?
Task Force on CMB Research (TFCR)

Report outdated; time for new planning



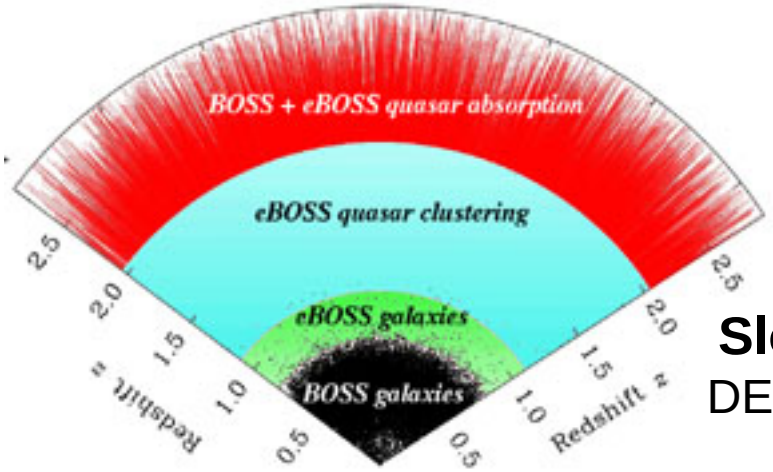
Clear progress

CMB needs a new survey of the whole landscape – cross agency – after the mid-decadal report – with a process to move forward to Stage IV

Miscellaneous

Hobby-Eberly Telescope Dark Energy eXperiment (HETDEX)

Deep pencil beam spectroscopic BAO survey
DETF stage III; NSF, non-federal funding



Sloan Digital Sky Survey

DE pieces are BOSS, eBOSS
NSF, DOE, other funding

PanSTARRS-1 (4)

Primarily transients/NEOs; imaging; DETF stage III
NSF, other funding

‘Chameleon’ DE particle experiment (UCB)

NSF, NASA, other funding

Individual investigator awards

Not really “projects”, but include instruments, hardware development, theory, and simulation, for dark energy and cosmic frontier goals

Mid-Scale Innovations Program (MSIP)

Decadal Survey – New Worlds, New Horizons – recommended MSIP as second priority large project.

AST Portfolio Review Committee recommended rolling University Radio Observatories (UROs), Telescope Systems Instrumentation Program (TSIP), & large-facility design and development into MSIP.

Before MSIP, mid-scale projects were funded on an *ad hoc* basis; this included VERITAS, CDMS, Auger, ACT, CBI, QUIET, HETDEX, PolarBear, DES, etc.

Seven awards from FY14-15 competition includes projects in CMB, epoch of reionization, gravitational radiation, and other areas of astrophysics. In particular, includes co-funding of a Physics Frontiers Center for NanoGrav. NanoGrav also received funding from NSF international office in a PIRE award.

Second competition (FY16-17) in progress; upper limit on project budget $30M; pre-proposals now under evaluation.