
PPA Science Tall Building Elevator Speech

R.Dubois

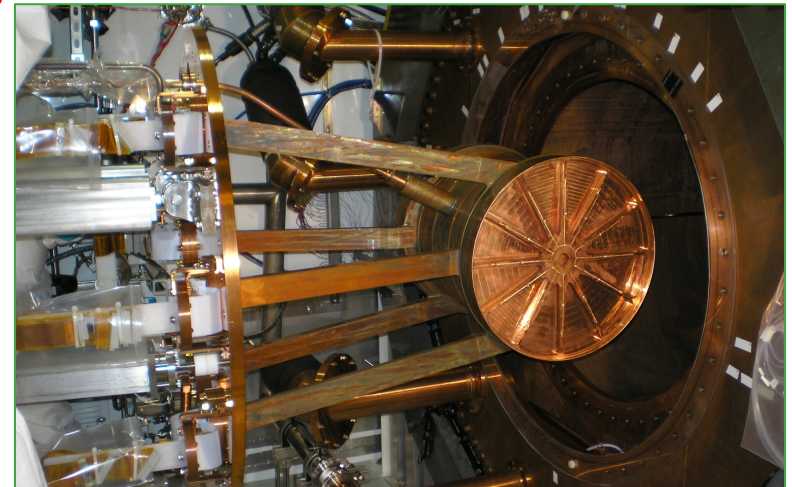
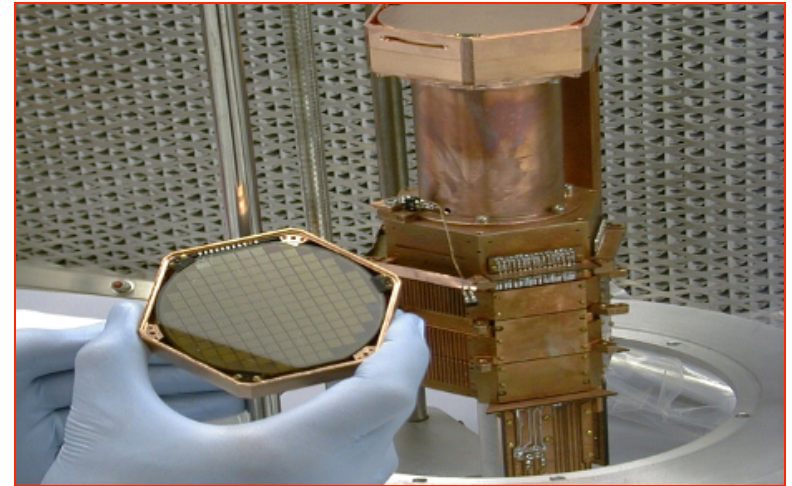


Slides adapted/swiped from D.MacFarlane

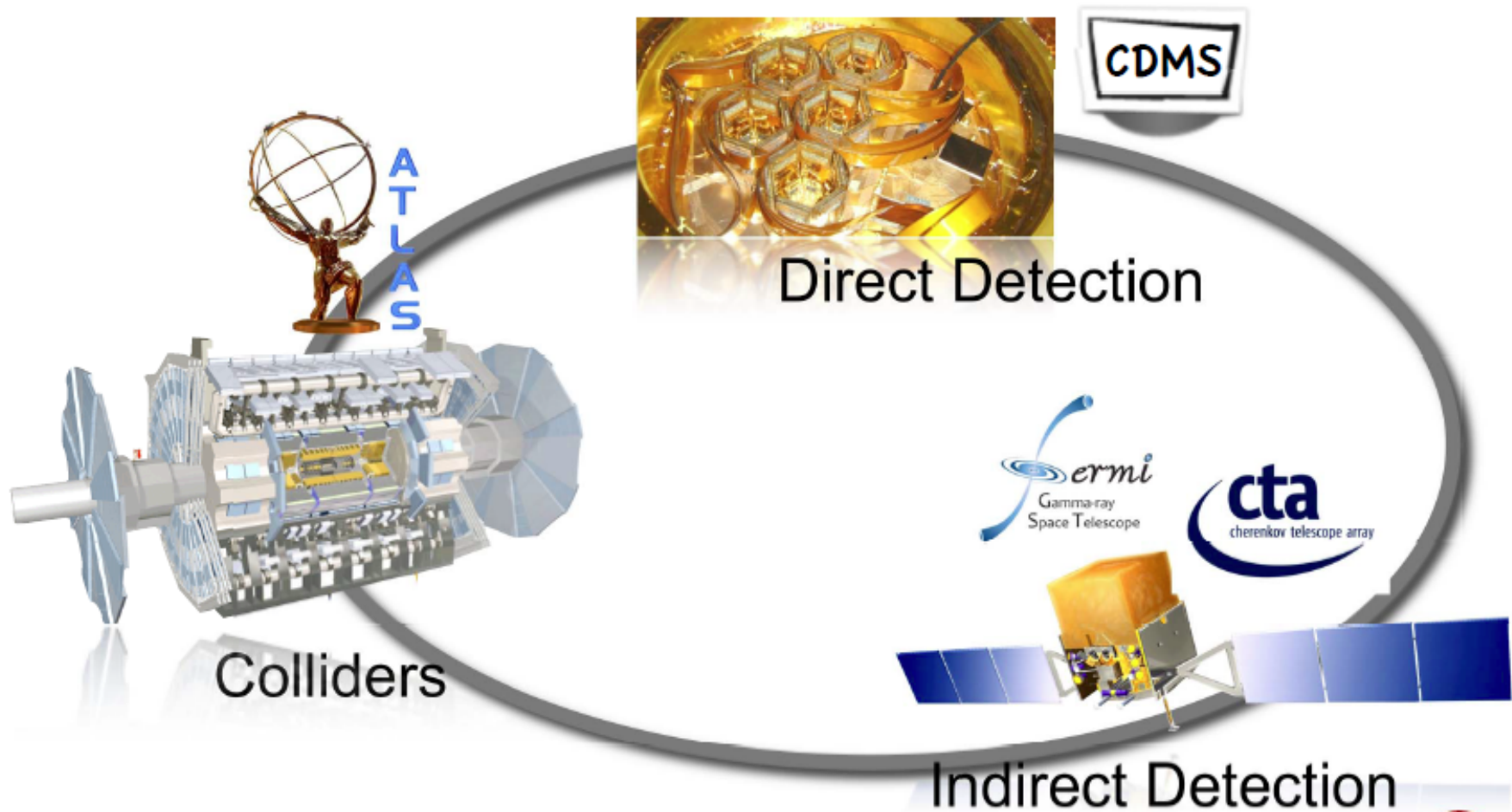


Pursuing Frontiers of Scientific Discovery

- **Discovery at the energy frontier**
 - ☑ Searching for physics beyond the Standard Model with ATLAS
- **Discovery at cosmology frontier**
 - ☑ Nature of dark energy with DES and LSST
 - ☑ Discovery of dark matter with CDMS, Fermi GST, CTA
 - ☑ Nature of inflation with CMB R&D
- **Discovery at intensity frontier**
 - ☑ Nature of the neutrino with EXO
 - ☑ Origins of matter-antimatter asymmetry in quark sector



Connections: Particle Dark Matter

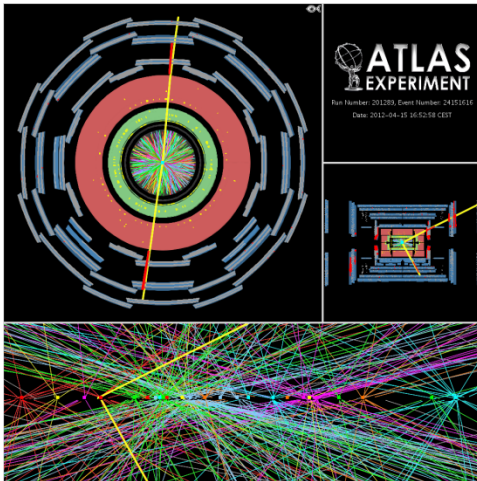


Energy Frontier focus: ATLAS

Energy Frontier

ATLAS
Data: 2008-2020

ATLAS Upgrade
Project: 2017-2022
Data: 2022-2030



$Z \rightarrow \mu\mu$ with 25 vertices

- As seen in the Muppets movie
- Higgs, SUSY searches
- Operate Tier 2 center at SLAC for simulations
- Theory group simulates the underlying physics

Intensity Frontier focus: EXO and LBNE

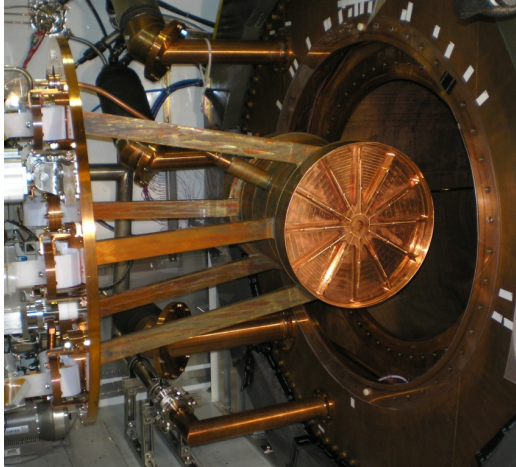
Nature of neutrino

EXO-200
Data: 2011-2015

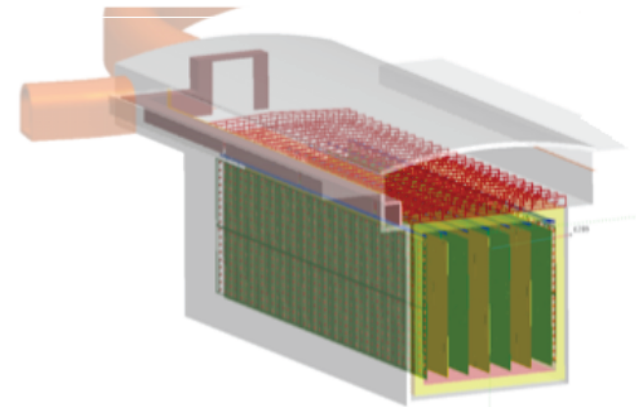
EXO
Project: 2016-2020
Data: 2020-2030

Neutrino oscillations
and CP violation

LBNE
Project: 2013-2020
Data: 2020-2030



- EXO operated at WIPP
- Data FedExed to SLAC
- Looking to see if neutrino is its own antiparticle via neutrinoless double beta decay.



SLAC just joined LBNE

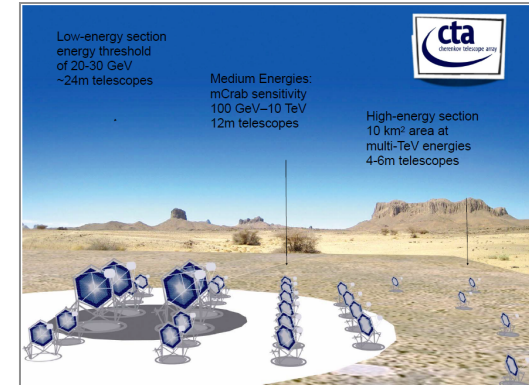
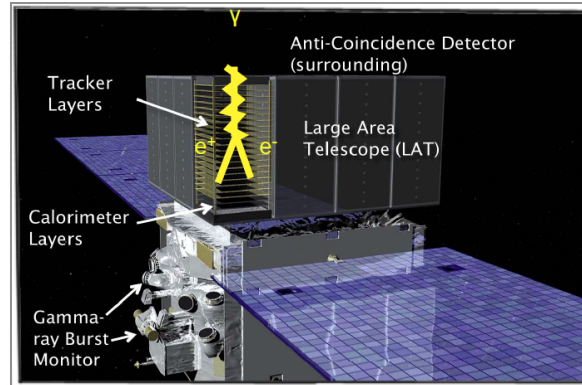
+ BABAR winding down in its LTDA cocoon

Cosmic Frontier focus: Fermi, LSST & CDMS

Cosmic Particles +
Indirect Dark Matter

Fermi GST
Data: 2008-2018

CTA
Project: 2017-2021
Data: 2017-2030



- Fermi in 350 km orbit
- γ -ray telescope
- Data processed at SLAC
 - 15 GB/day \rightarrow $\frac{3}{4}$ TB
- Sent to NASA/Goddard to be made public

- Dark matter searches
- Pulsars, supernovae
- AGN, GRBs
- Sun, moon
- Binaries!

- European led
- Probably in Argentina
- US doing R&D on novel telescope desing
- R&D simulations at SLAC

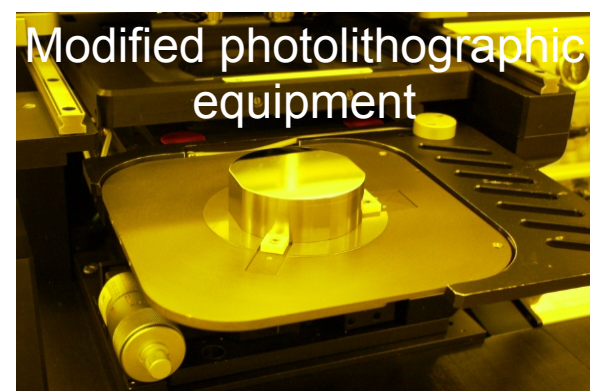
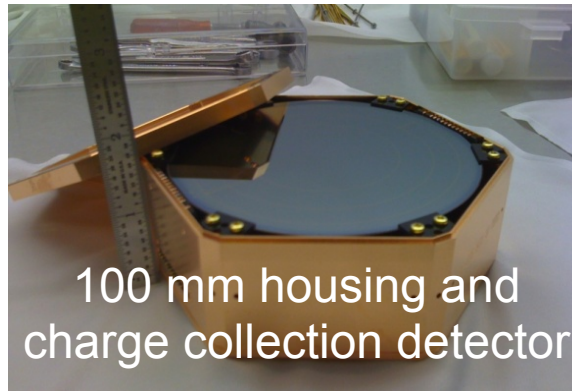
(and a bit of astrophysics too!)

Cosmic Frontier focus: Fermi, LSST & CDMS

Direct Dark Matter

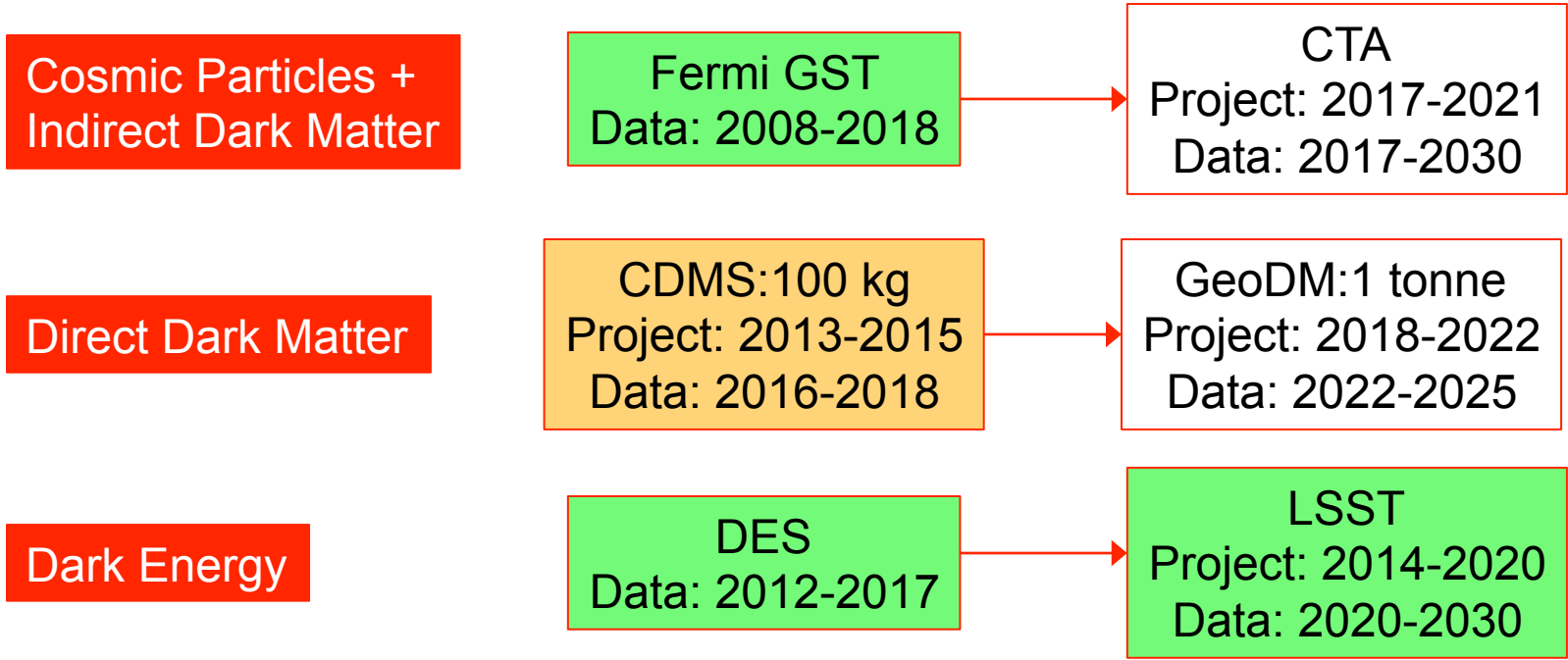
CDMS:100 kg
Project: 2013-2015
Data: 2016-2018

GeoDM:1 tonne
Project: 2018-2022
Data: 2022-2025



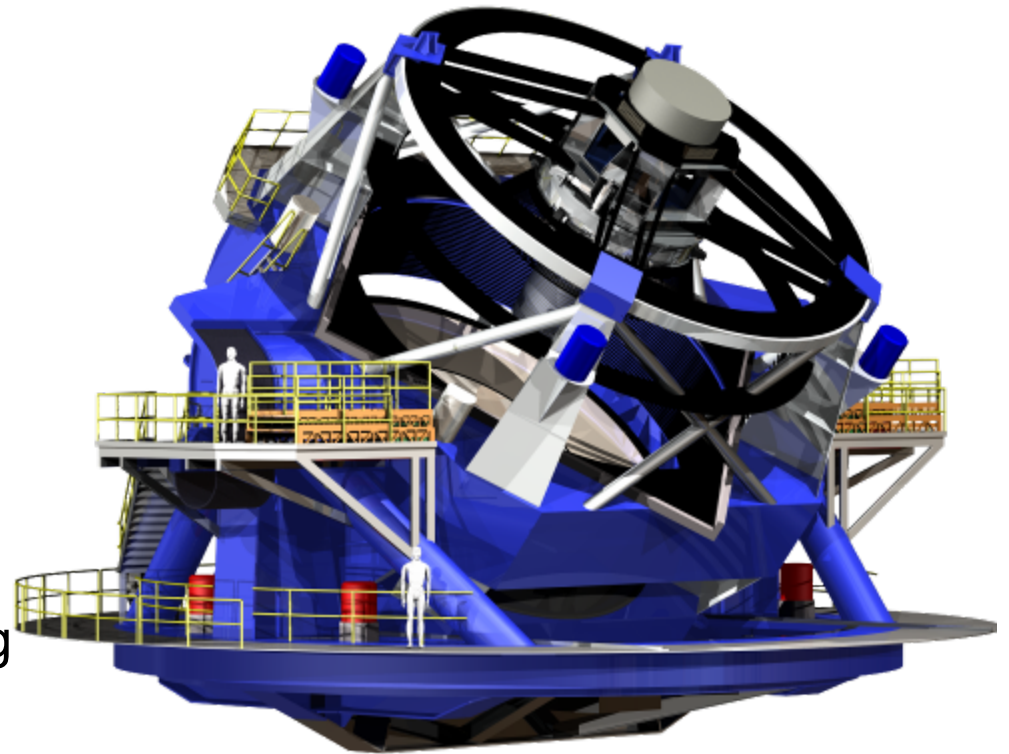
- CDMS now at Soudan mine
- Moving to SnoLab
- Looking for vibrations from Dark Matter particle hitting crystal
- Simulations done at SLAC

Cosmic Frontier focus: Fermi, LSST & CDMS



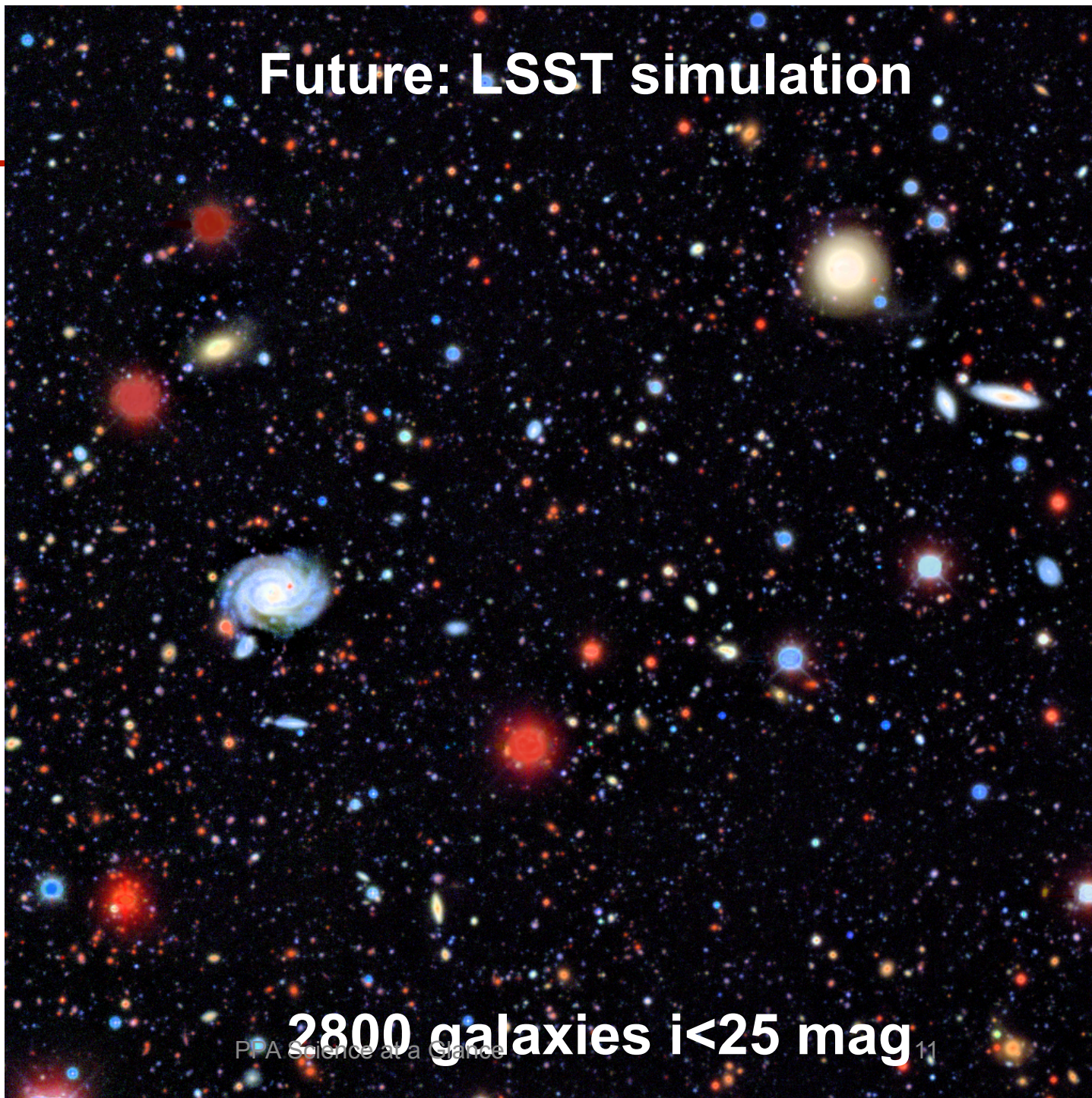
Future program: Large Synoptic Survey Telescope

- Provide a sensitive survey of the entire sky at visible wavelengths every few nights
 - Tight constraints on dark energy
 - Rich program of astrophysics & astronomy
- Weak lensing, SNe
- 3 Gpixel camera
- NSF lead agency, DoE supplying camera
- NCSA is the big data center
- Dark Energy collaboration will need an analysis center
 - SLAC would not mind hosting it
- Astro theory cosmology simulations



Future: LSST simulation

7.5 arcminutes



2800 galaxies $i < 25$ mag