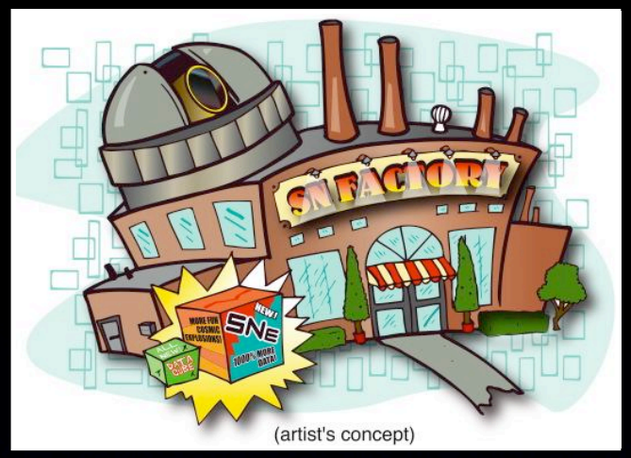


Greg Aldering
Staff Scientist
SNf Project Lead

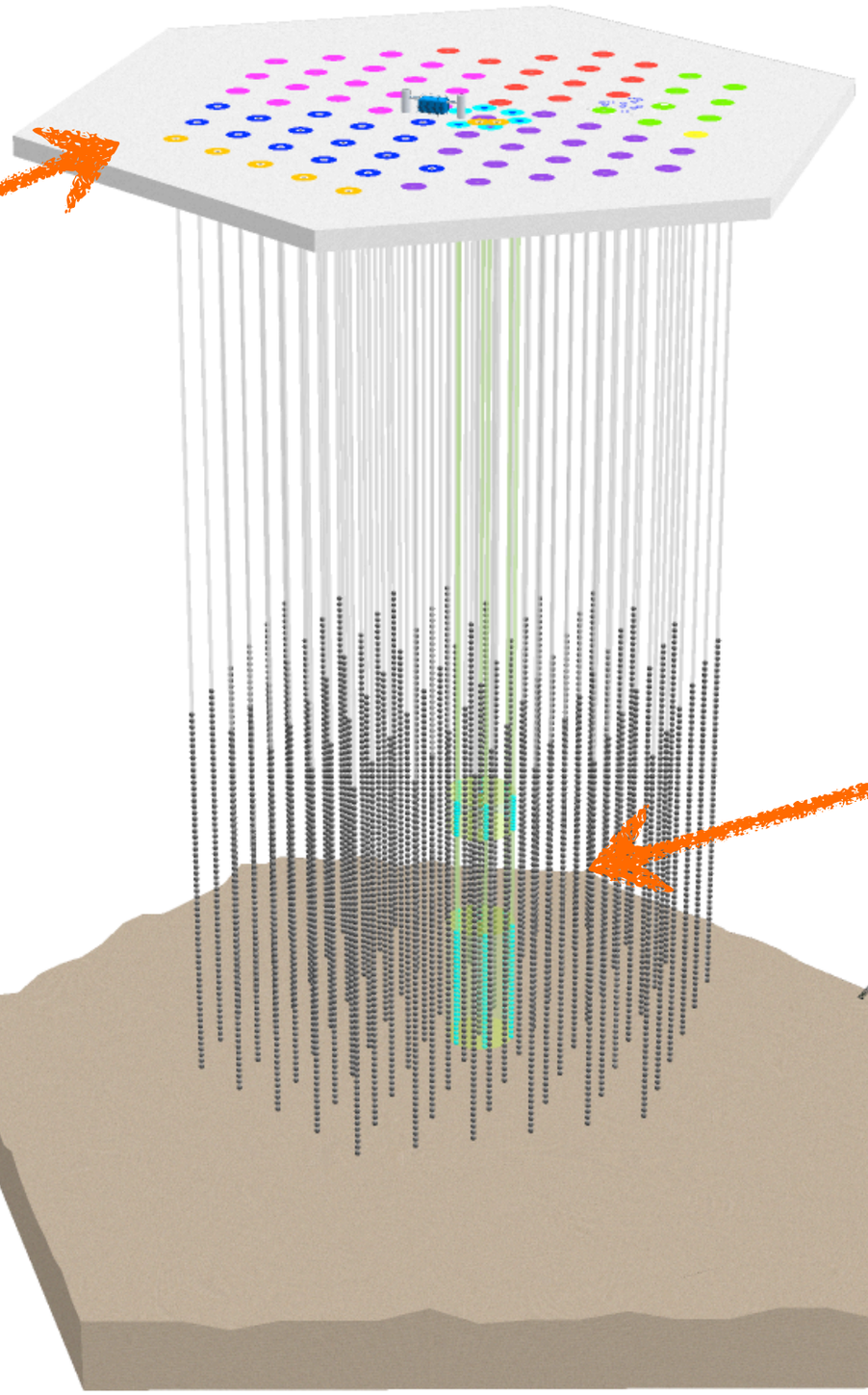
- Interests: observational cosmology and instrumentation, specialty in SN Ia spectroscropy
- Involved in SCP, JDEM

Nearby Supernova Factory

- Reduce SN Ia systematics for cosmology by using well-studied samples of low-reshift SNe Ia
- Flux-calibrated spectral time series of SNe Ia
- Starting work on astrophysical absolute color calibration

IceCube: PeV photon showers

Stijn Buitink



Cosmic Ray Shower:
random arrival direction
high muon content

Photon Shower:
pointing back to source
low muon content

Mike Childress

Grad Student

Supernova Factory

Host Galaxies of Type Ia Supernovae

- Study SN Ia progenitors by observing the galaxies in which they are born
- Measure galaxy age, stellar mass, and metallicity from imaging and spectroscopy
- Study correlations of SN properties with galaxy properties to better standardize SNe Ia
- Special topics:
  - SNe Ia in low-metallicity galaxies
  - Host galaxies of super-Chandrasekhar SNe Ia

Joanne Cohn

Cluster of galaxies and galaxies in clusters

studies using mostly N-body simulations

with Martin & Yookyung (and earlier Renske)

Clusters of galaxies:

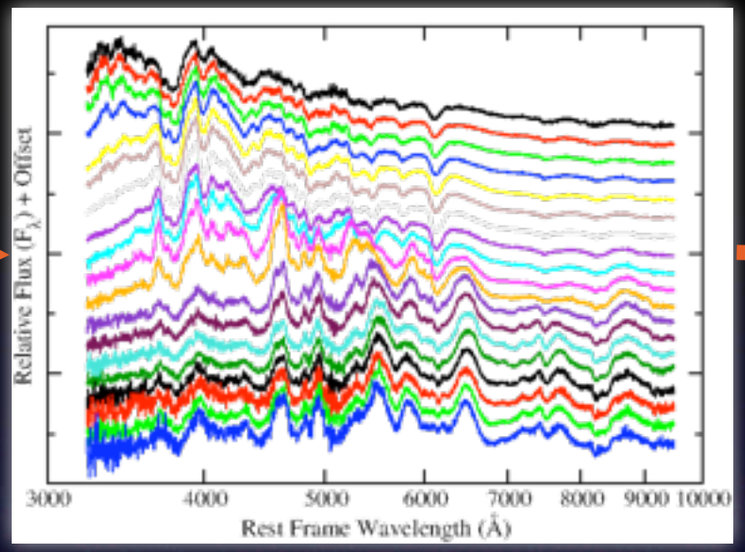
- Cluster finding in simulations (SZ, optical)
- Multiwavelength cluster mass estimates, line of sight dependence (SZ, richness, WL, velocity dispersions)
- Filaments and how they correlate with and affect these measurements and especially their scatter
  - How to pull out their presence with multiwavelength data

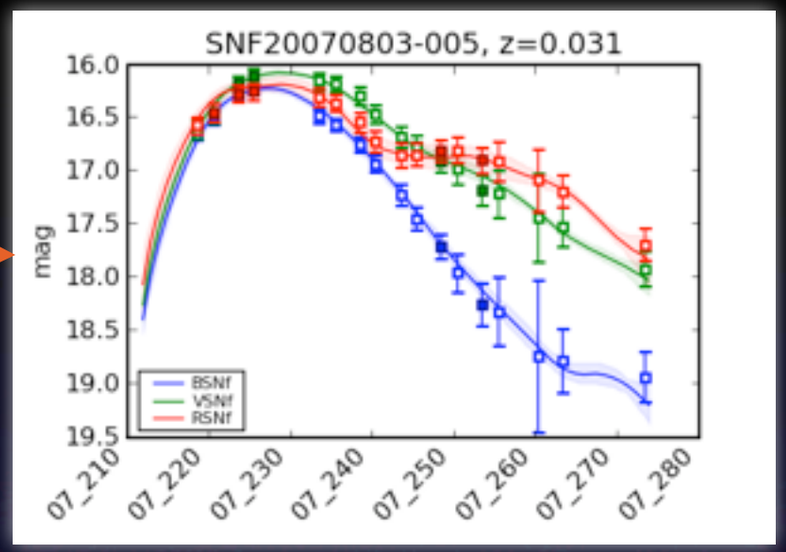
Galaxies in clusters

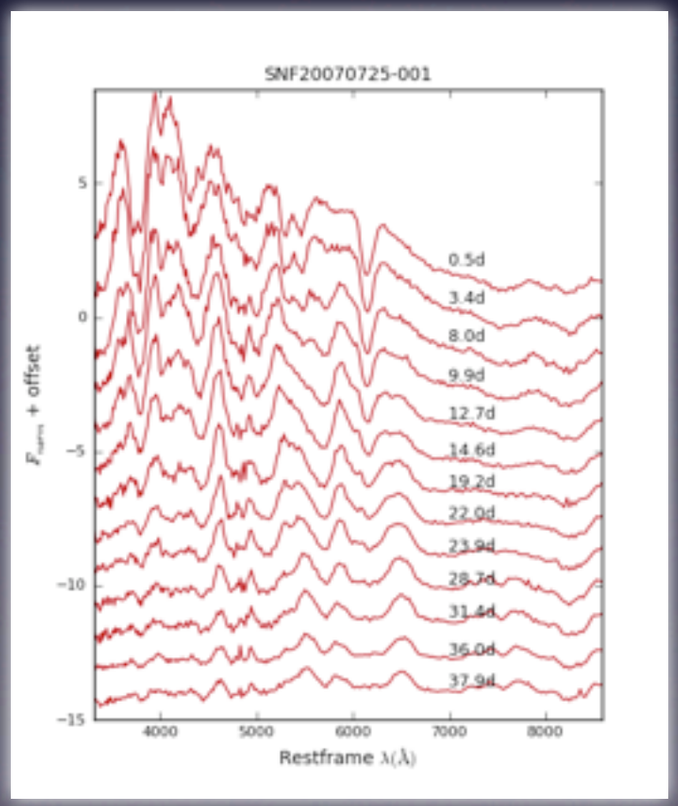
- Retain the memory of where they came (how much, effects on evolution in cluster)?
- Merge more often than expected earlier--consequences for galaxy evolution?

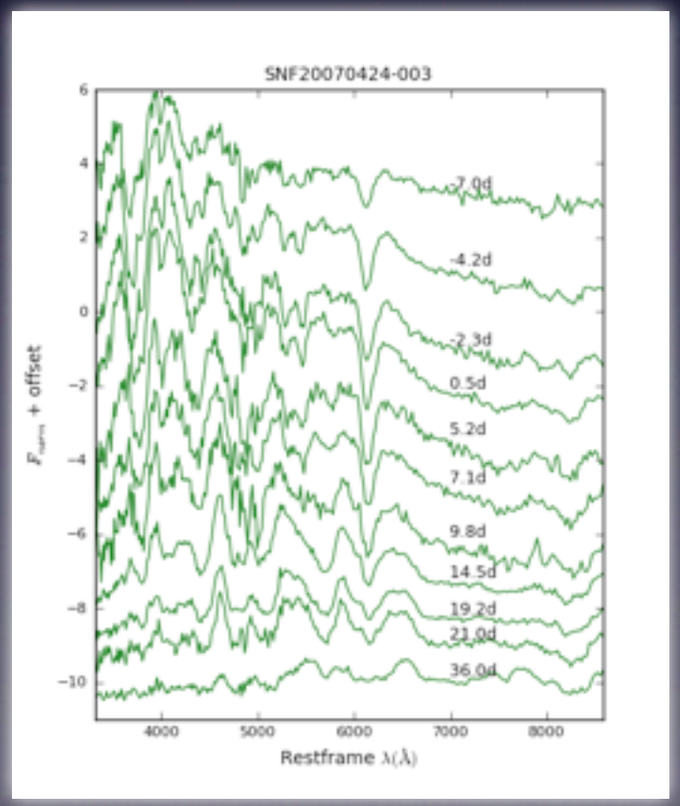
Twin Supernova

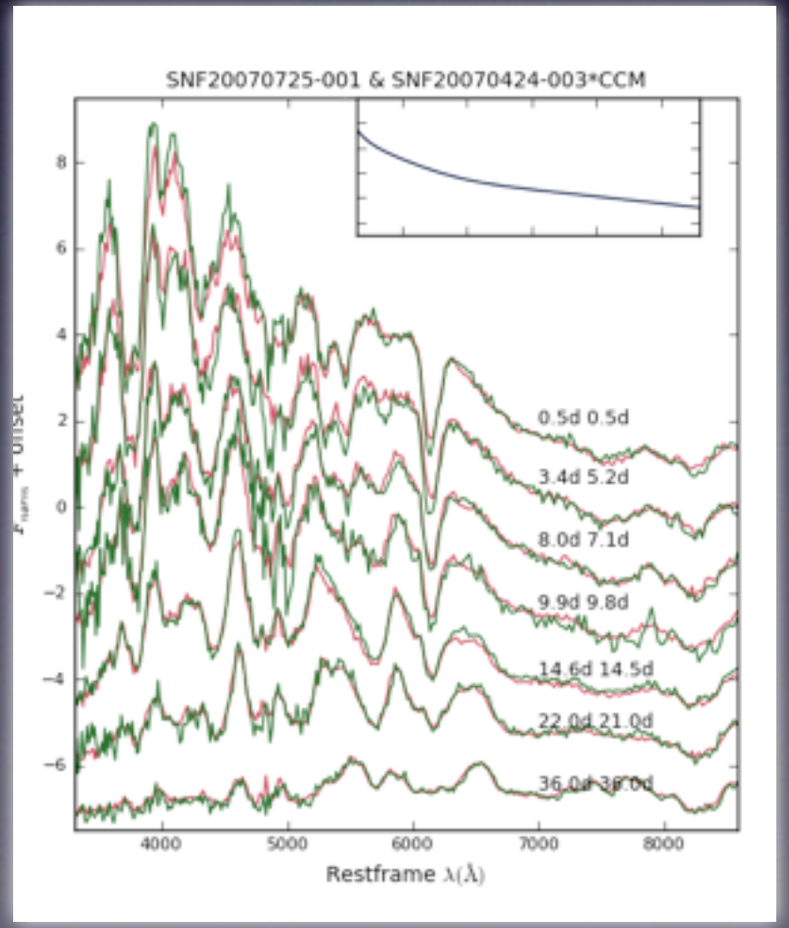
Hannah Fakhouri
SNfactory

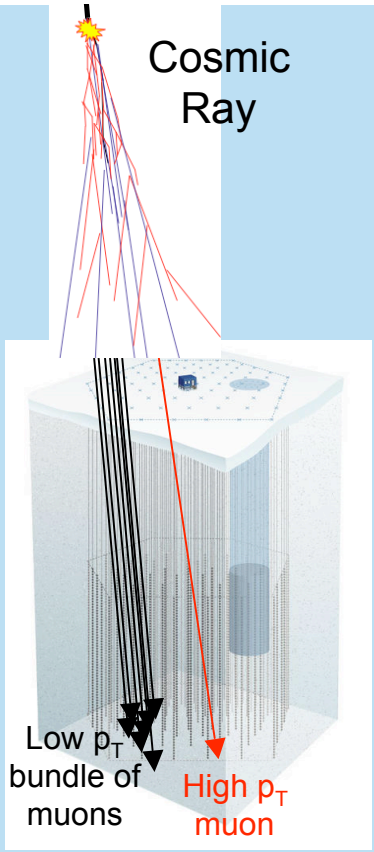






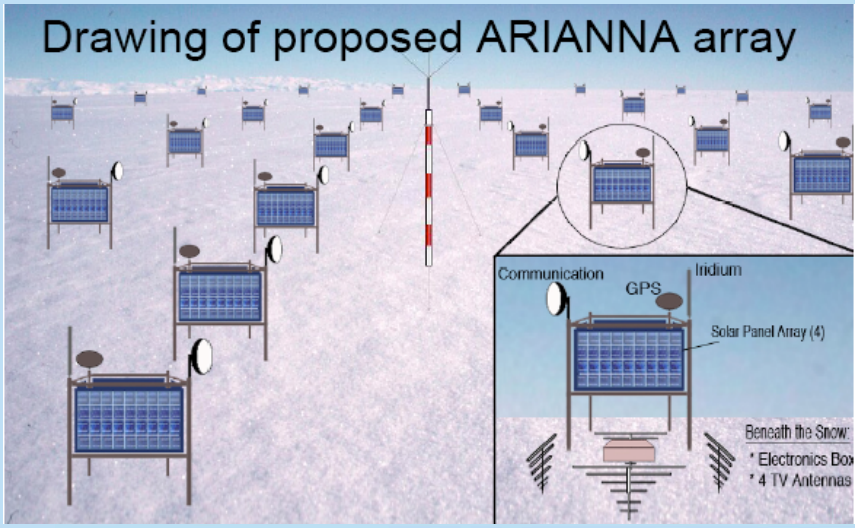






IceCube and ARIANNA

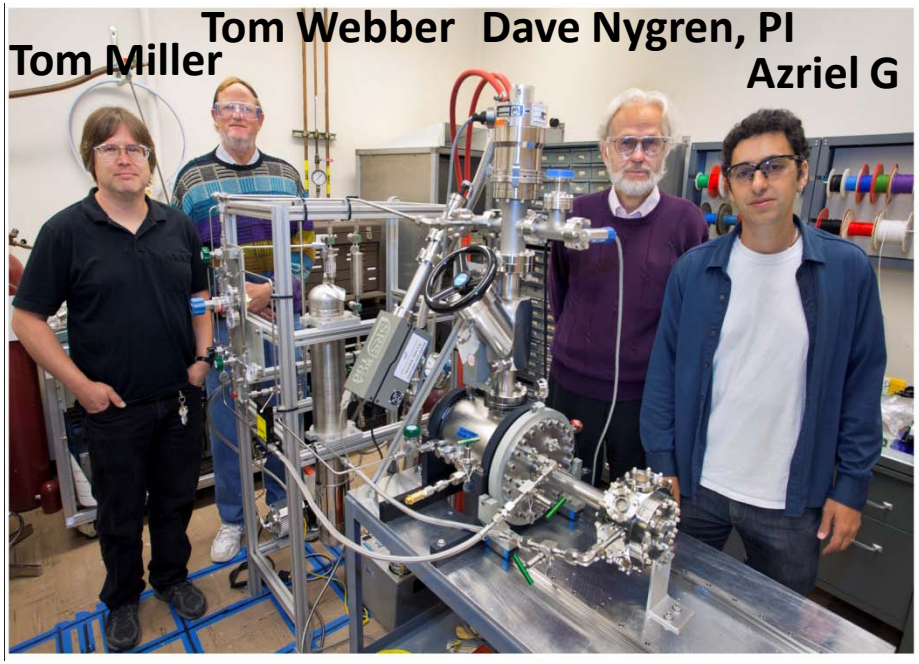
- IceCube: High p_T Muons
  - Created by π, K, and heavy quark hadrons produced early in cosmic ray showers with $E_{CM} \geq 1$ TeV
  - IceCube is able to track muons with a minimum separation of ~200 m ($p_T \sim 8$ GeV/c)
  - An independent method to measure CR composition in the region of the CR "knee"

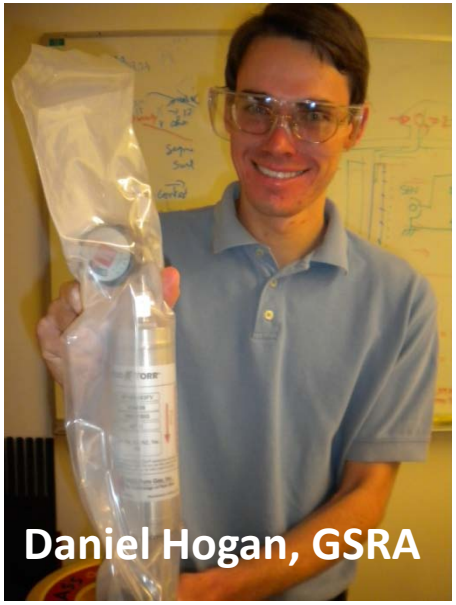


- ARIANNA: An ultra high energy neutrino detector
  - Detects radio Cherenkov emission from GZK neutrinos ($E_\nu > 10^8$ GeV)
  - Uses sea/ice reflection on Ross Ice Shelf
  - Prototype station deployed last season
  - Calculated electromagnetic interaction length when LPM effect is strong ($E_\nu > 10^{11}$ GeV)

Lisa Gerhardt

High Pressure Electroluminescent Xenon TPC for neutrinoless double beta decay





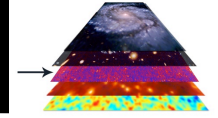
PLUS: **Helmuth Spieler, Derek Shuman, Dennis Chan (UG)**

AND help from Stu Loken, Jim Siegriest

Currently assembling in Bldg 70Aa prototype 1kg of Xe TPC to demonstrate energy resolution 0.5~ 1 % FWHM

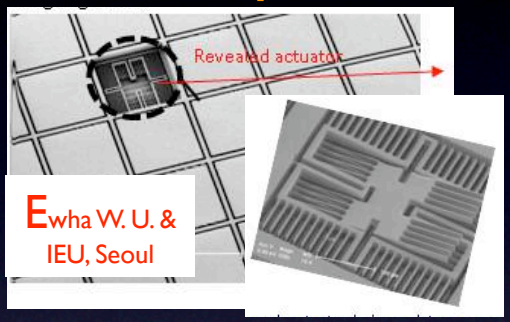
Part of NEXT Collab. towards 100 kg 136Xe in Canfranc (Spain)

Bruce Grossan 2010-2011

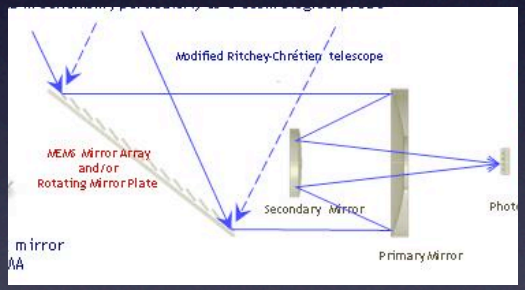


• UFFO
msec optical Gamma-Ray Burst Space Observatory

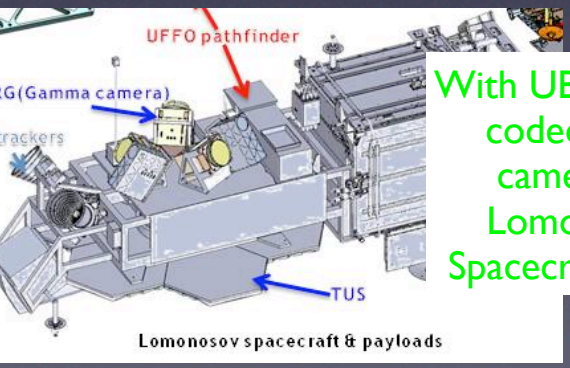
MEMS μmirror Array....



Steers telescope beam....



➡ first 10^{-3} - 100 s in optical

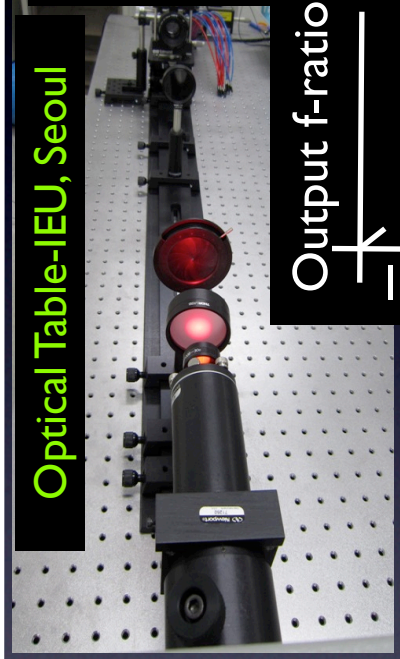


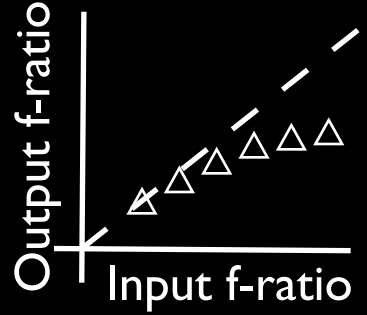
With UBAT X-ray coded mask camera on Lomonosov Spacecraft 2012!

W/ Il Park, UFFO collab.

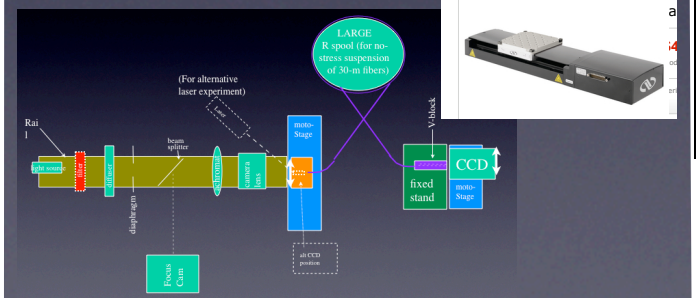
• IBBOSS
BigBOSS Fiber Testing/ Quality Control

Focal ratio degradation & throughput testing





Automate - Repeat 5000X!

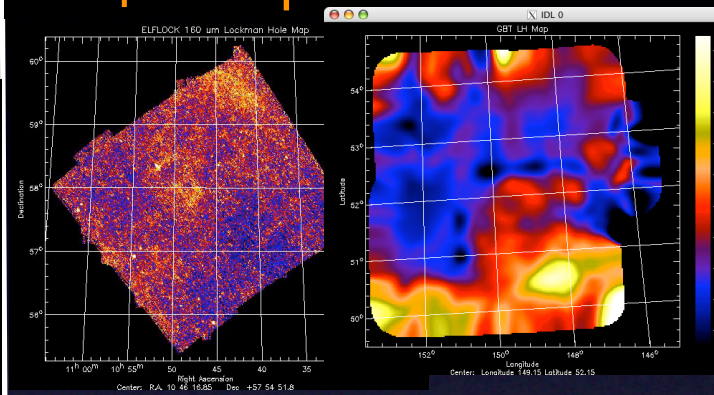


W/ HJ Lim, IEU, BigBOSS collab.

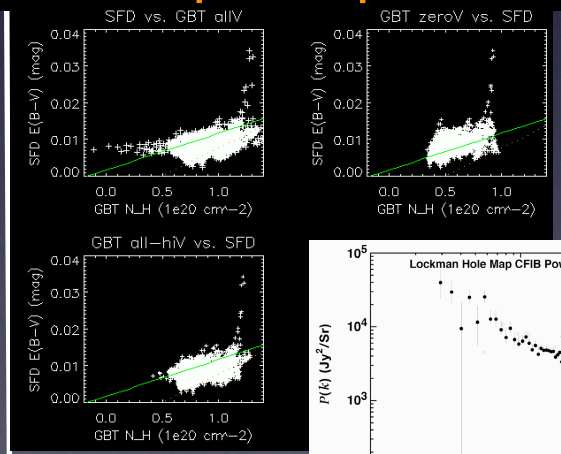
• CMB foregrounds/ other "backgrounds"

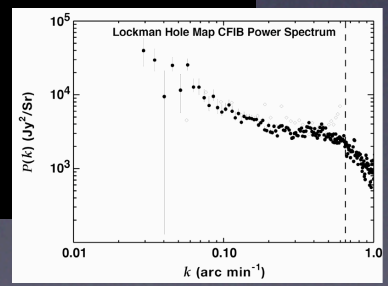
Lockman Hole 160 μm map

HI Map



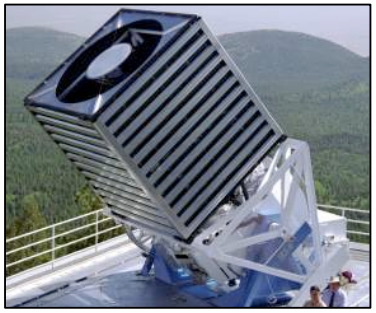
Which velocities correlate? Power Spec as predicted?

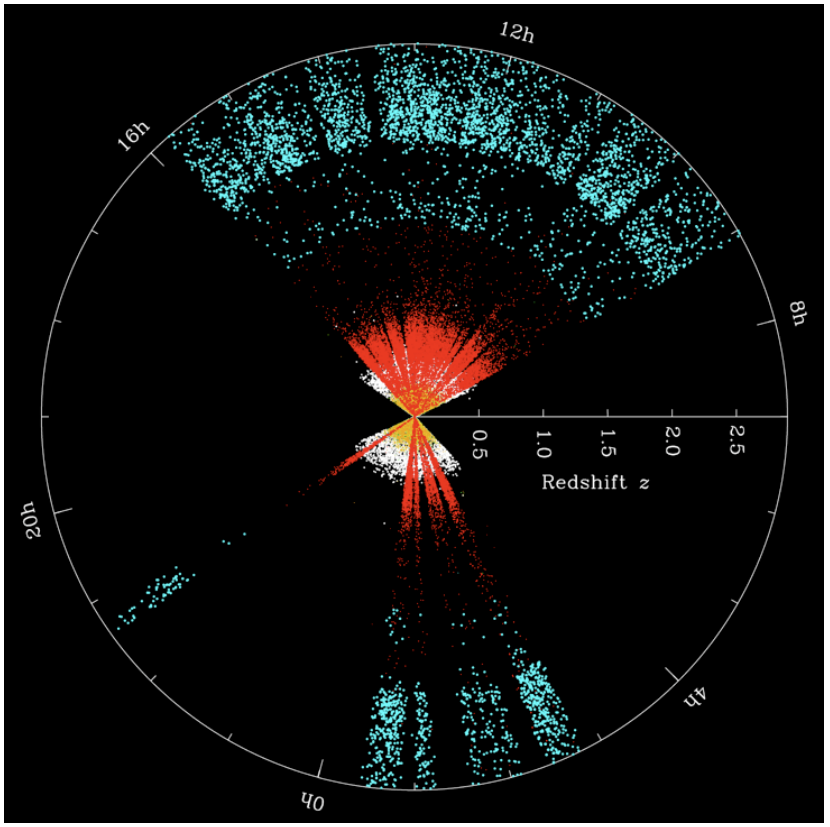




Dust prediction 200GHz?

w/Smoot & I hope Sudeep Das will agree to participate!



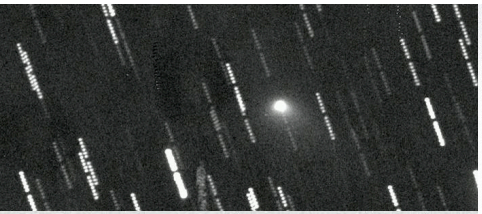


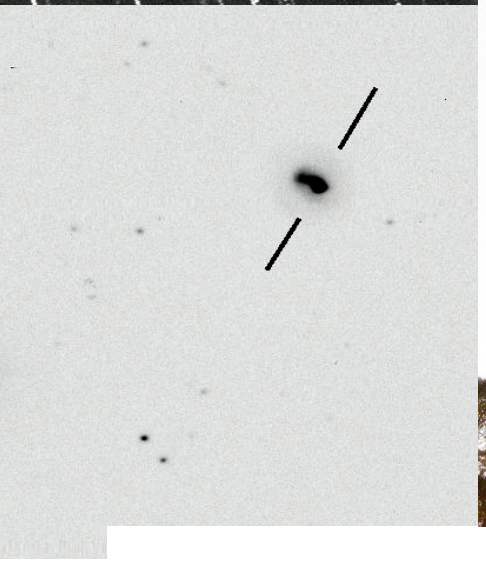
Shirley Ho

cwho@lbl.gov

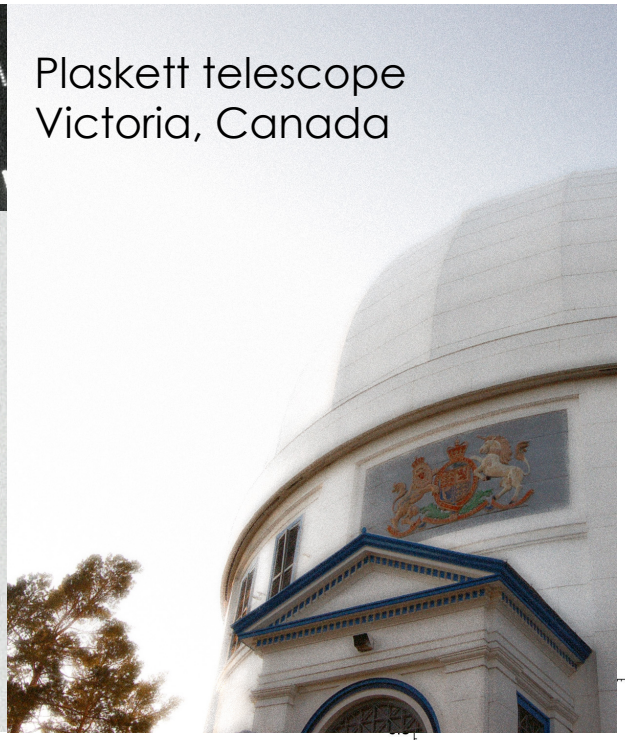
I am a physicist whose interest evolved from high energy particle physics, Quantum computing when I was a young undergraduate at Berkeley, to cosmology as I get older. Now, my major interests are in projects called SDSS III, and Planck Satellite, working with wonderful scientists all over the world, especially those who sit next to me at Lawrence Berkeley National Lab, thanks to the Seaborg and Chamberlain Fellowships.

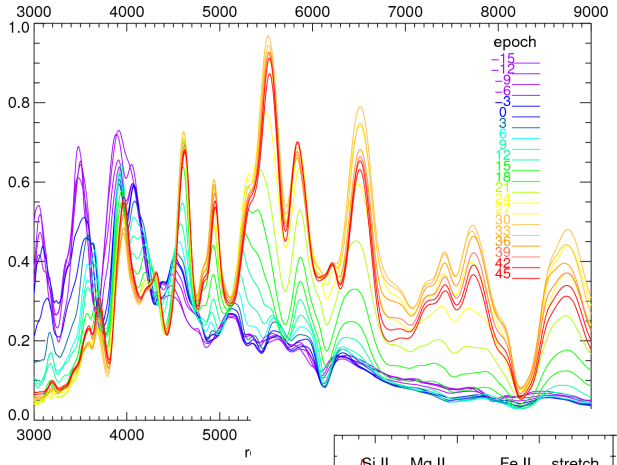
http://lymanalpha.lbl.gov/~shirley/Home.html





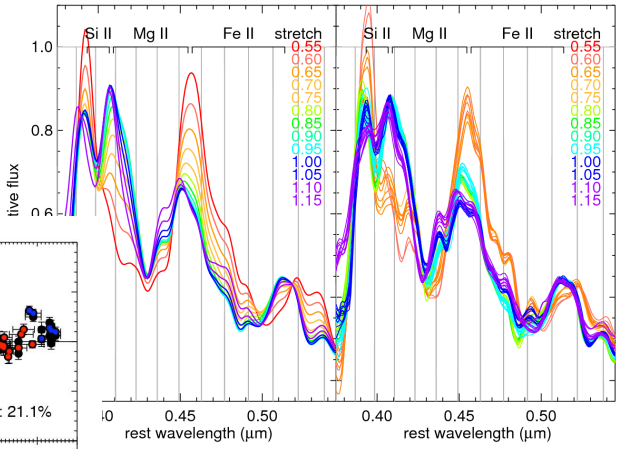
Plaskett telescope
Victoria, Canada

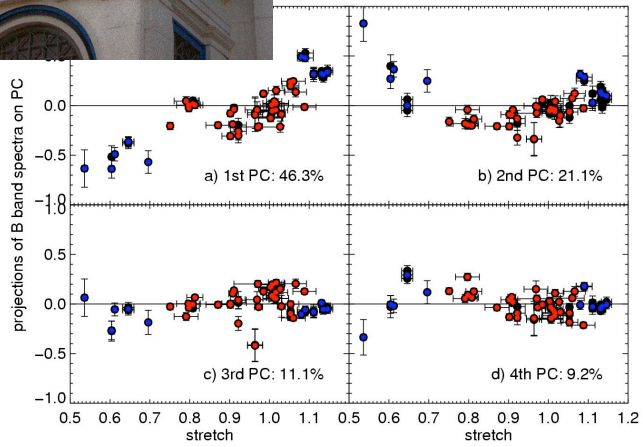


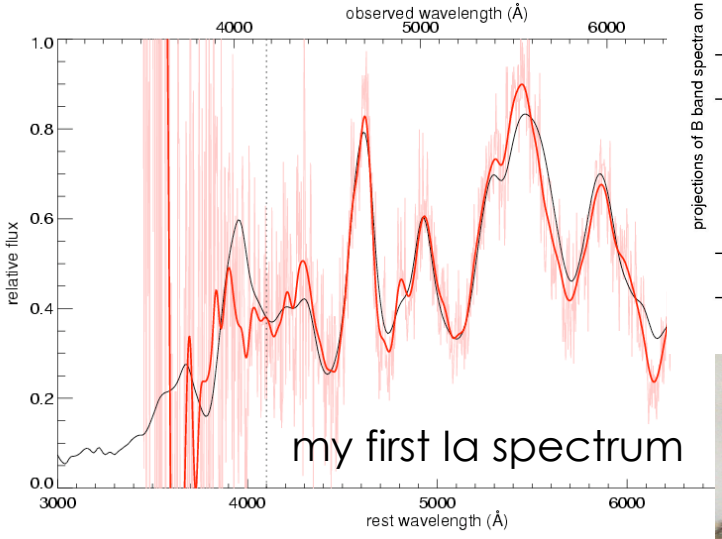


spectral template

PCA







my first Ia spectrum

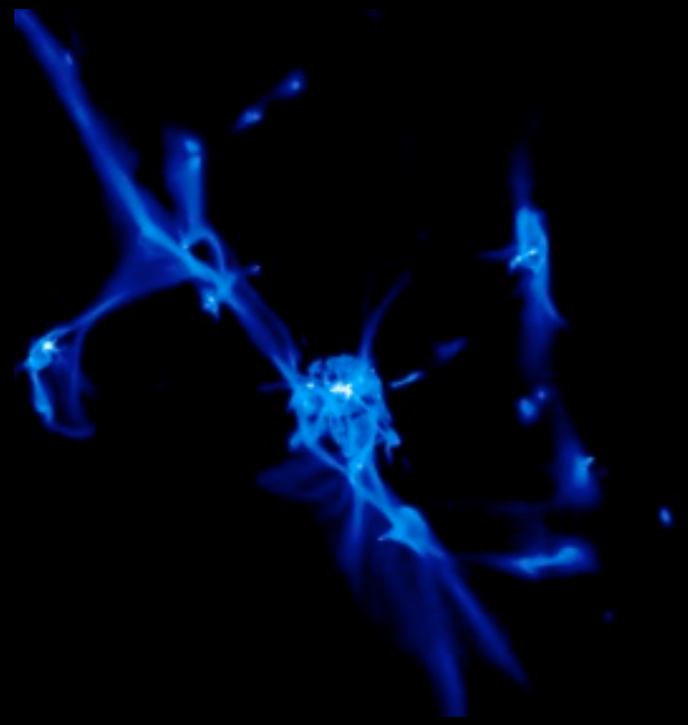
my other projects

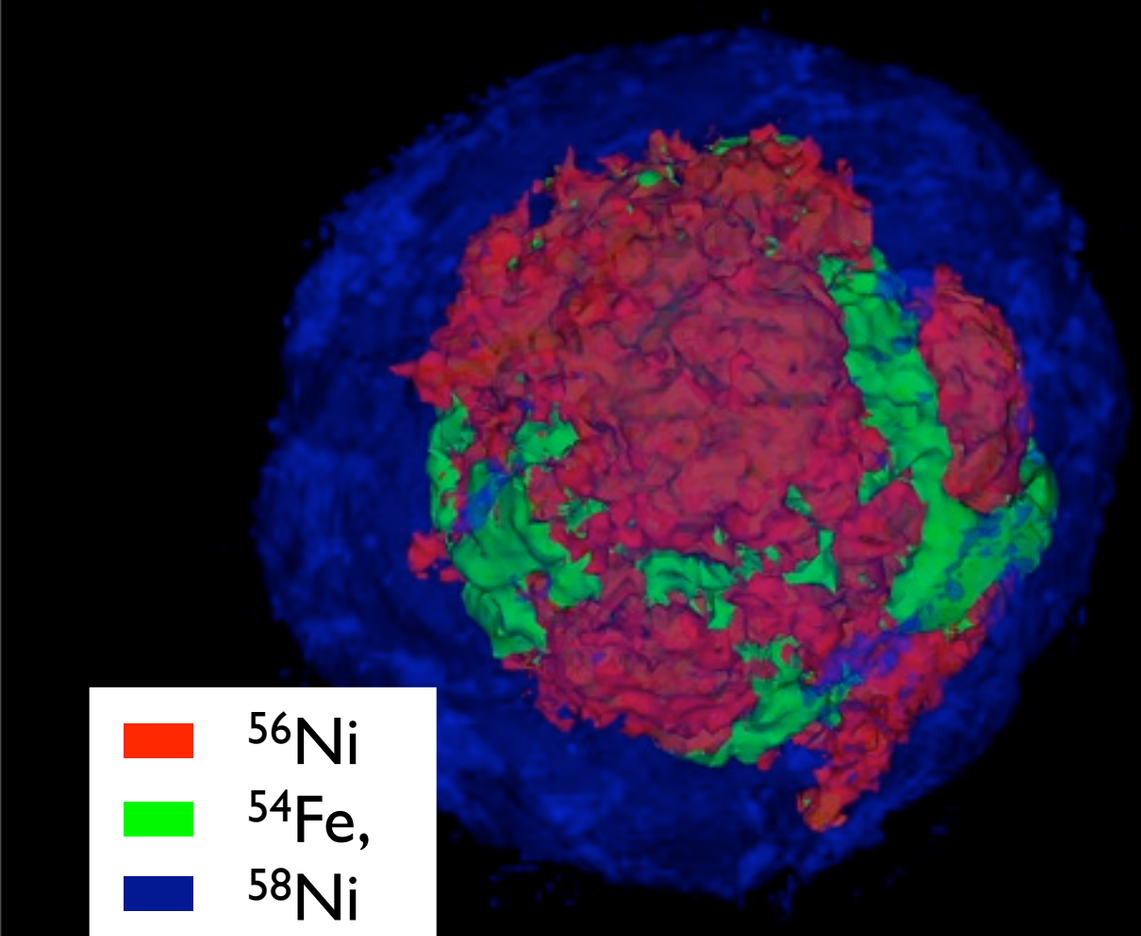
Eric Y. Hsiao

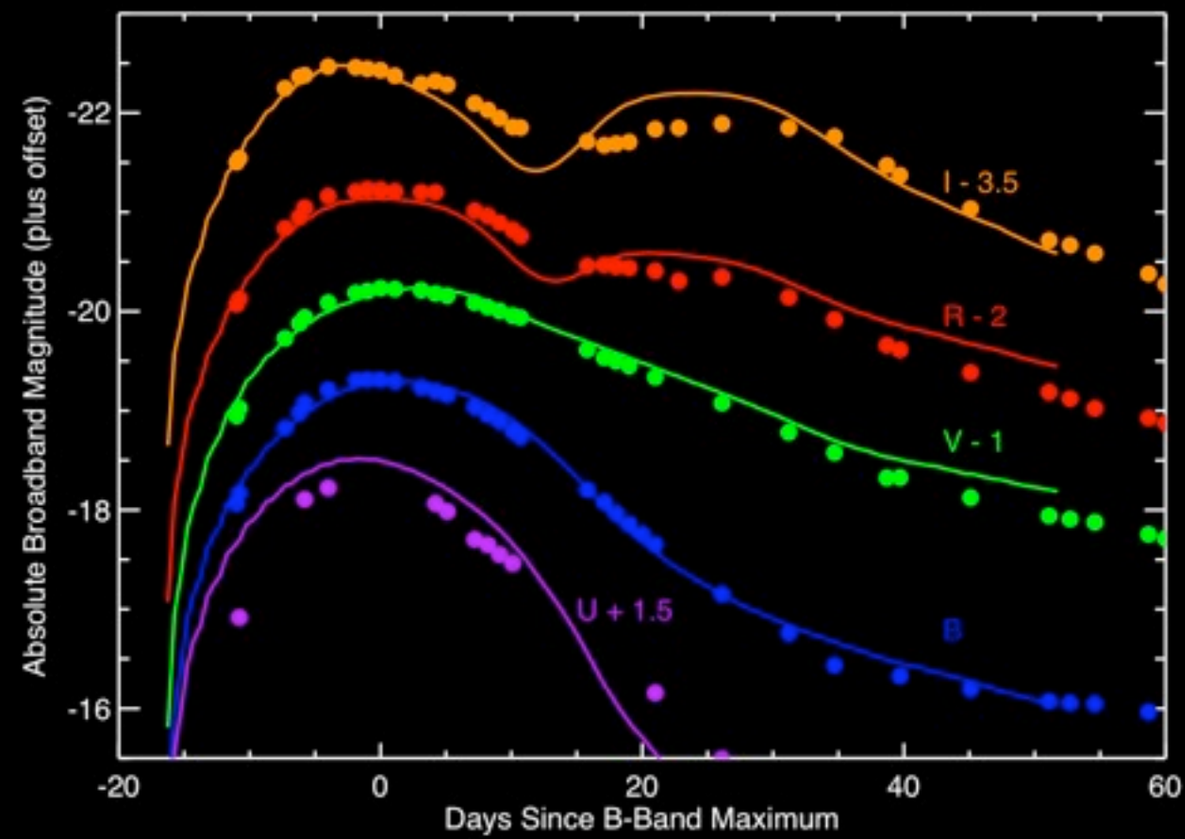
Dan Kasen

LBNL NSD & UCB physics
building 70A-239

computational astrophysics
modeling of supernovae & transients
hydrodynamics/nuclear physics/neutrino-photon transport

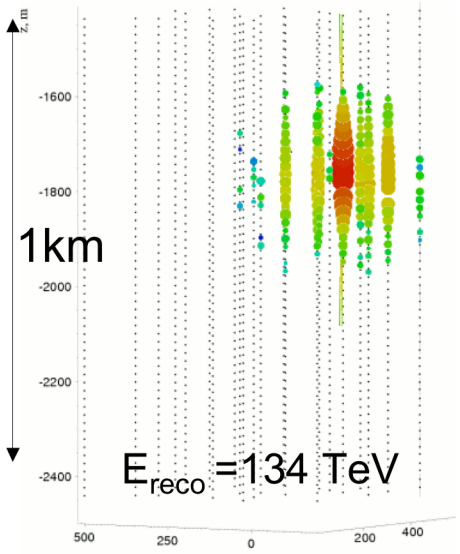






Dr Joanna Kiryluk

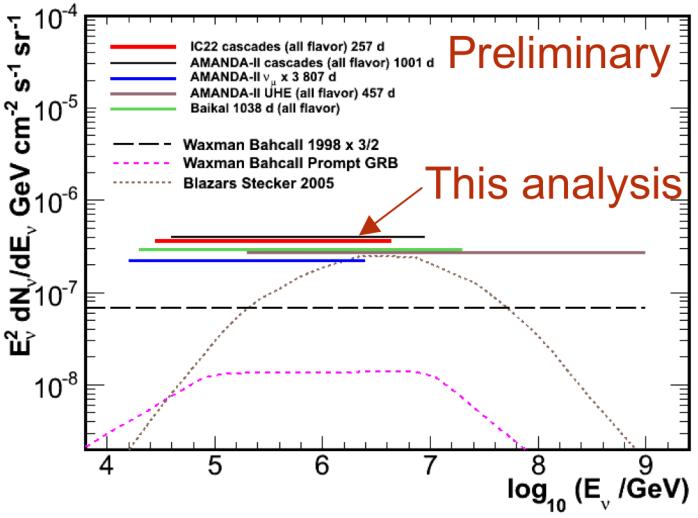
Physicist Project Scientist



IceCube experiment at the SouthPole:
First search for HE extraterrestrial neutrino induced cascades.

$\nu_e + N \rightarrow e + X$ (CC) and $\nu + N \rightarrow \nu + X$ (NC)

STAR experiment at RHIC:
Spin structure of the nucleon (pol. pdf's) from polarized proton-proton collisions.



PDSF computing cluster at NERSC:
Computing for IceCube (PI) and STAR.

Dr Joanna Kiryluk

Physicist Project Scientist

IceCube experiment at the SouthPole:

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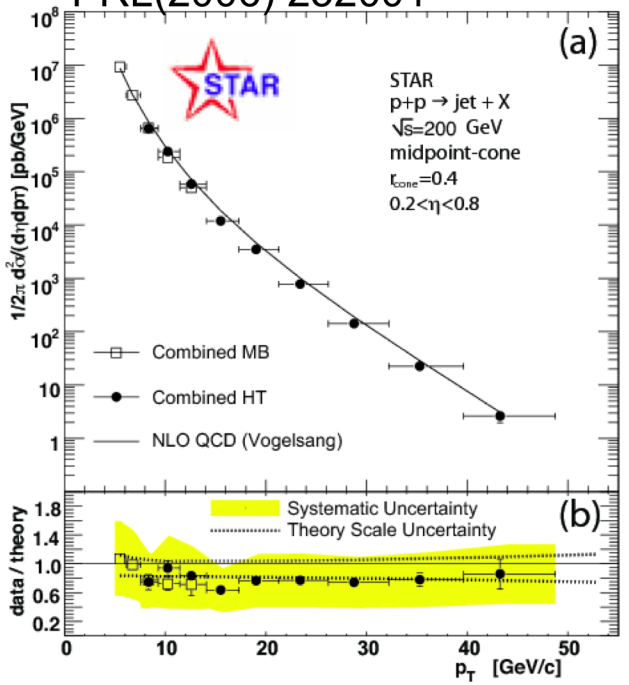
PRL(2006) 252001



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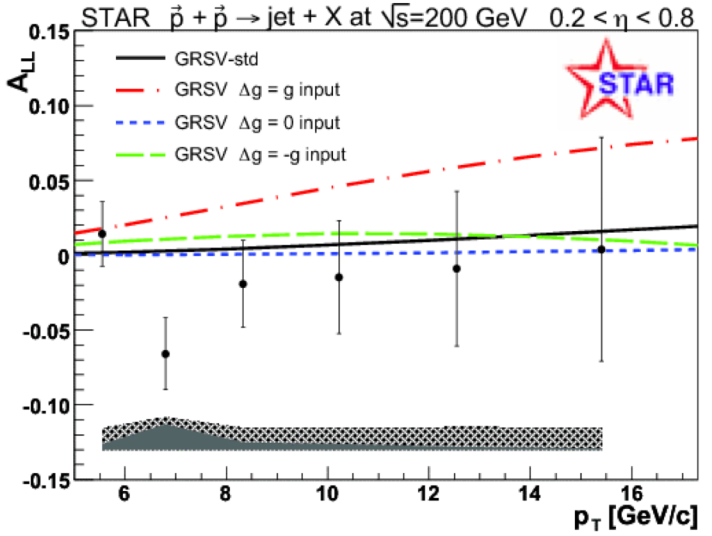


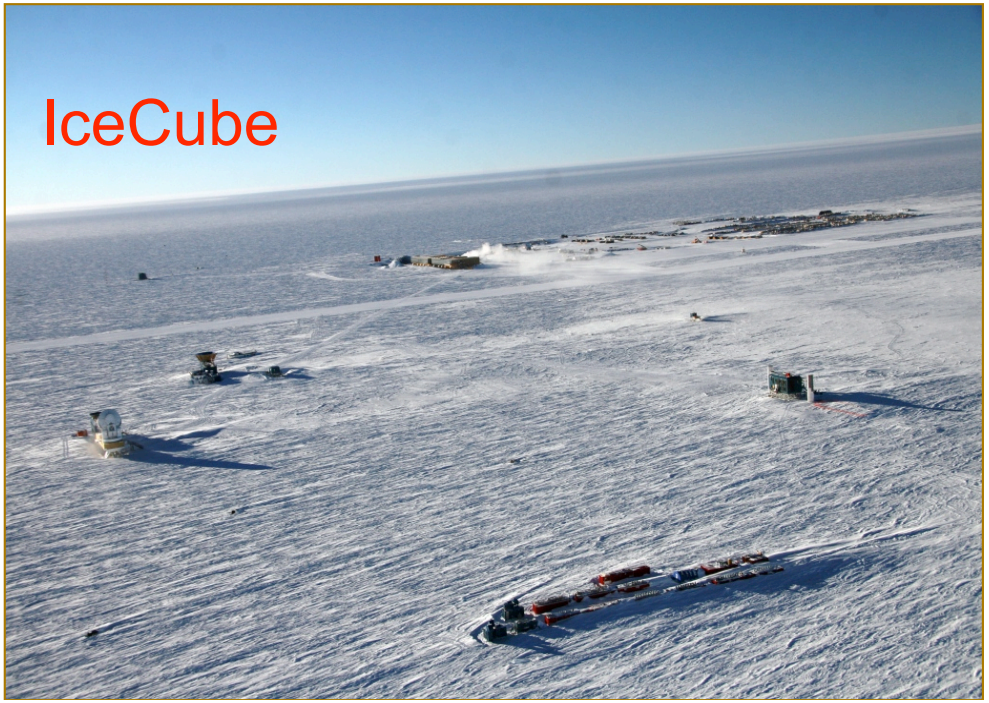
PDSF computing cluster at NERSC:

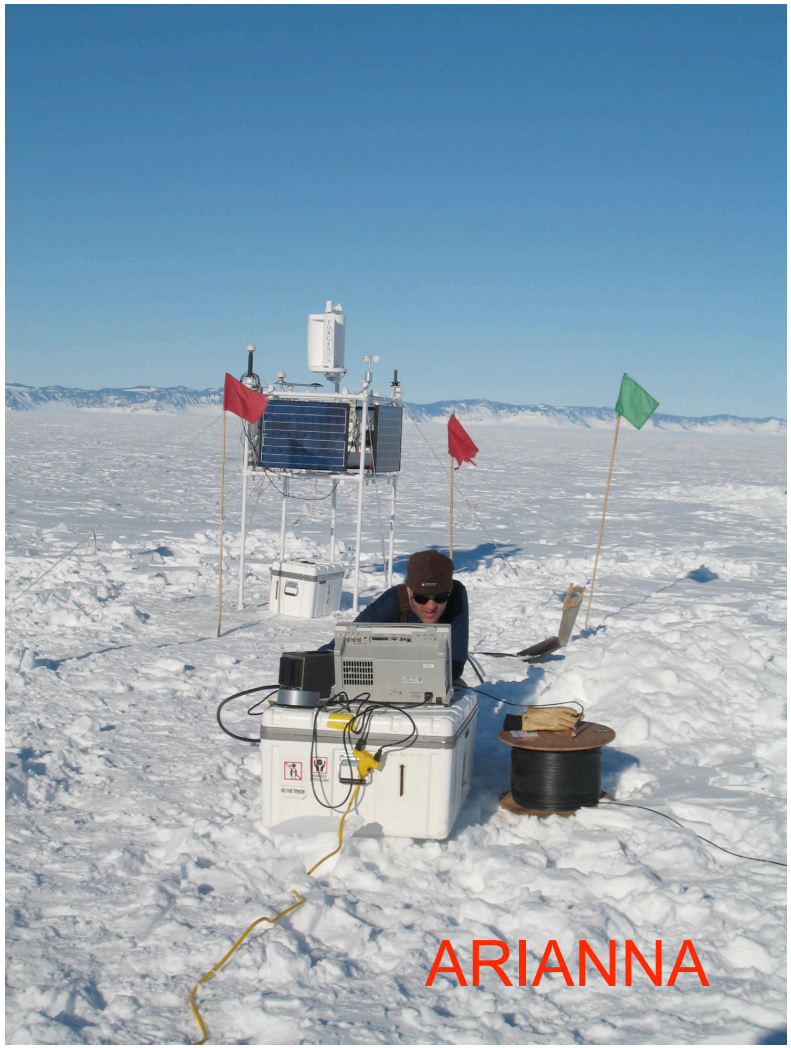
Computing for IceCube (PI) and STAR.

Neutrino Astronomy in Antarctica

Spencer Klein

- Finding the sources of high energy cosmic-rays
- The 1 km^3 IceCube is optimized for 100 GeV to 100 PeV neutrinos
- The proposed 100 km^3 ARIANNA detector is optimized for energies above 10^{17} eV

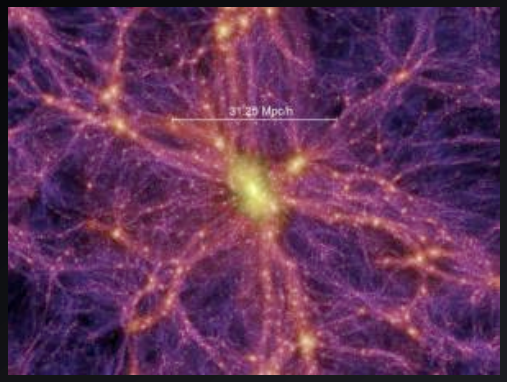





Mike Lampton
UC Berkeley
Space Sciences
SNAP & JDEM
project office
Mission Design
Optical Design
Three DE methods:
supernovae
weak lensing
baryon oscillations
SNAP artwork: Robin Lafever

GRAVITATIONAL LENSING

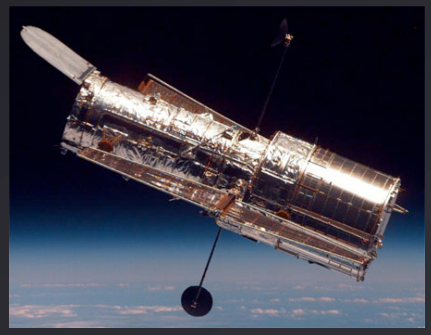
Alexie Leauthaud



Springel et al. 2005

Abell 2218

- *The Galaxy-Dark Matter connection.*
- *The Dark Matter content of groups and clusters (Matt George)*
- *Maps of the Dark Matter distribution*
- *Cosmological parameters*
- *WFIRST !*



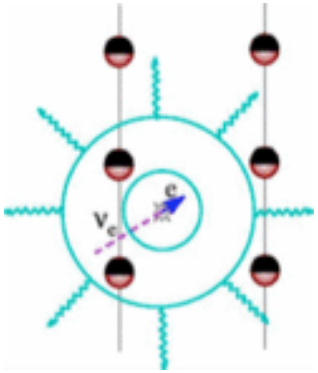
COSMOS survey - HST

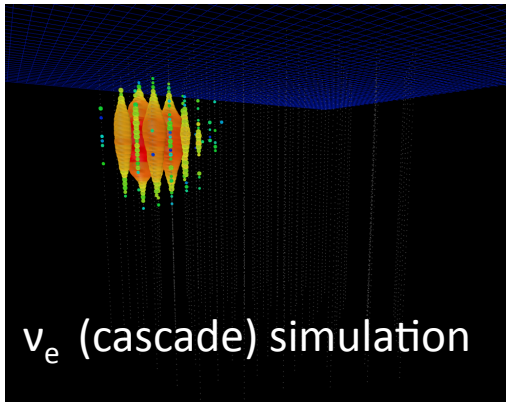
Dark Matter
Dark Energy

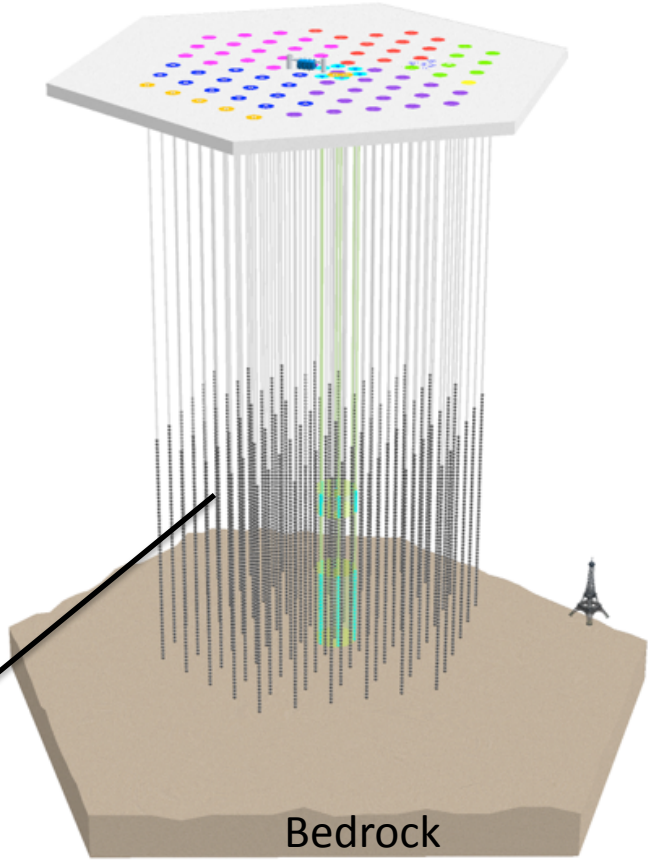
asleauthaud@lbl.gov

Mariola Lesiak-Bzdak
Guest, IceCube

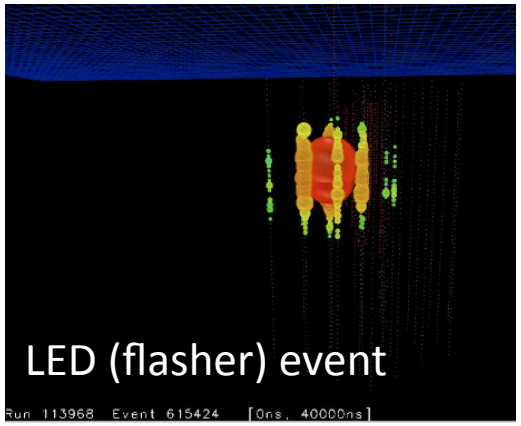
- Searching for extra-terrestrial ν_e

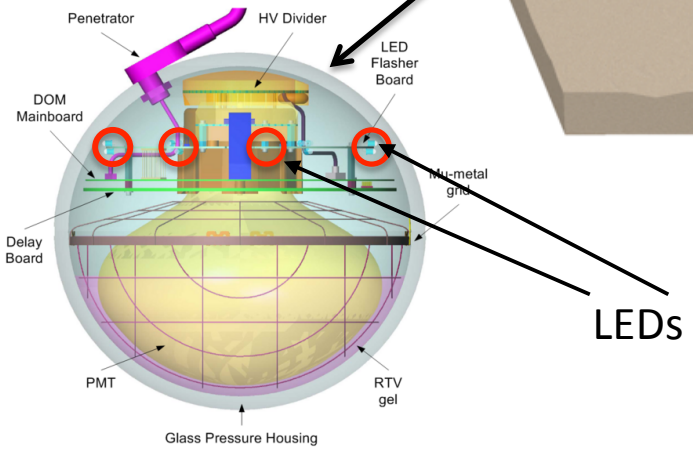






- LED (flasher) data analysis





Eric Linder (co-Director INPA)

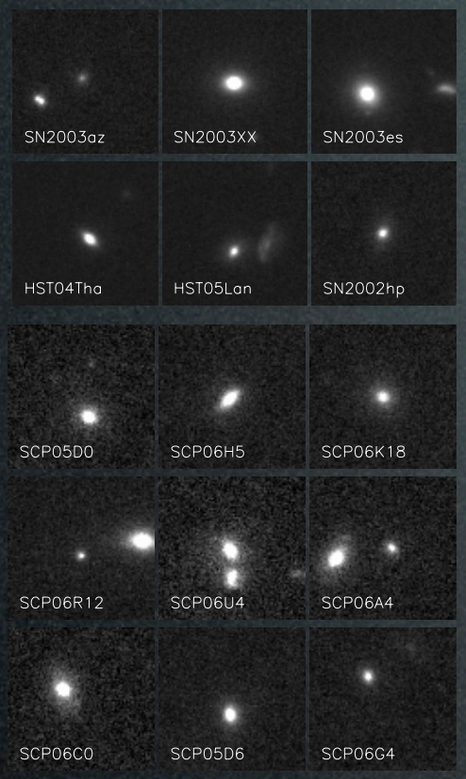
Current Research:

Theory models, science design and science reach of experiments, cosmology fitting to data, systematics, new windows on dark energy and gravity.

- **"Early, cold, or stressed dark energy" – beyond w**
- **Parametrizing gravity theories (scale/time dependence)**
- **Analysis of methods to control SN, WL systematics**
- **Theory motivation for w~-1 (DBI, barotropic, gravity)**
- **LSS simulations away from Λ**
- **Statistical methods for correlated reconstruction of w(z)**
- **Neutrino mass**

BigBOSS, Dome A, JDEM, PolarBear, SCP

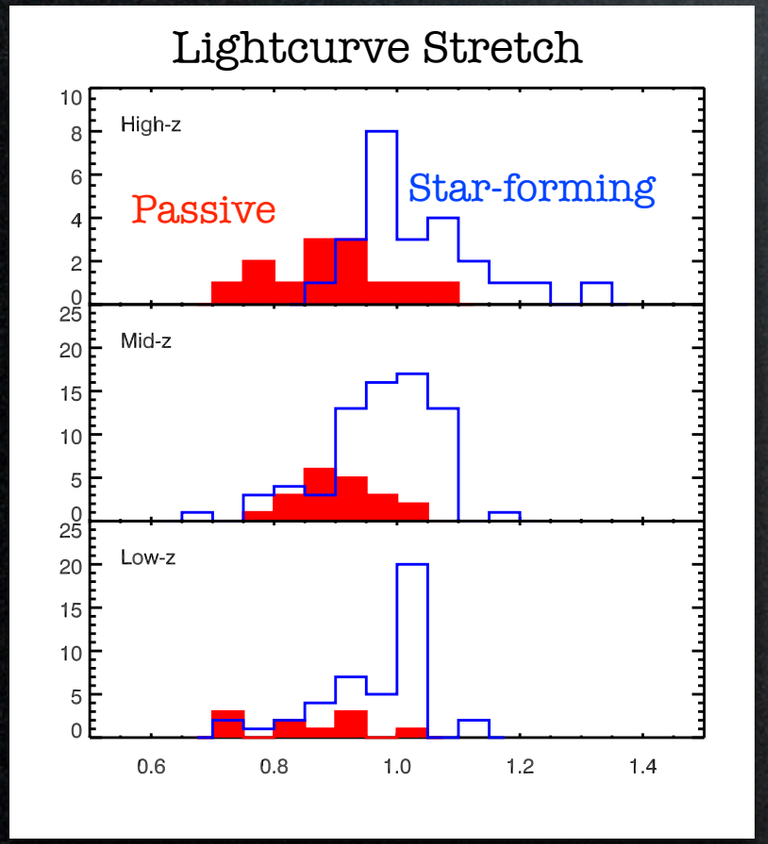
The Host Galaxies of SNe Ia (Josh Meyers)

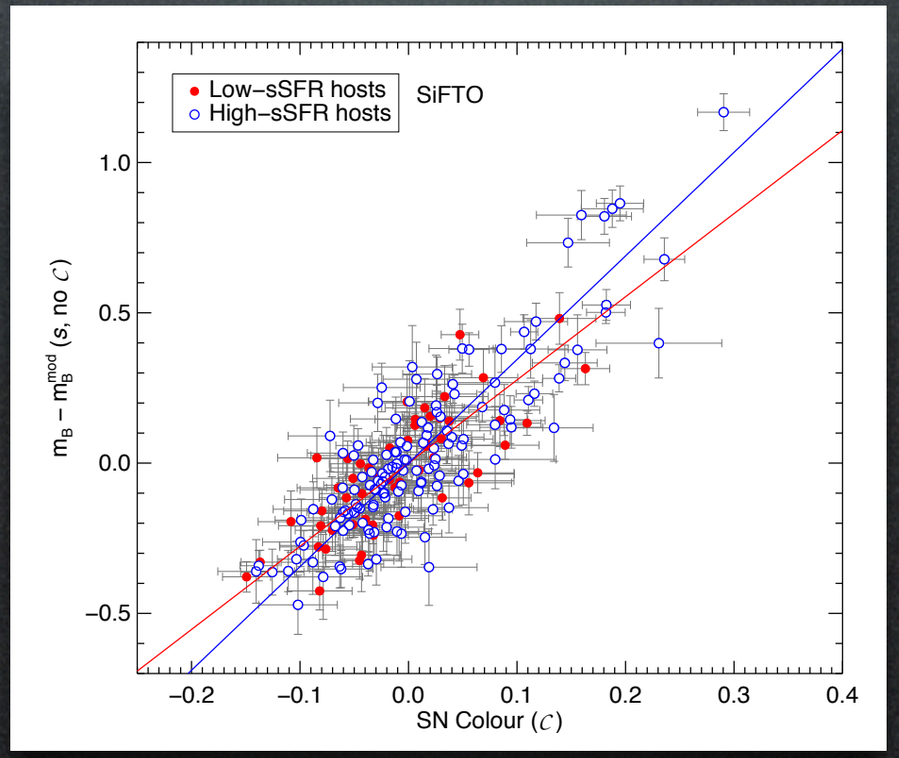


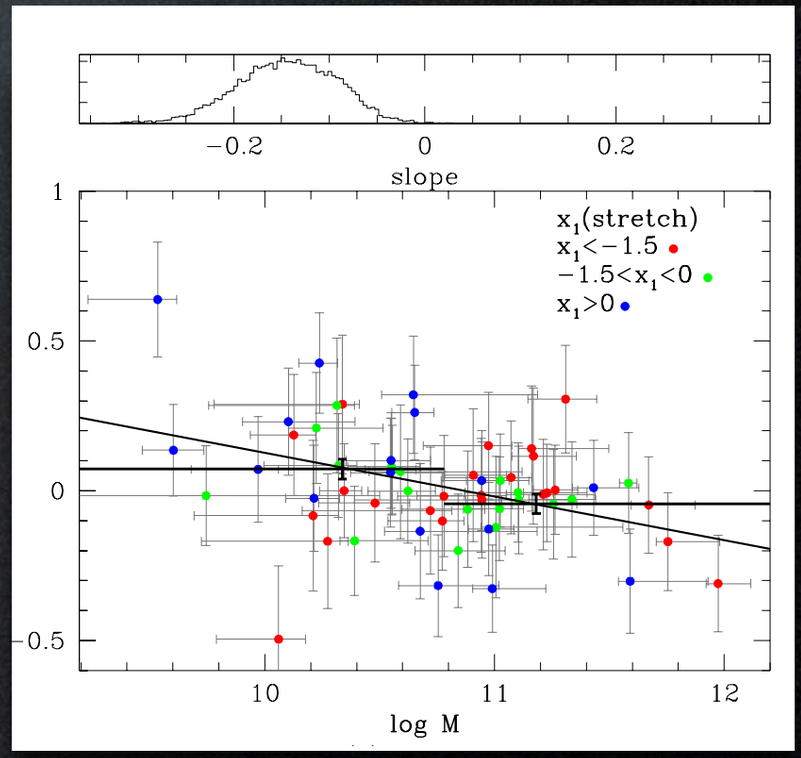
SNe Ia are correlated with their hosts:

1. SN rate increases with SF rate
2. SN LC is faster in early-type hosts
3. CMR is shallower in early-type hosts
4. SNe Ia are brighter in more massive hosts

I look at the photometry, morphology and spectroscopy of SNe hosts to classify them.





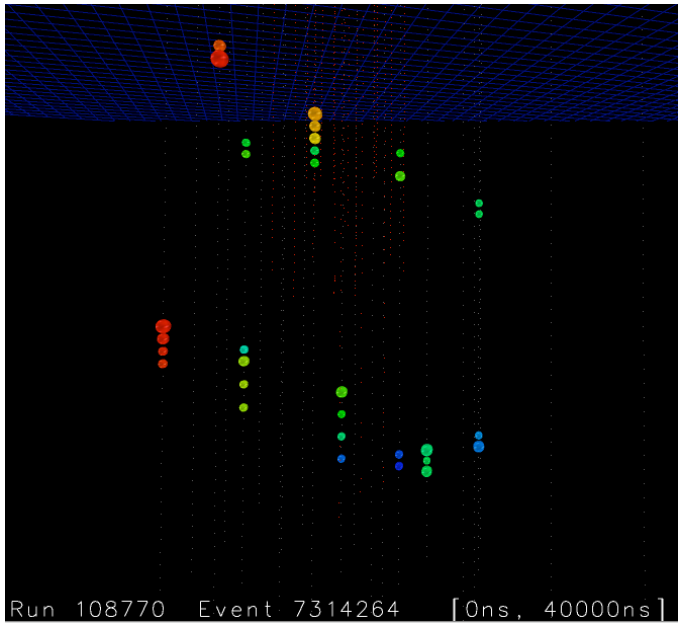


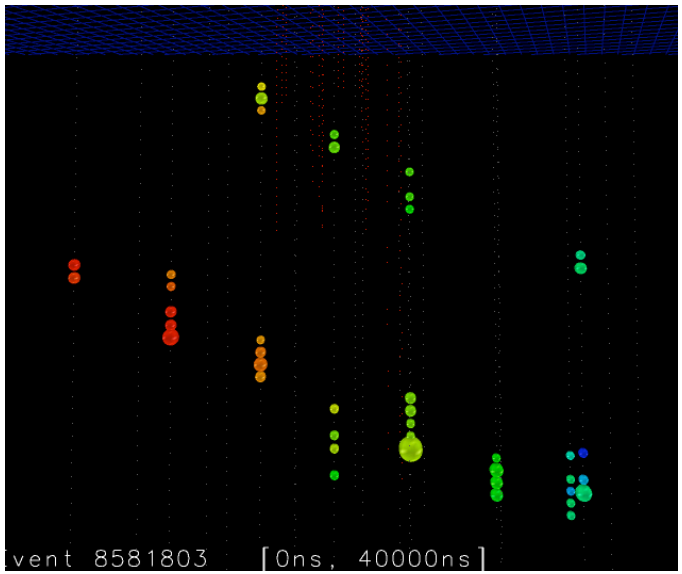
Sandy Miarecki

UCB Graduate Student
IceCube Group: Spencer Klein

<u>Research</u>: Searching IceCube for upgoing double-tracks of charged particles (as predicted by some Supersymmetry and Kalusa-Klein models)

<u>Service project</u>: Improving muon energy measurements in IceCube using dE/dx.



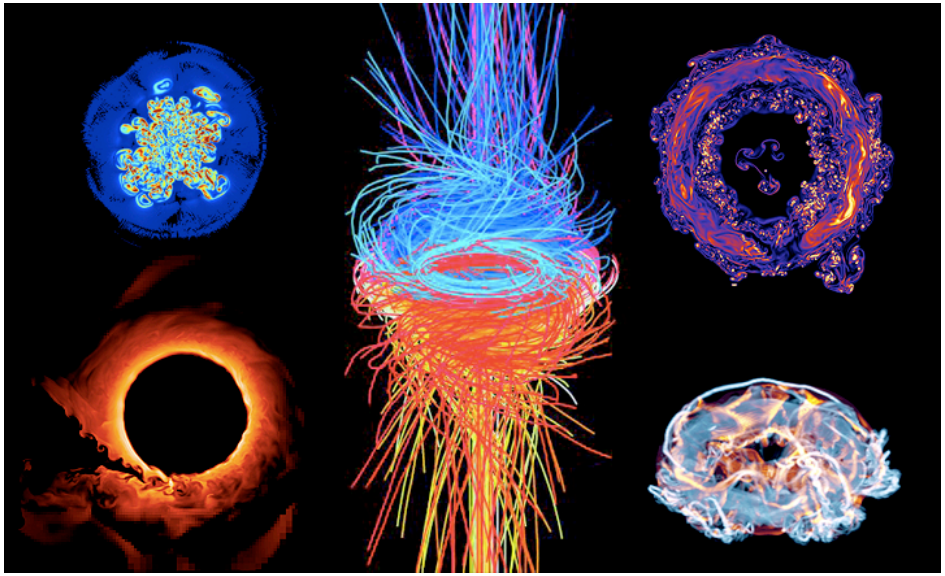


Computational Cosmology Center

Leads: Peter Nugent & Julian Borrill
Members: Janos Botyanszki, Chris Cantalupo, Nino Cucchiara, Ben Dilday, Ted Kisner, Dovi Poznanski, Rajesh Sudarsan and Rollin Thomas
Visitors/Guests/Associates: Ed Baron, Josh Bloom, Dan Kasen, Radek Stompor

We are involved in a variety of astrophysics-related projects, both theoretical and observational, which require HPC resources. These include: Planck, EBEX, CMBPol, PolarBear, Palomar Transient Factory, La Silla SN Search, SciDAC Computational Astrophysics Consortium, The UC High Performance AstroComputing Center, BOSS, DES, BigBOSS, WFIRST (JDEM, SNAP…), SN Factory, etc.

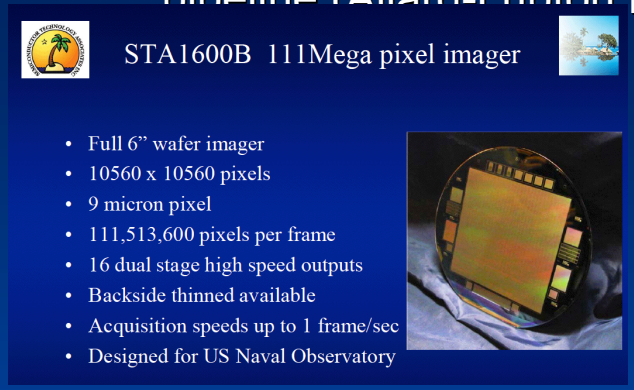
PALOMAR TRANSIENT FACTORY

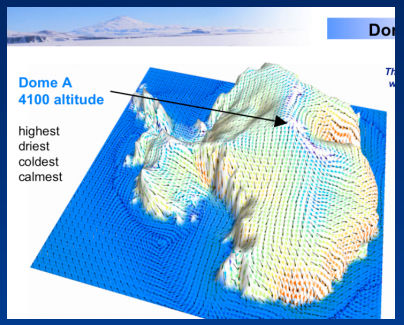


SciDAC Computational Astrophysics Consortium

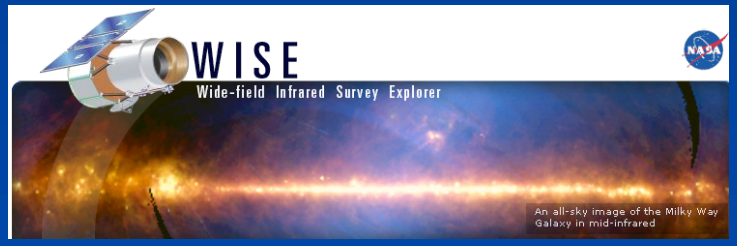
Carl Pennypacker

1) Collaborating on CCD and Infrared Detector Development and science pipeline (Allard-Lupton Method) for Dome A Observatory

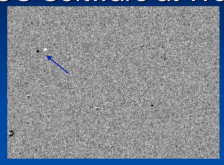




2) The HOU Student/Teacher/Scientist Asteroid Search -- over two hundred asteroids discovered by students



A Sample Image Subtraction -- HOU Software at Work



• This is a subtracted image. The white and black dots in the upper left corner represent an asteroid.

3) Hands-On Universe Curriculum and Teacher Training: CP is President of Permanent Council, Global HU (5000 Teachers trained last year). Next -- Oakland!! And Universe Quest Afterschool Program:

Lawrence Berkeley National Laboratory

Neutrino Physics and Nuclear Science Division Programs

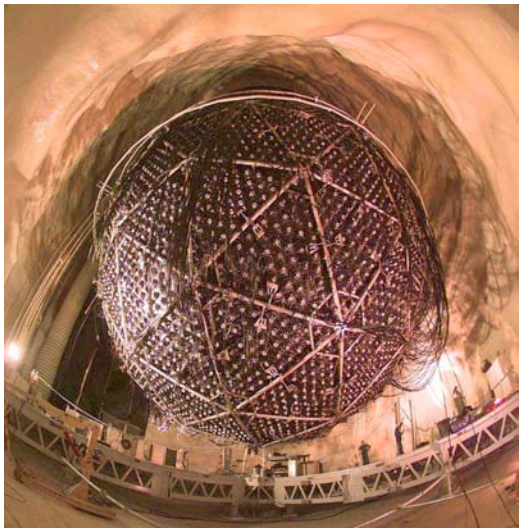
Alan Poon
Institute for Nuclear and Particle Astrophysics
Nuclear Science Division

http://neutrino.lbl.gov
awpoon@lbl.gov
+1 (510) 495-2467

Neutrino Physics

- In the past decade, LBNL's Nuclear Science and Physics Divisions played leadership roles in KamLAND and Sudbury Neutrino Observatory (SNO), which demonstrated non-zero neutrino mass and neutrino oscillations.

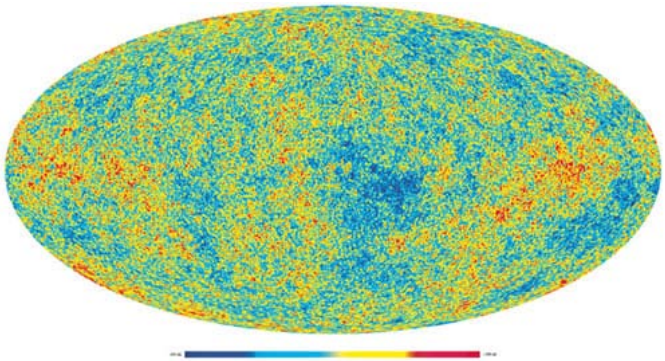
- In the coming decade, we will try to answer the following fundamental questions concerning the neutrinos:
  - what is the absolute mass scale of neutrinos?
  - are neutrinos their own anti-particles?
  - what is the size of the mixing angle θ_{13} and is there CP violation in the neutrino sector?



SNO

KamLAND

Measuring the neutrino mass

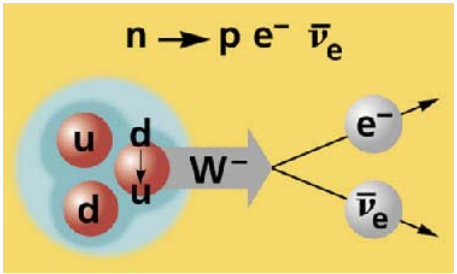


- Cosmology:
  - Multi-parameter model fit
  - Current limit $\sum m_\nu < \sim 1$ eV

Heaven

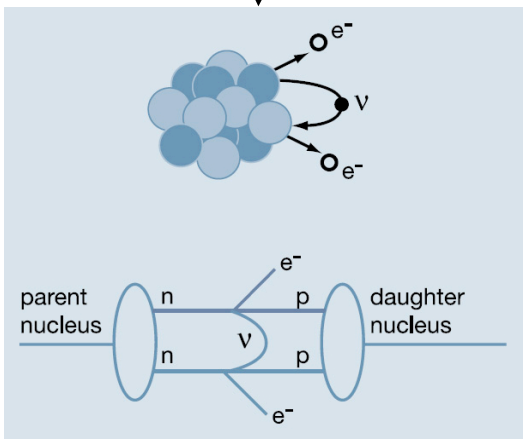
Mass Measurements

Surface



- Kinematics of β decays:
  - Model independent
  - Current limit $m_\nu < 2.3$ eV

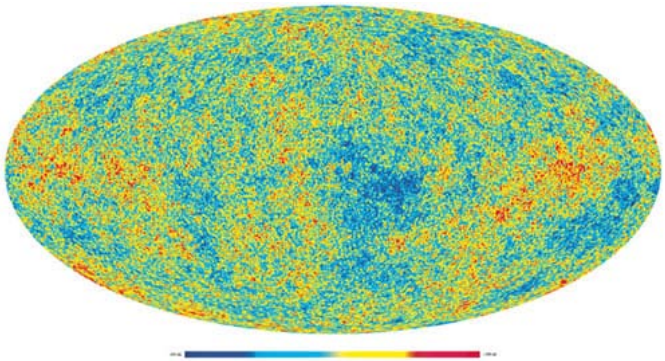
Underground



- ββ decays:
  - Model dependent (nuclear matrix elements)
  - Current limit $m_{\beta\beta} < 0.35$ eV

(+ controversial 6σ result of 0.3 eV)

Measuring the neutrino mass



- Cosmology:
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Mass Measurements

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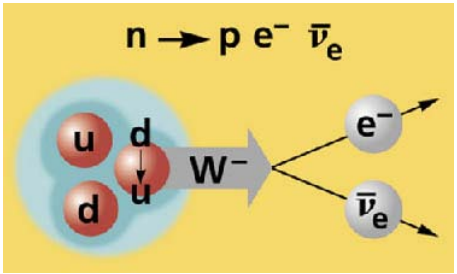

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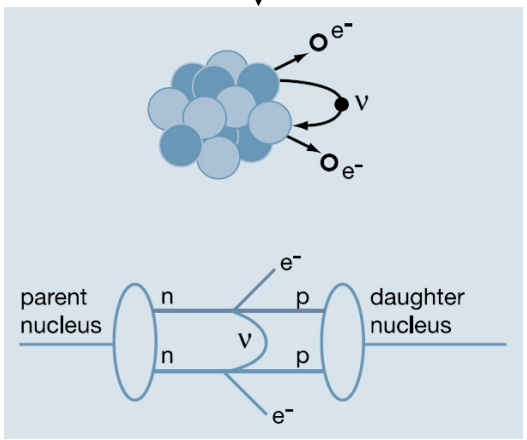

- ββ decays:
  - Model dependent (nuclear matrix elements)
  - Current limit $m_{\beta\beta} < 0.35$ eV

(+ controversial 6σ result of 0.3 eV)

$\nu = \bar{\nu}$?

What do they measure?

- Cosmology: $\sum m = \sum_{i=1}^{3} m_i = m_1 + m_2 + m_3$
- β decays: $m_\beta = \sqrt{\sum_{i=1}^{3} |U_{ei}|^2 m_i^2}$
- ββ decays: $m_{\beta\beta} = \sum_{i=1}^{3} \left| U_{ei}^2 m_i \right|$
- Oscillations: $\Delta m_{ij}^2 = m_j^2 - m_i^2$

Complementary measurements

What do they measure?

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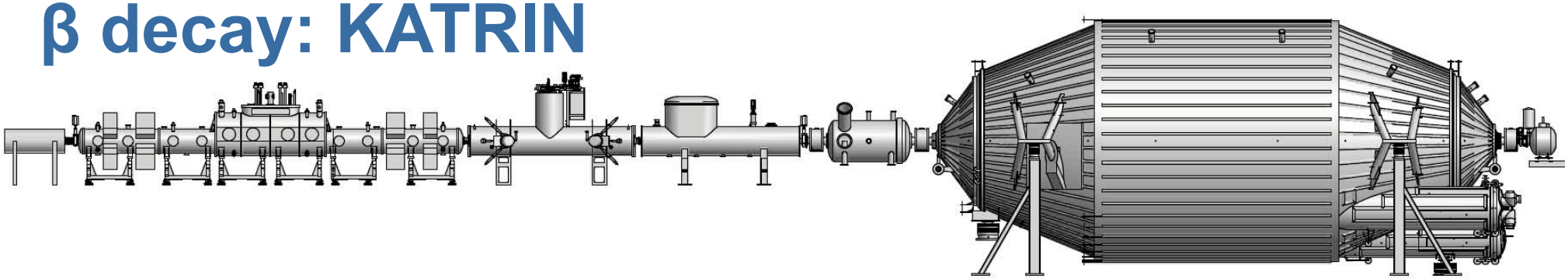
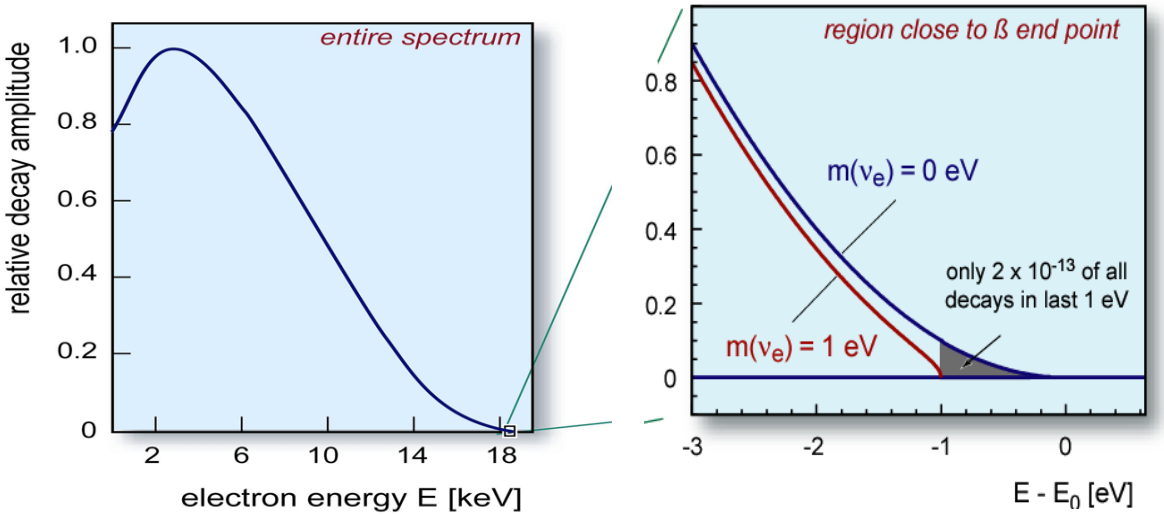
- Oscillations: $\Delta m_{ij}^2 = m_j^2 - m_i^2$

Complementary measurements

LBNL and UCB programs cover all these measurements

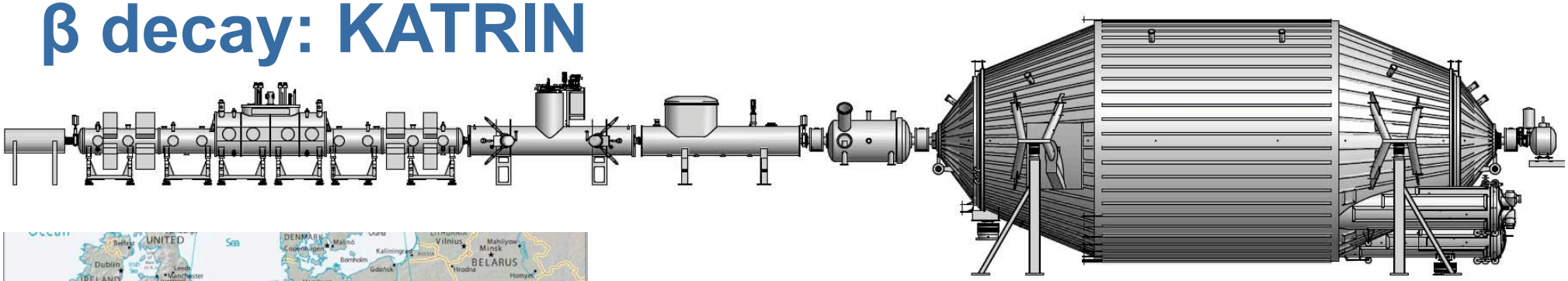
β decay: KATRIN

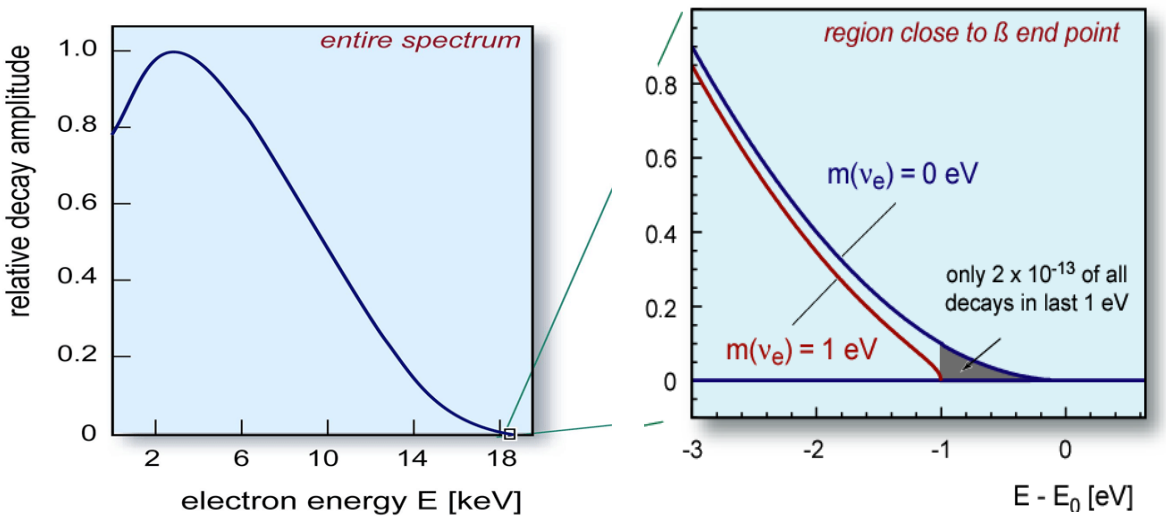




- ^{3}H beta decay
- Sensitivity: m<0.2 eV (90% CL)
- Construction in progress, physics run to begin in 2012.

β decay: KATRIN





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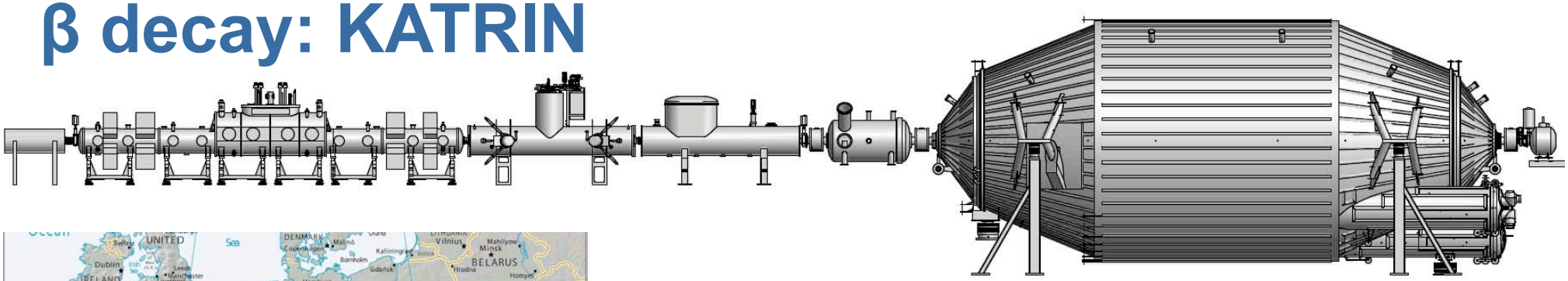
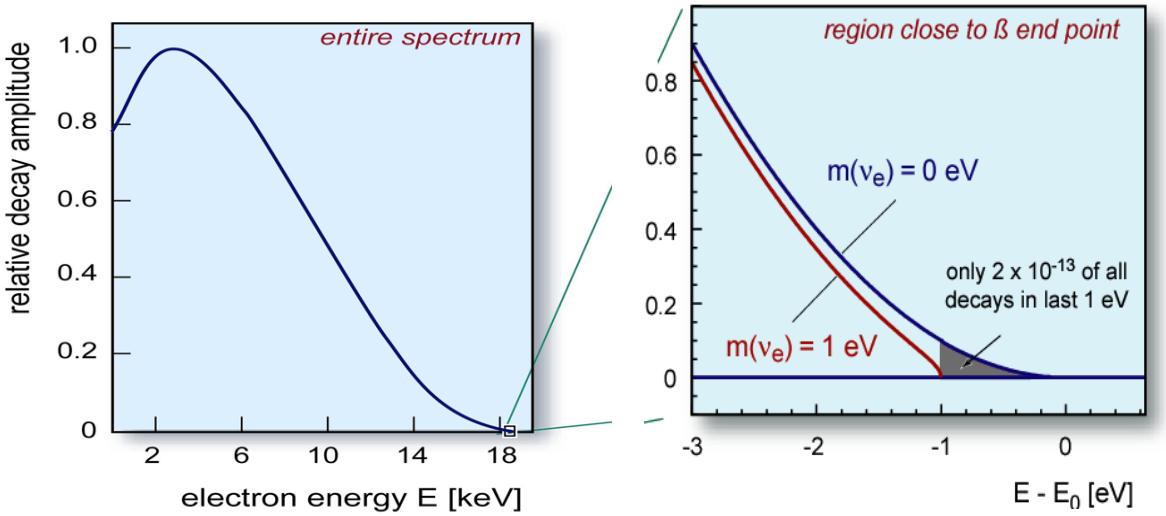
β decay: KATRIN

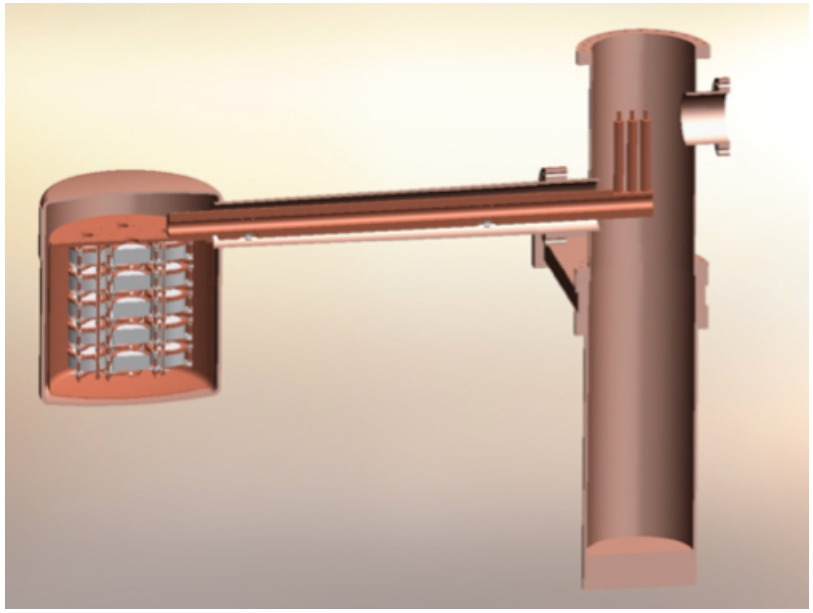


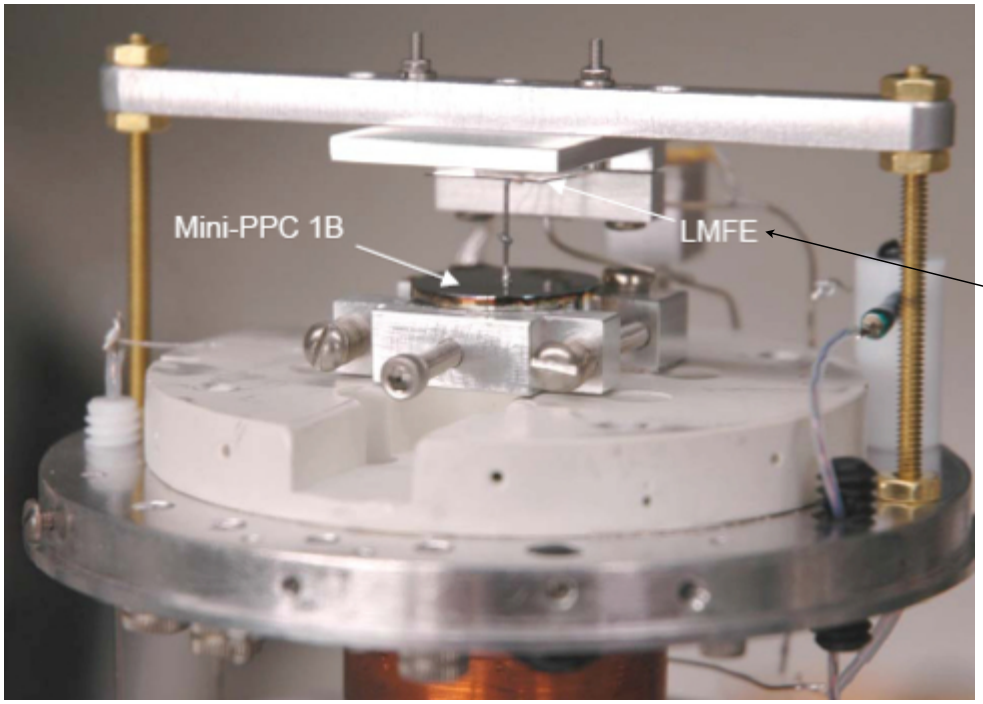


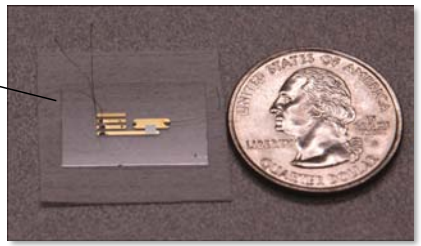
- ^{3}H beta decay
- Sensitivity: m<0.2 eV (90% CL)
- Construction in progress, physics run to begin in 2012.

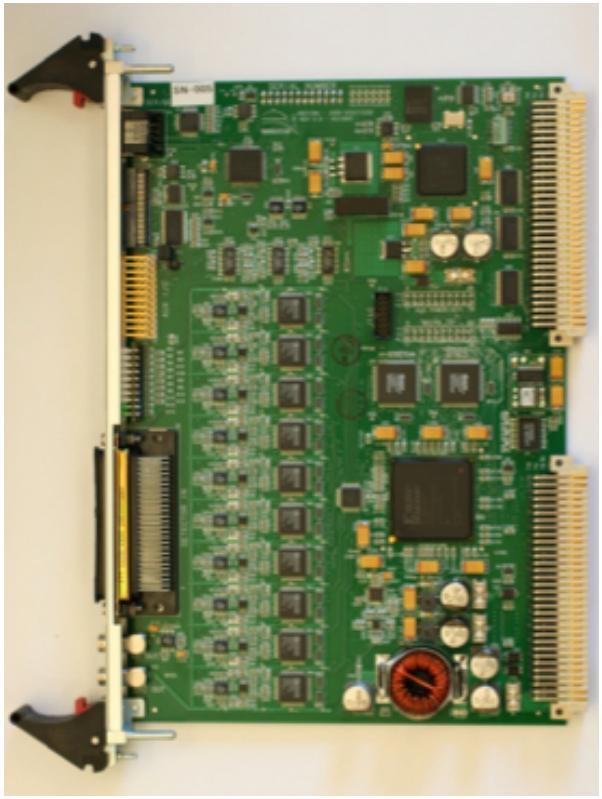
ββ-decay: MAJORANA

- ^{76}Ge neutrinoless ββ decay experiment
- Construction of a 60-kg prototype, the MAJORANA DEMONSTRATOR, is about to begin. The ultimate goal is to build a tonne-scale experiment
- Advanced HPGe detector and low-noise electronics development at LBNL. We are improving these components for dark matter search as well.





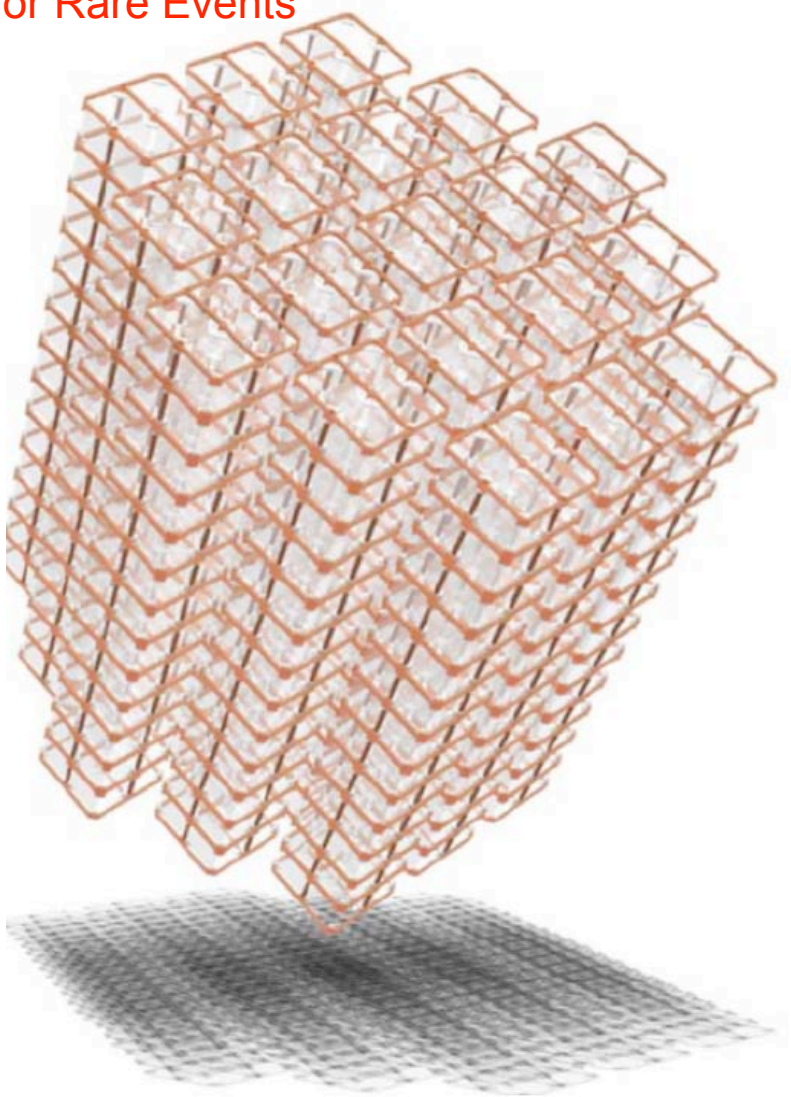




CUORE

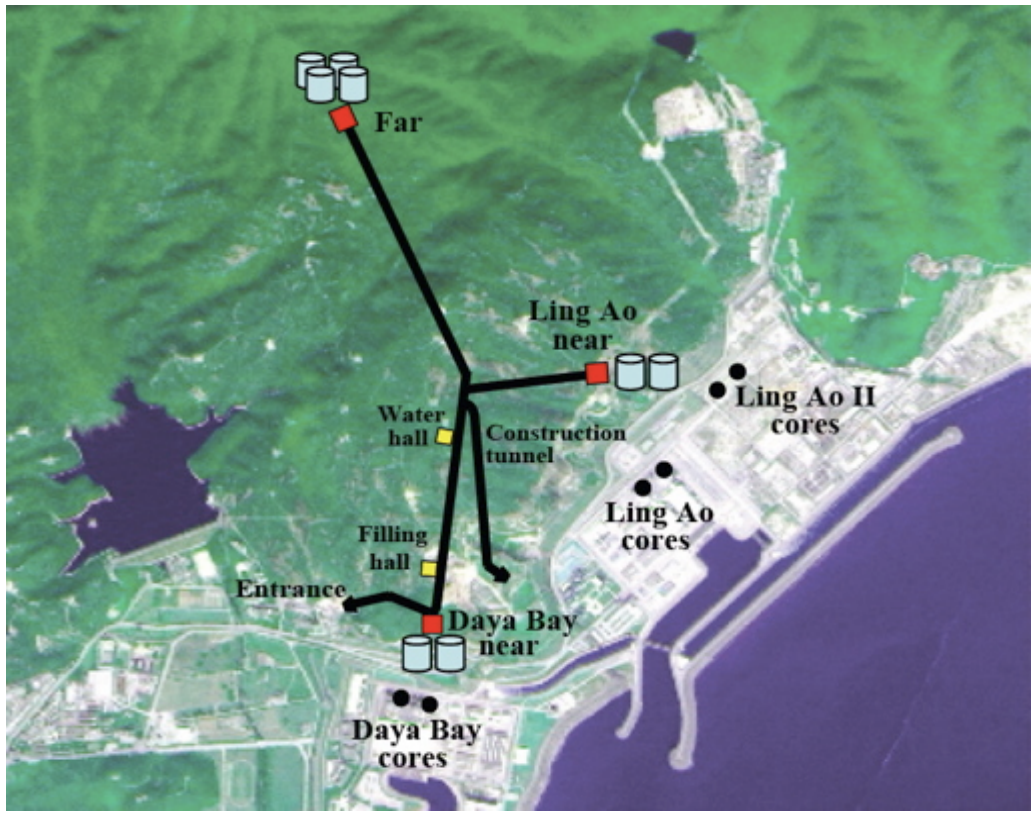
Cryogenic Underground Observatory for Rare Events

- Neutrinoless double beta decay search in ^{130}Te. Detectors are TeO_2 crystals operated as cryogenic bolometers at ~10 mK
- Currently under construction at Gran Sasso National Lab in Italy
- Expected sensitivity to probe the inverted-hierarchy neutrino mass range
- CUORE-0 (first tower of CUORE) will be operated as an independent experiment. Data taking to start in 2011.
- Next-generation bolometer research planned at LBNL with new cryostat

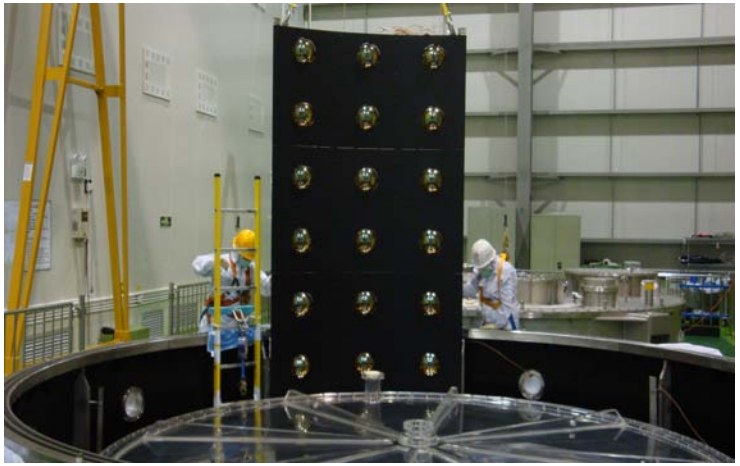


The Daya Bay Reactor Neutrino Experiment

- Determine the unknown neutrino oscillation amplitude, $\sin^2 2\theta_{13}$, to better than 0.01 using $\bar{\nu}_e$ at the Daya Bay Nuclear Power Plant.



Underground hall



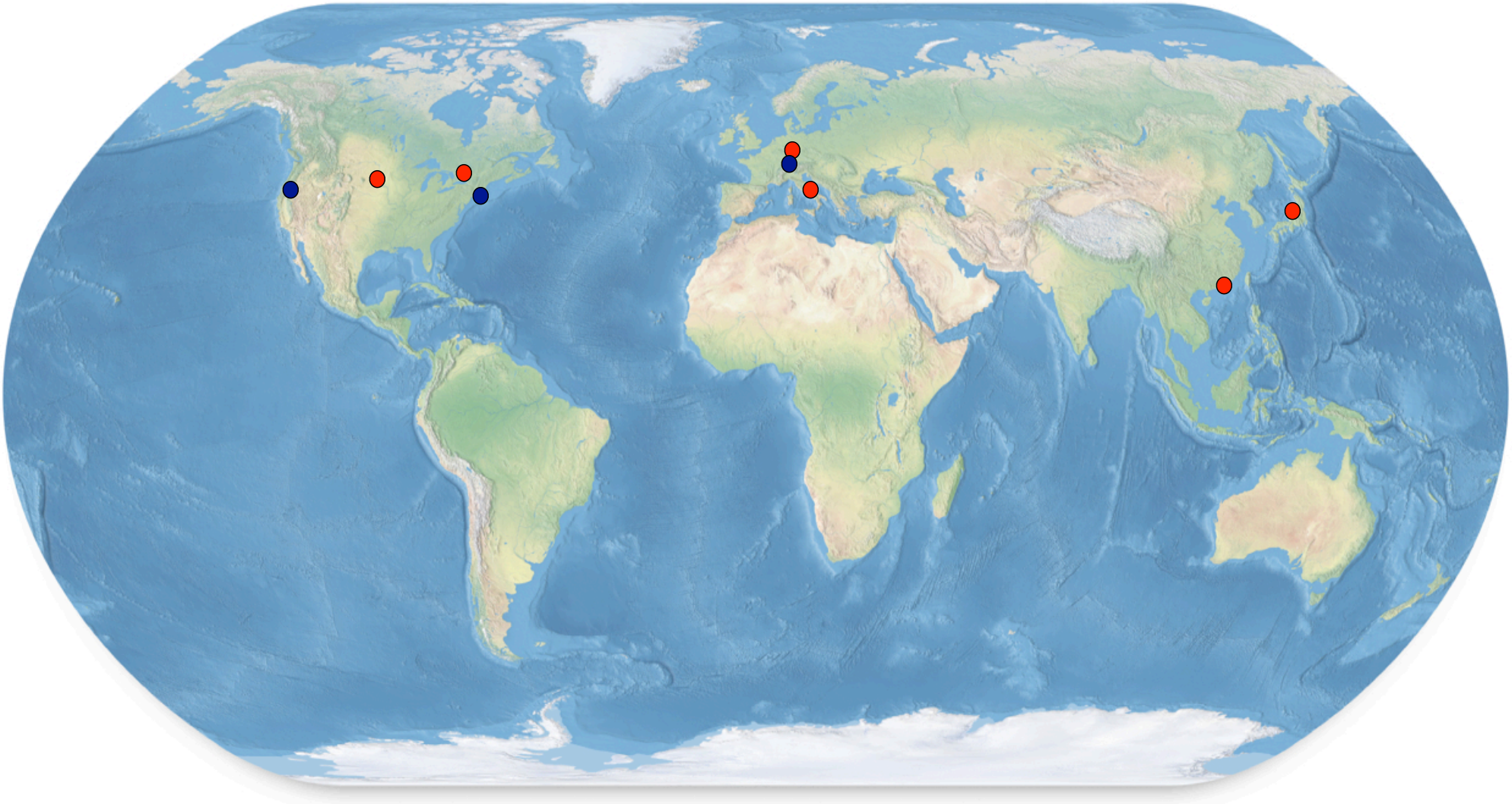
Milestones:

Data taking in Daya Bay Hall 2010

Data taking with all 3 halls 2011

BERKELEY LAB

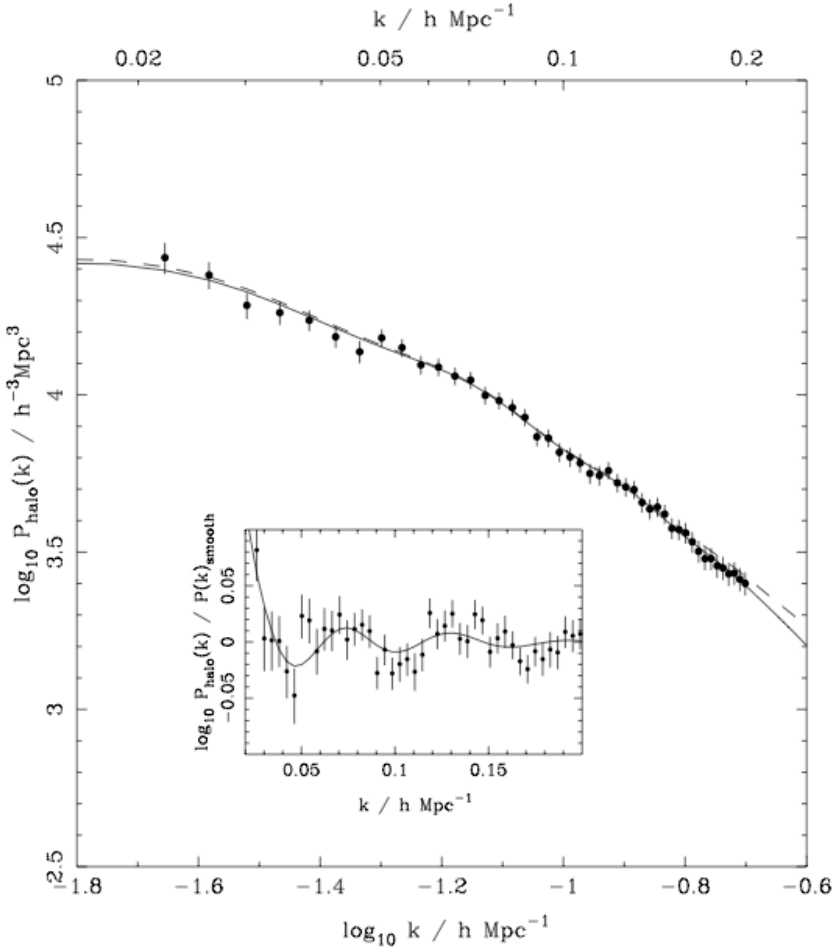
Neutrino and NSD programs



Neutrino and NSD programs

Beth Reid

SDSS DR7 LRG P(k)



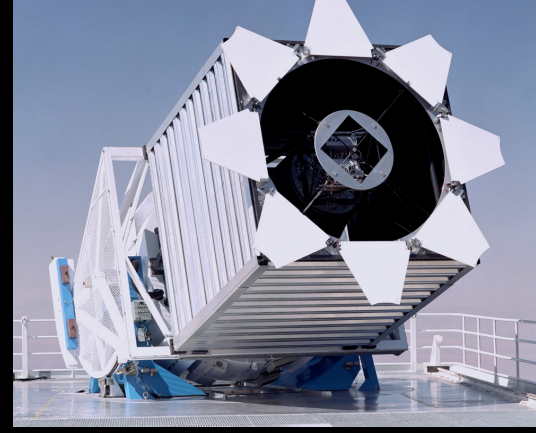
Princeton (Spergel)

ICC Barcelona (Verde)

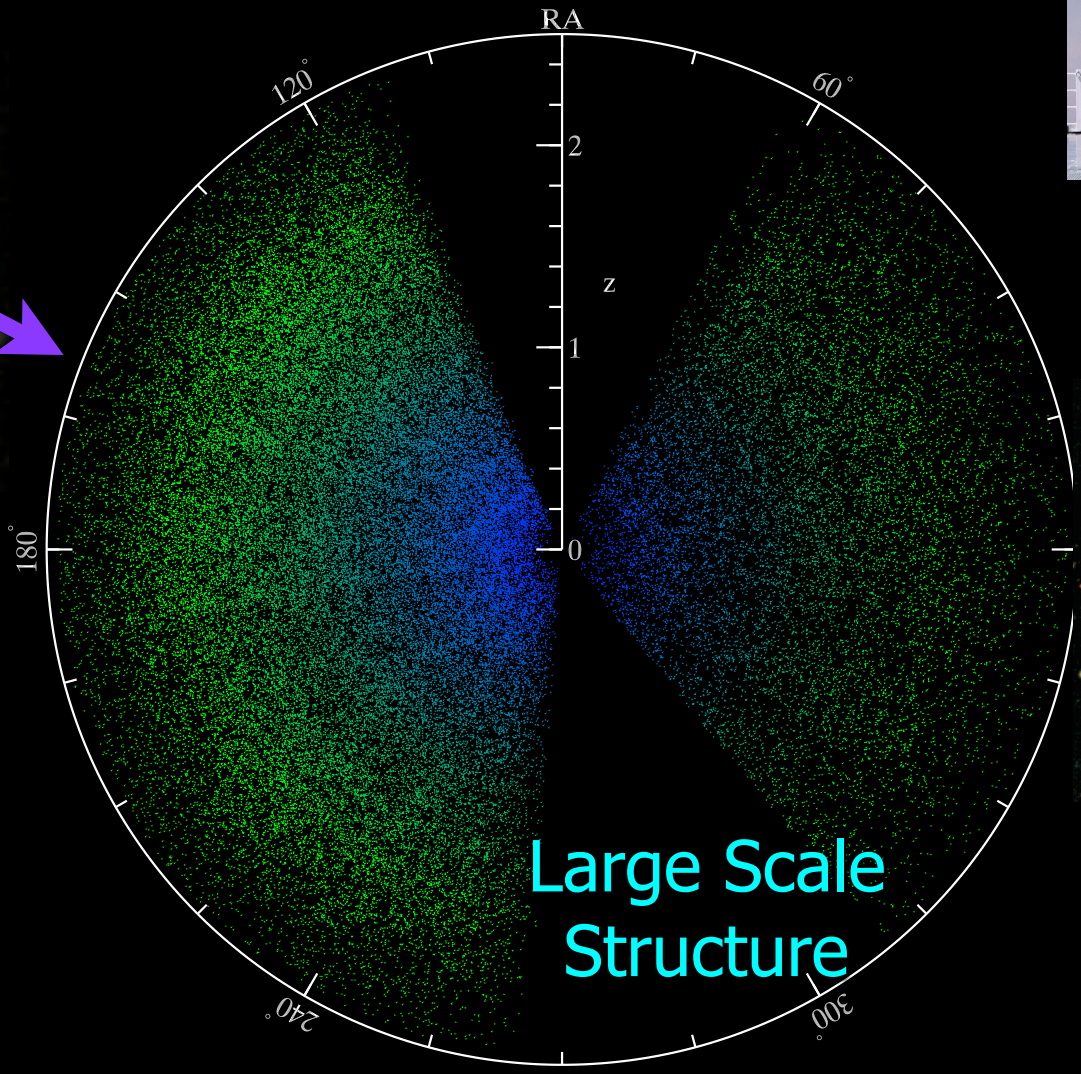
LBNL (BOSS)

Large-scale structure: BAO, redshift space distortions, neutrino masses, non-Gaussianity, halo model

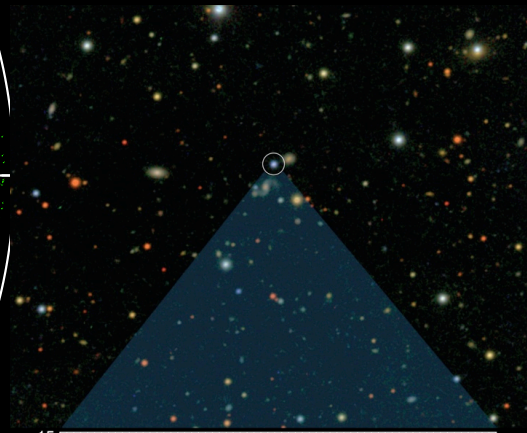
Sloan Digital Sky Survey-III:
Baryon Oscillation Spectroscopic Survey

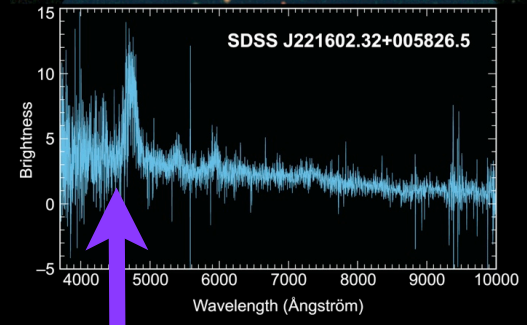


QUASARS!



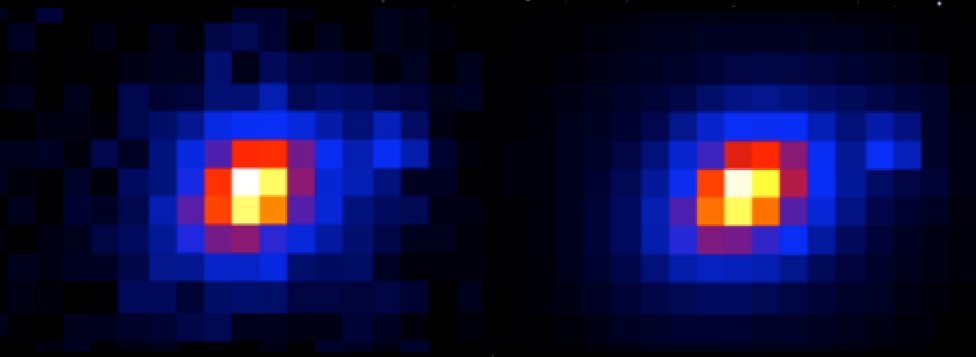
Large Scale Structure





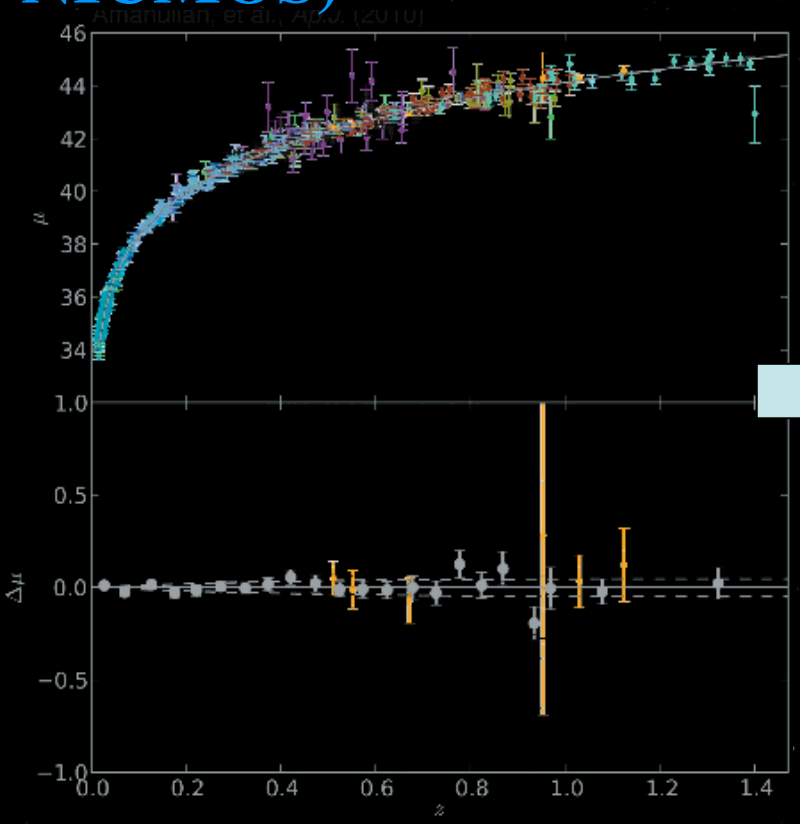
Nic Ross nproSS@lbl.gov

Lyman-α Forest

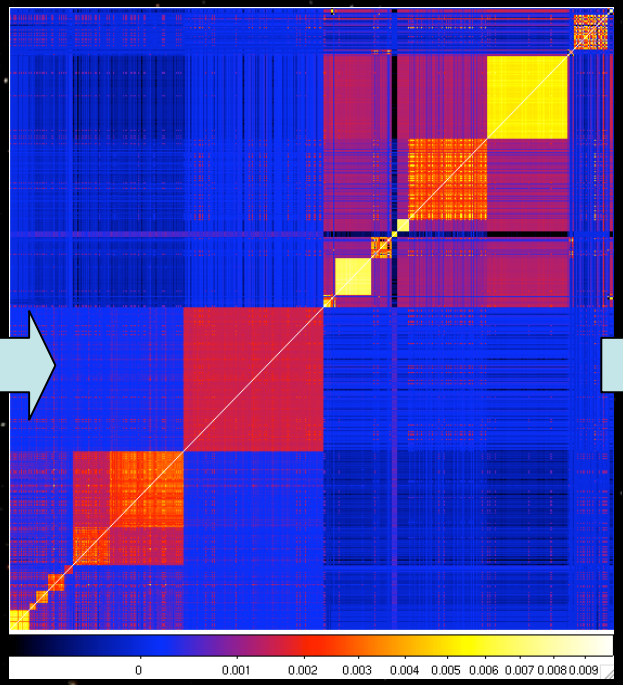


David Rubin
Graduate Student with SCP

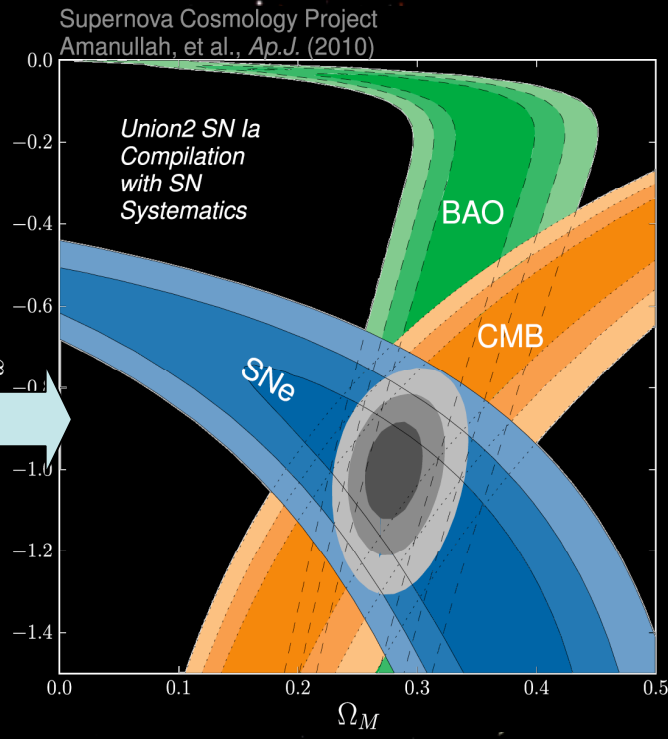
Photometry (mostly NICMOS)



Union Compilation

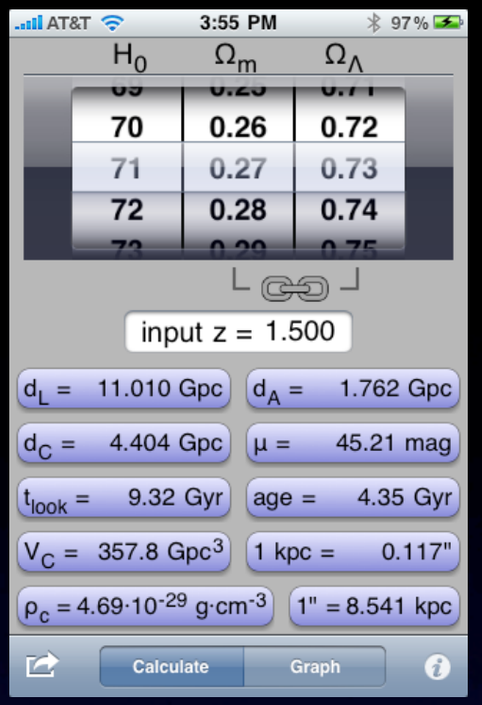


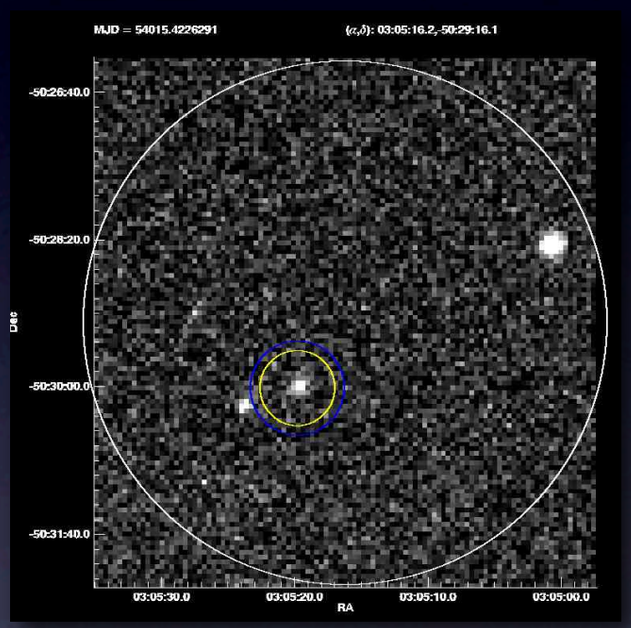
Analysis of Systematic Errors



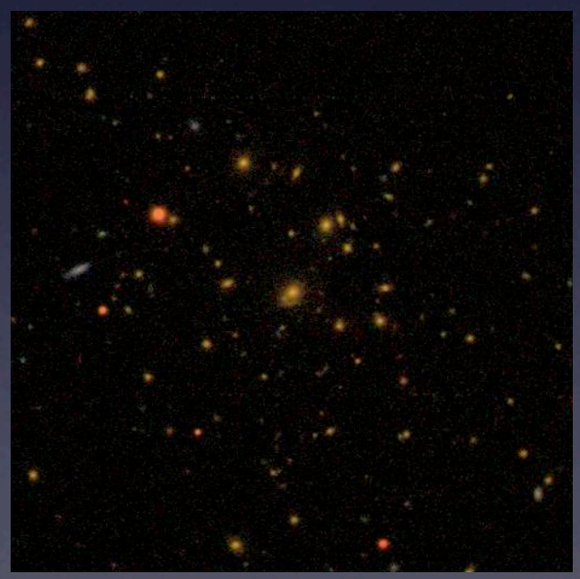
Cosmology Fitting

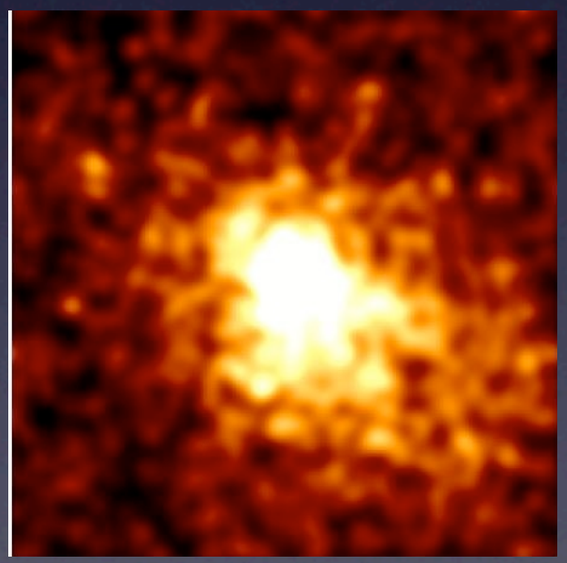
Eli Rykoff
SCP Project Scientist





Things that go bump in the night: PhD in 2005, prompt optical observations of GRBs

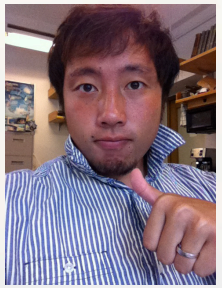




Things that don't go bump in the night: Cosmology with galaxy clusters (optical + Xray)

Now: back to (slower) transients

Shun Saito



Japanese Society for Promotion of Science (JSPS) fellow
Dep. of Physics, The Univ. of Tokyo / Dep. of Astronomy, UC Berkeley

* highlights (working on theoretical cosmology)
  - Nonlinear effects on galaxy clustering based on PT
    - neutrino mass **S.S, Taruya, Takada (2008,2009,2010)**
    - redshift distortions **Taruya, Nishimichi, S.S (2010)**
  - CMB polarization & Gravitational Wave **S.S, Ichiki, Taruya (2007)**

* current interest
  - Isocurvature perturbation & LSS probes **with M.White**
  - Galaxy Power Spectrum measurement **mainly by J.Carlson**
  - CMB lensing & Weak lensing **Namikawa, Taruya, S.S coming soon**
  - Gravitational Wave Standard Siren **Nishizawa, Taruya, S.S coming soon**

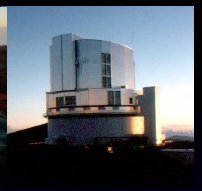
HST Cluster SN Survey Nao Suzuki & SCP

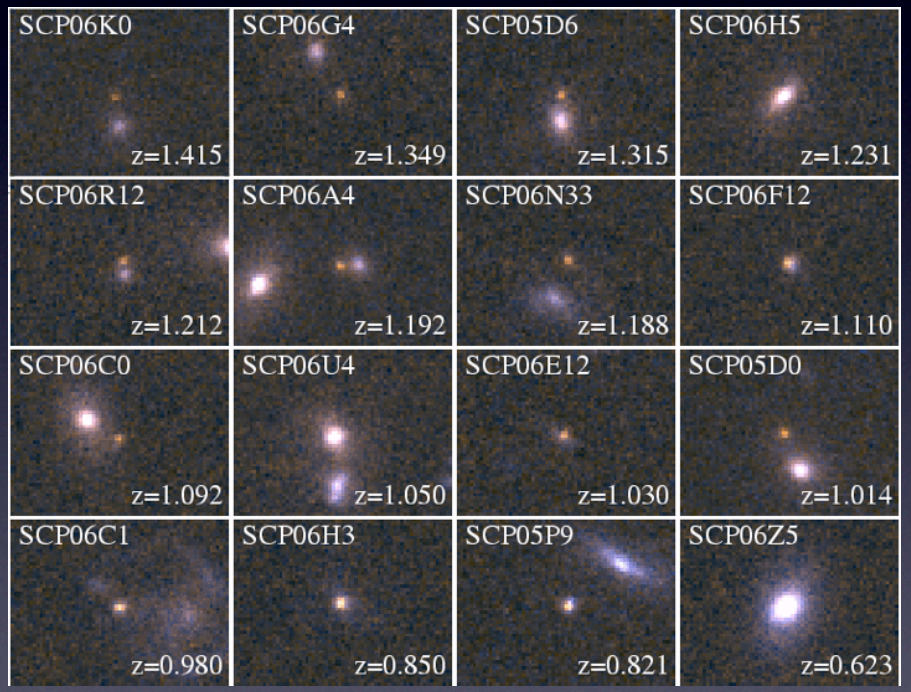
HST

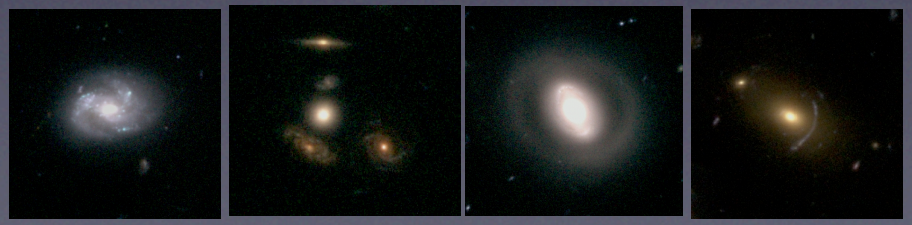
Keck

VLT

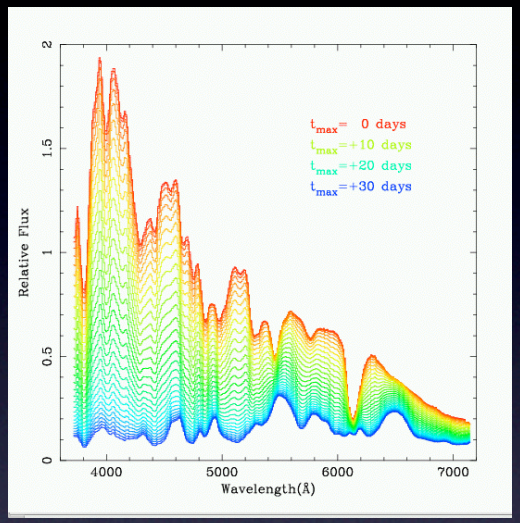
Subaru







Spectral Time Series with PCA



SNIa Spectral Diversity