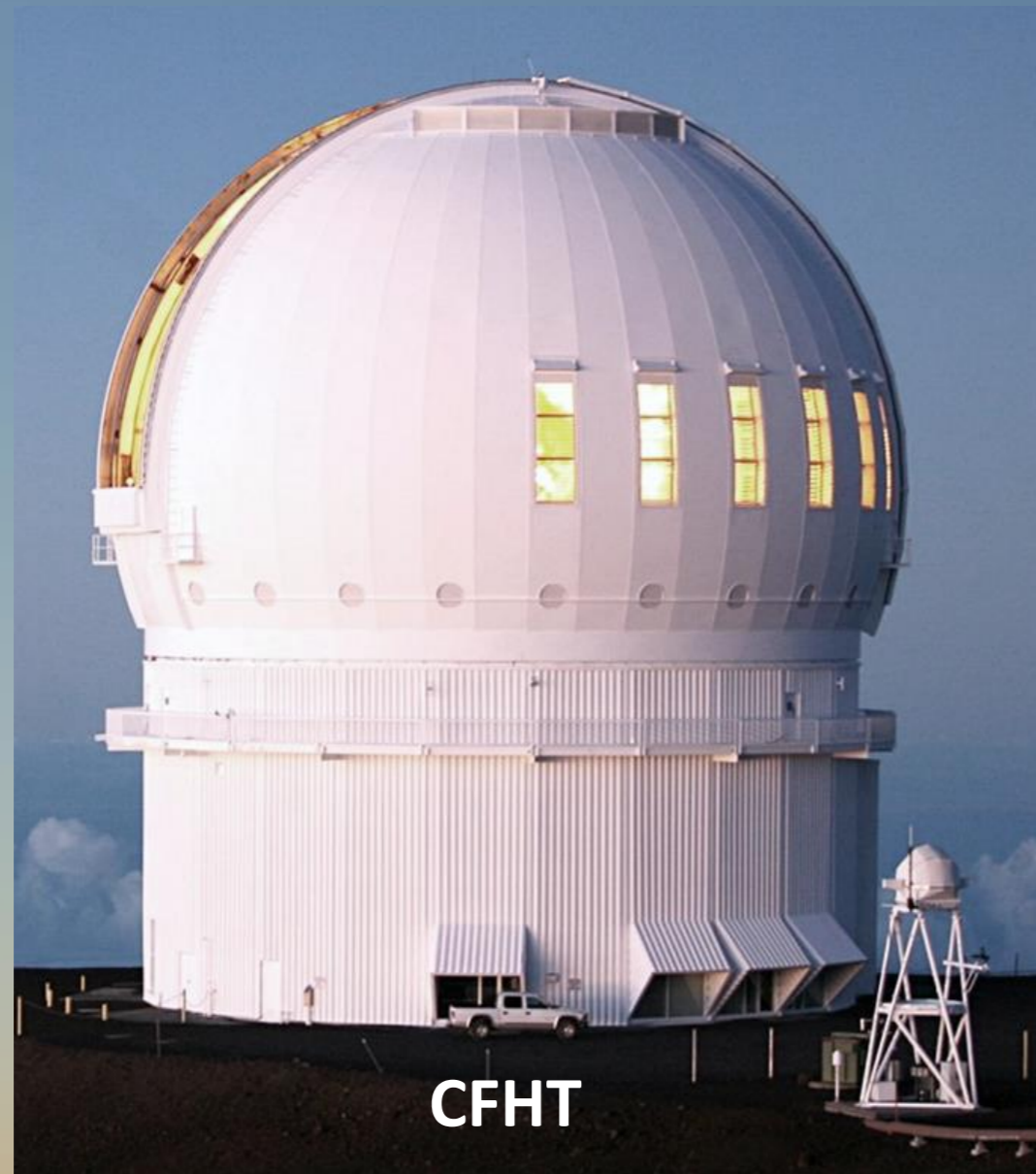


# The Maunakea Spectroscopic Explorer: Conceptual design and recent updates

Jen Marshall  
MSE Project Scientist  
Texas A&M University

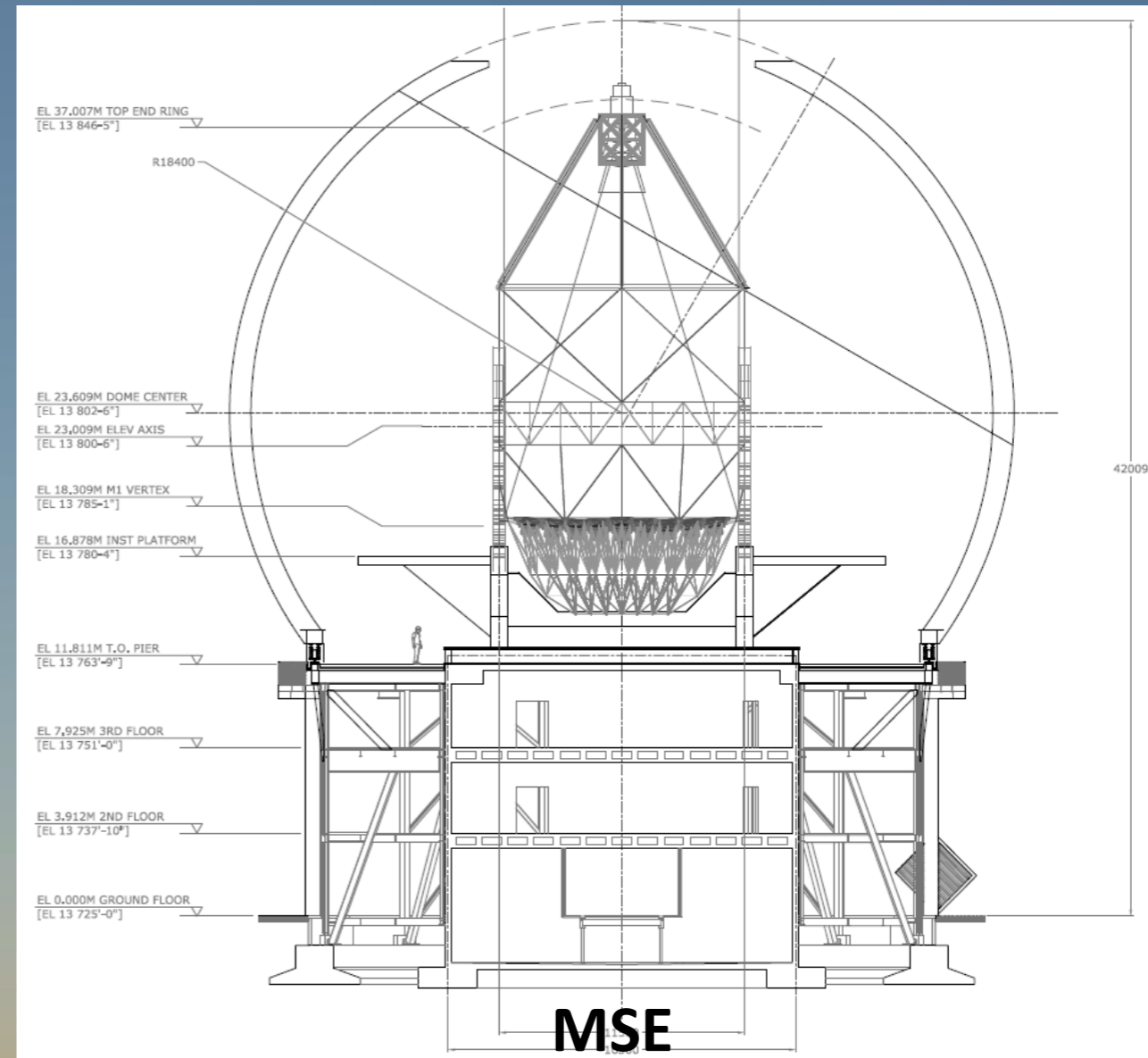
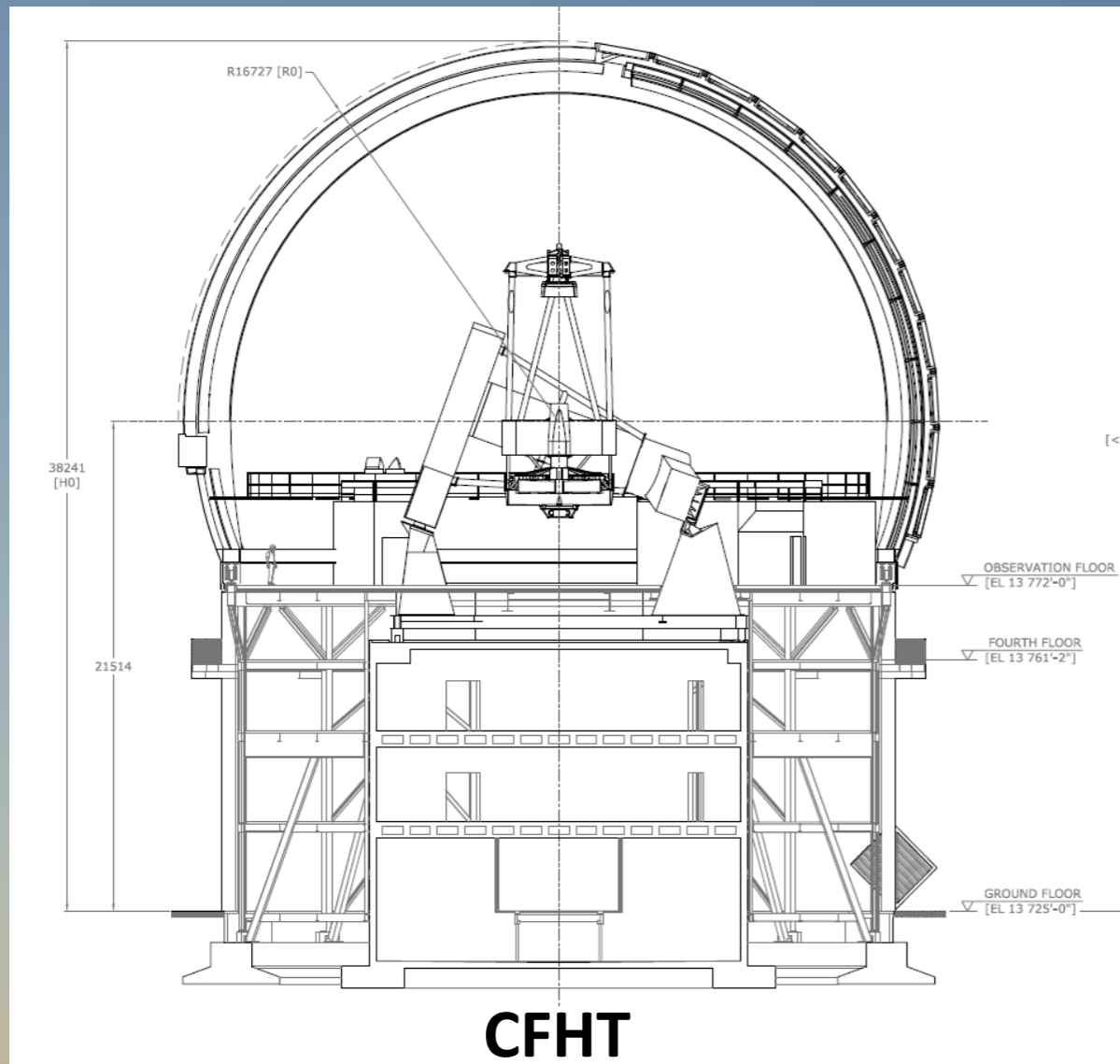


# Facility transformation

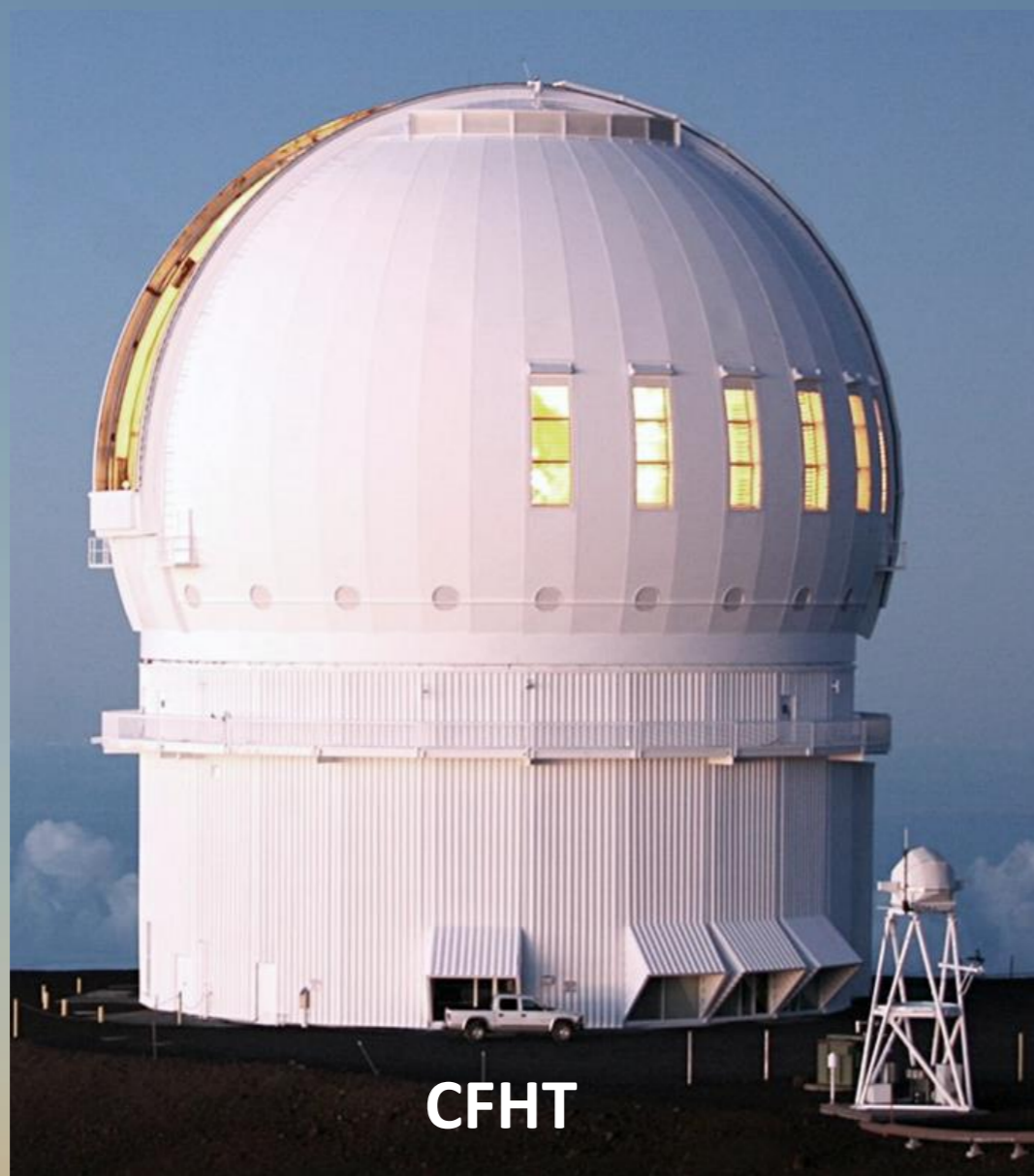


- Canada-France-Hawaii Telescope has a 40 year history of scientific and outreach leadership on Maunakea
- Out of environmental and cultural respect, a strong desire to preserve the external appearance of CFHT after MSE completion
  - MSE will reuse the CFHT summit building without additional ground disturbances
  - Limiting size increase of the new facility building and enclosure to 10%

# Facility transformation



# Facility transformation



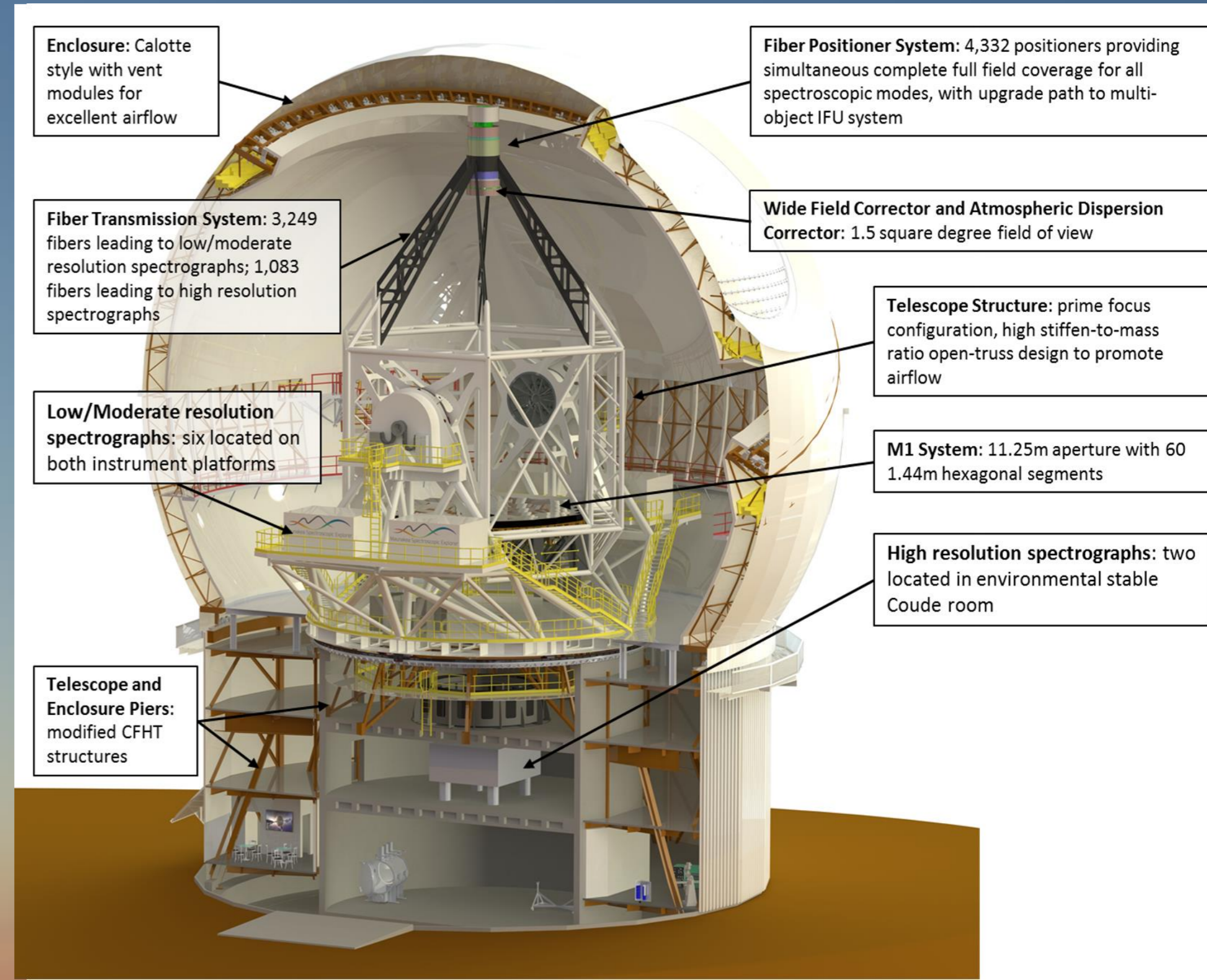
**CFHT**



**MSE**

- 11.25m diameter telescope
- 1.5 square degree field of view
- 4,332 fiber positioner feeds two sets of spectrographs
  - Low/moderate resolution:
    - $R = \lambda / \Delta\lambda \sim 3,000$  or  $R \sim 6,000$
    - UV to H band
    - 3249 fibers
  - High resolution:
    - $R \sim 30,000$
    - 3 optical wavelength windows
    - 1083 fibers

**Completely dedicated  
survey facility**



# Science Working Groups



## Chemical nucleosynthesis

*Charli Sakari, San Francisco State; Ricardo Schiavon, Liverpool JMU*

Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32
Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50

## Exoplanets and stellar astrophysics

*Maria Bergemann, MPIA Heidelberg; Daniel Huber, UH*

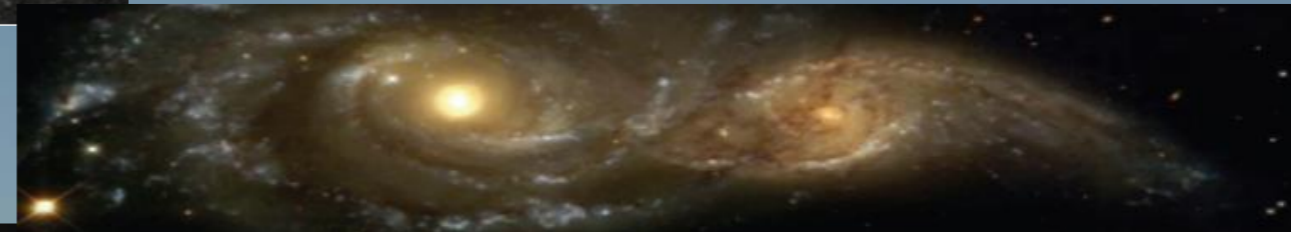


## Milky Way and resolved stellar populations

*Sarah Martell, UNSW; Xiaoting Fu, Kavli IAA at Peking University*

## Galaxy formation and evolution

*Sean McGee, University of Birmingham; Aaron Robotham, UWA*



## AGN and supermassive black holes

*Yue Shen, University of Illinois; Manda Banerji, IfA Cambridge*



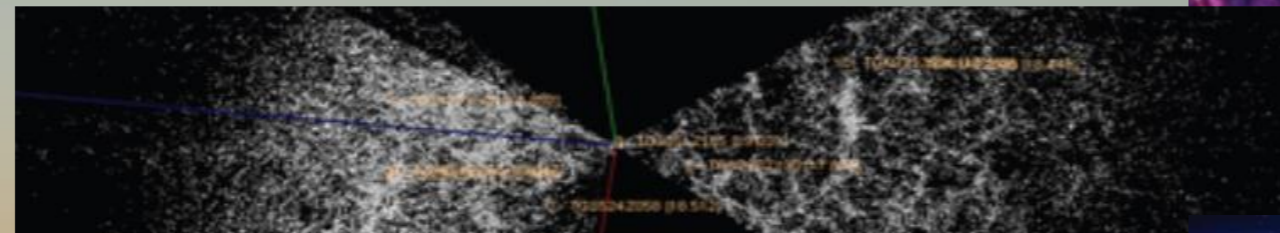
## Astrophysical tests of dark matter

*Ting Li, Carnegie Observatories; Manoj Kaplinghat, UC Irvine*



## Cosmology

*Will Percival, University of Waterloo; Christophe Yèche, CEA*

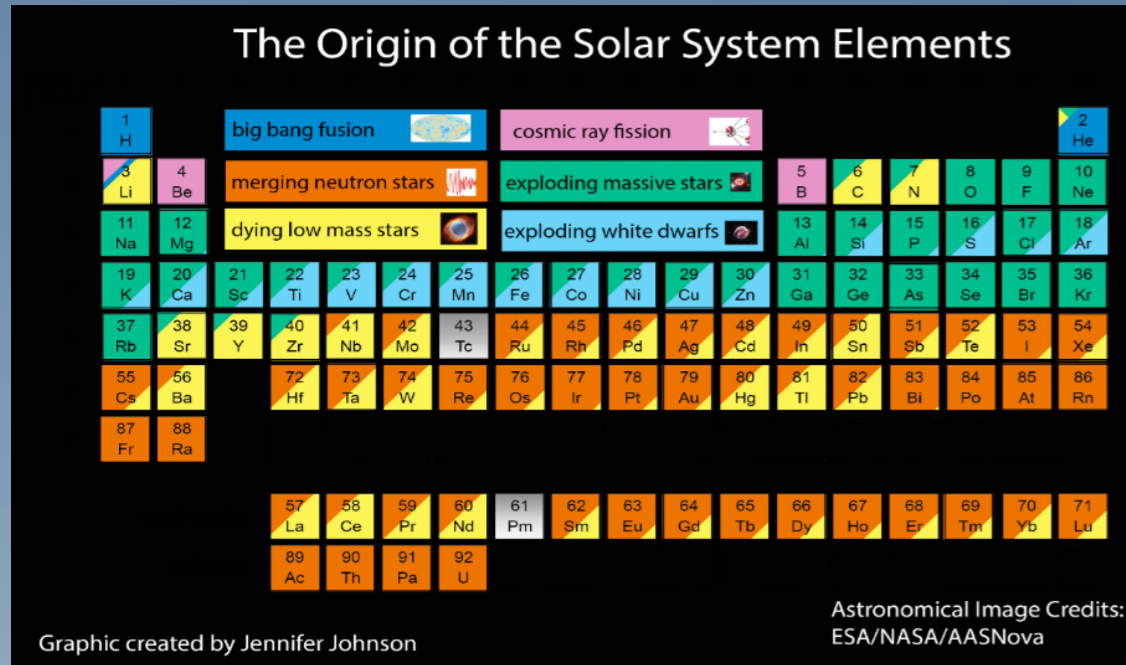


## Time domain astronomy and transients

*Suvi Gezari, STScI; Chien-Hsiu Lee, NOAO/NOIRLab*

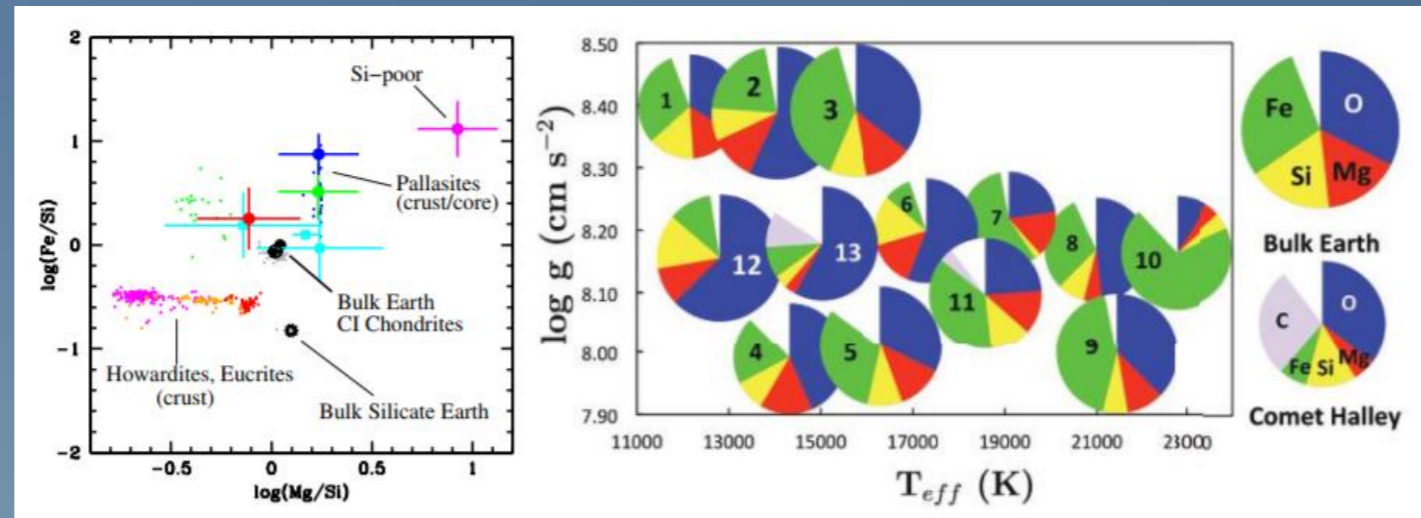


# Massive scientific capabilities



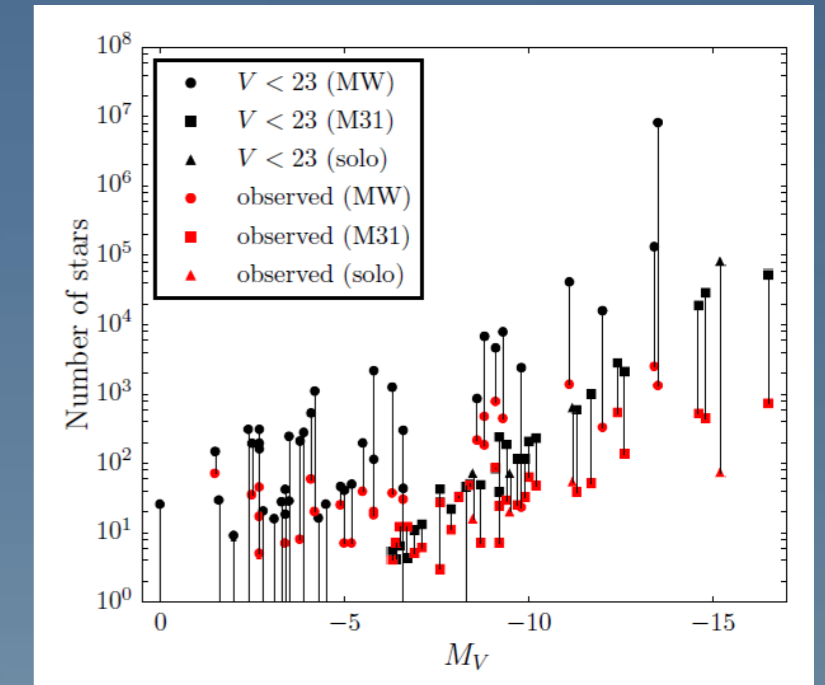
## Origin of the elements

Chemical Nucleosynthesis: Yong, Thirupathi, et al.



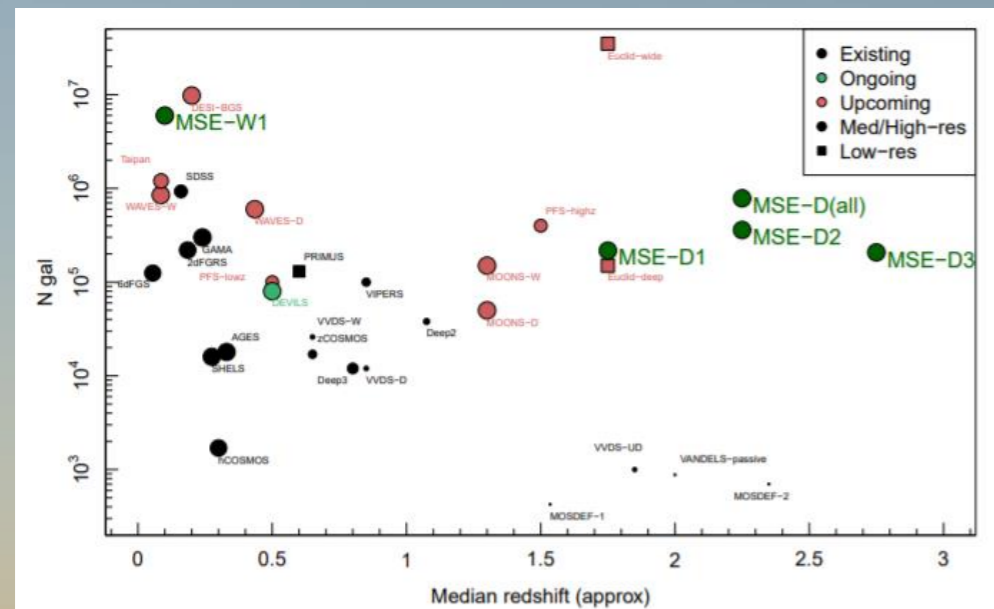
## Exoplanet composition

Stars and Exoplanets: Bergemann, Huber, et al.



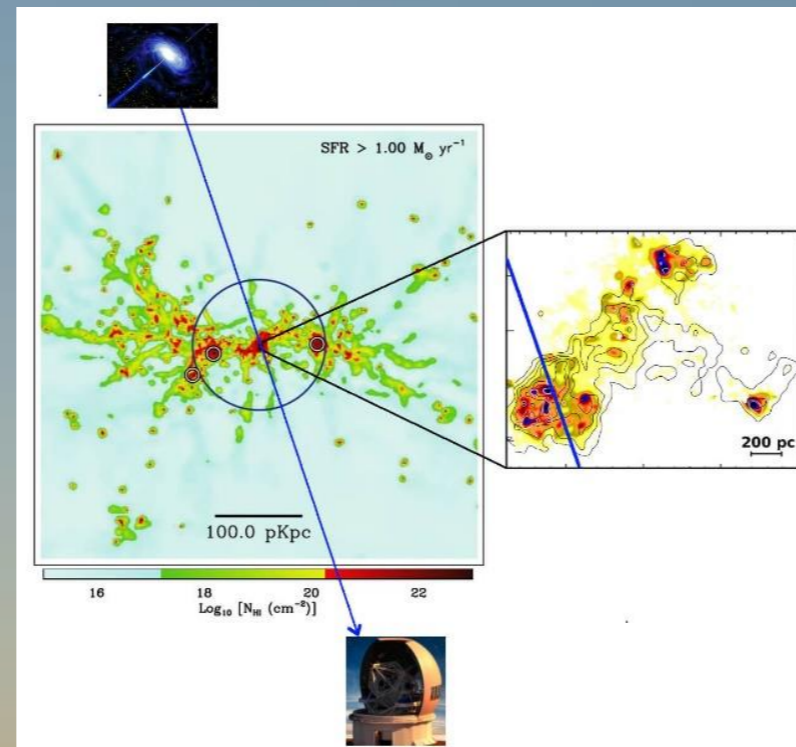
## Hundreds of UFD galaxies

Dark matter: Li, Kaplinghat, et al.



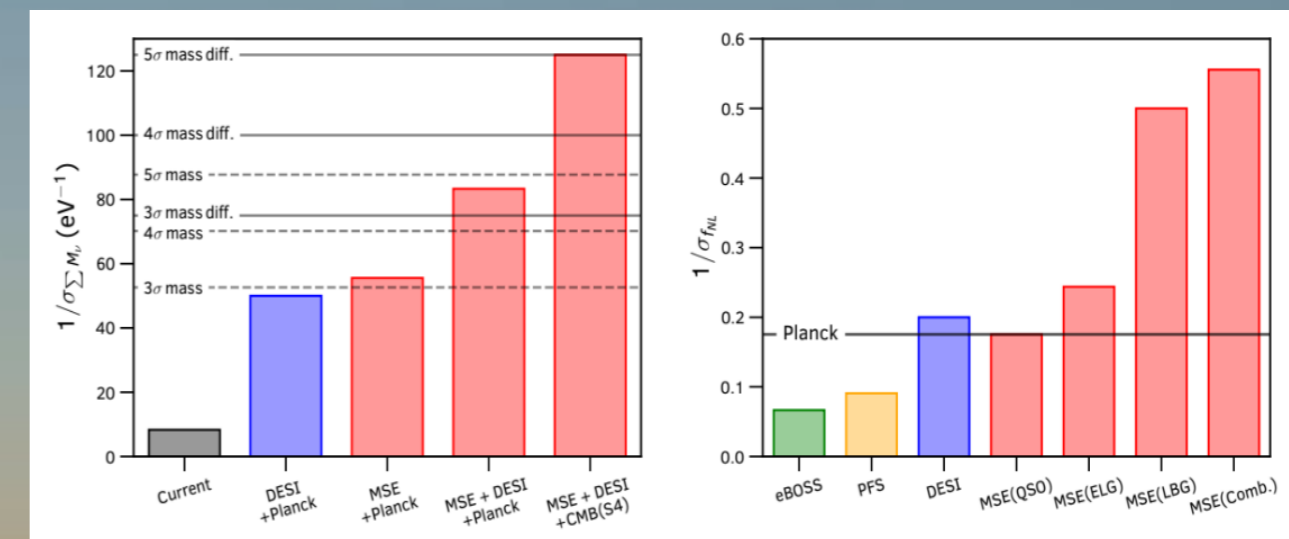
## Extragalactic surveys

Galaxy formation/evolution: Tran, Robotham, et al.



## Quasar absorption spectroscopy

AGN and SMBHs: Shen, Ellison, et al.



## Non-Gaussianity and the neutrino mass

Cosmology: Yèche, Percival, et al.

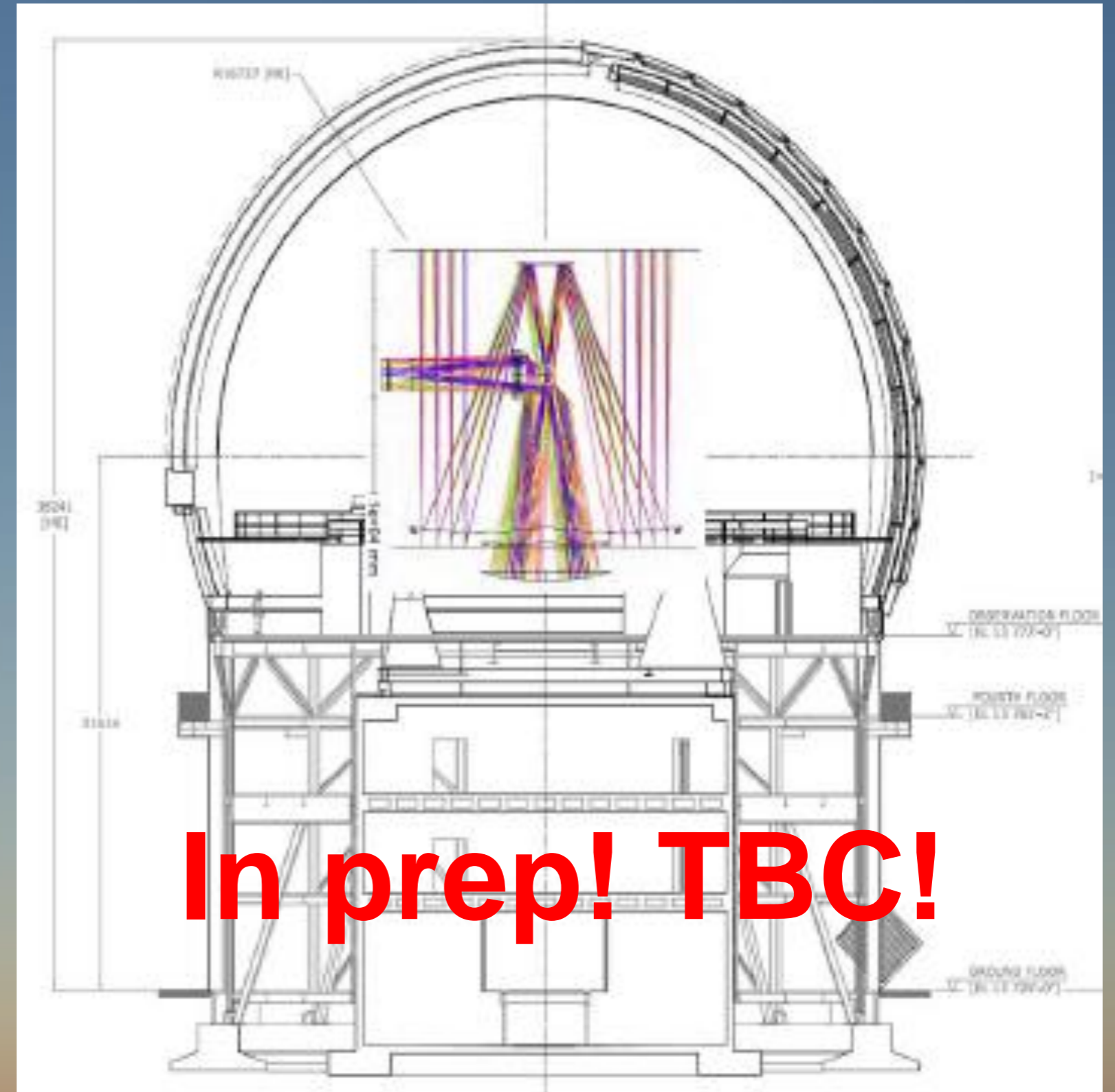




# MSE's new Quad Mirror concept

- 11.25m **14m diameter telescope**
- 1.5 square degree field of view
- 4,332 **~21,000 fiber positioner** feeds two sets of spectrographs
  - Low/moderate resolution:
    - $R = \lambda / \Delta\lambda \sim 3,000$  or  $R \sim 6,000$
    - UV to  $\#$  **K** band
    - **~5x** 3249 fibers
  - High resolution:
    - $R \sim 30,000$
    - 3 optical wavelength windows
    - **~5x** 1083 fibers
- **Nasmyth mounting allows shorter fibers, therefore higher sensitivity**
- **Fold mirror could enable adaptive optics**
- **Completely dedicated survey facility New design enables instrument changes**
- Also, recent spectrograph design updates (regardless of telescope design)

Red font=significant update to design



Credit: Sam Barden, MSE Systems Engineer

## About the MSE Project

The mission of the Maunakea Spectroscopic Explorer Project is to realize a dedicated facility that enables a diverse suite of large-scale spectroscopic surveys of millions of astrophysical objects at a range of wavelengths, spectral resolutions, redshifts, and spatial scales.


The MSE Project is hosted by the Canada-France-Hawaii Telescope Corporation, and supported by contributing organizations in Canada, France, Hawaii, Australia, China, India, South Korea, Texas, the UK, and the US. The MSE collaboration recognizes the cultural importance of the Maunakea summit to a broad cross-section of the Native Hawaiian community, and is committed to equity, diversity and inclusion.

Statements of MSE's mission, cultural respect, and equity, diversity and inclusion are available on <https://mse.cfht.hawaii.edu>.



# Join the Science Team!

Send an email to:  
[mseinfo@mse.cfht.hawaii.edu](mailto:mseinfo@mse.cfht.hawaii.edu)  
or  
[marshall@mse.cfht.hawaii.edu](mailto:marshall@mse.cfht.hawaii.edu)



**Maunakea Spectroscopic Explorer**

ORGANIZATION SCIENCE **NEWS** DOCUMENTS

CFH

## Call for Maunakea Spectroscopic Explorer Science Team Membership

**Call for Maunakea Spectroscopic Explorer Science Team Membership**

A major science development phase will get underway in April/May 2018, that will be spearheaded by the international science team. Specifically, they will develop the first phase of the MSE Design Reference Survey (DRS). The DRS is planned as a 2 year observing campaign that will demonstrate the science impact of MSE in a broad range of science areas and will provide an excellent dataset for community science. It will describe and simulate an executable survey plan that addresses the key science described in the Detailed Science Case. The DRS will naturally undergo several iterations between now and first light of MSE: this first phase (nicknamed DRS1) will set the foundation for its future development.

DRS1 will be supported by the Project Office and will use various simulation tools, including Integration Time Calculators, fiber-assigning software, and a telescope scheduler. It is anticipated that the DRS will become the first observing program on MSE come first light of the facility, and it will be used by the Project Office going forward to understand the consequences for science for all decisions relating to the engineering and operational development of MSE.

# Timeline to Science Operations

Science Commissioning will begin in 2032

- Based on a technically paced schedule with no constraints on resources and cash flow

The project timeline is organized in four major overlapping phases with three milestones:

- Preliminary Design Phase - 2 yrs
- Construction Phase - 6.5 yrs duration
- System-Level Assembly, Integration and Verification (AIV) Phase - 5.5 yrs
- Science Commissioning - 2 yrs

Receive Construction Permit from the State

Construction Phase start approved

Receive new  
Master Lease

