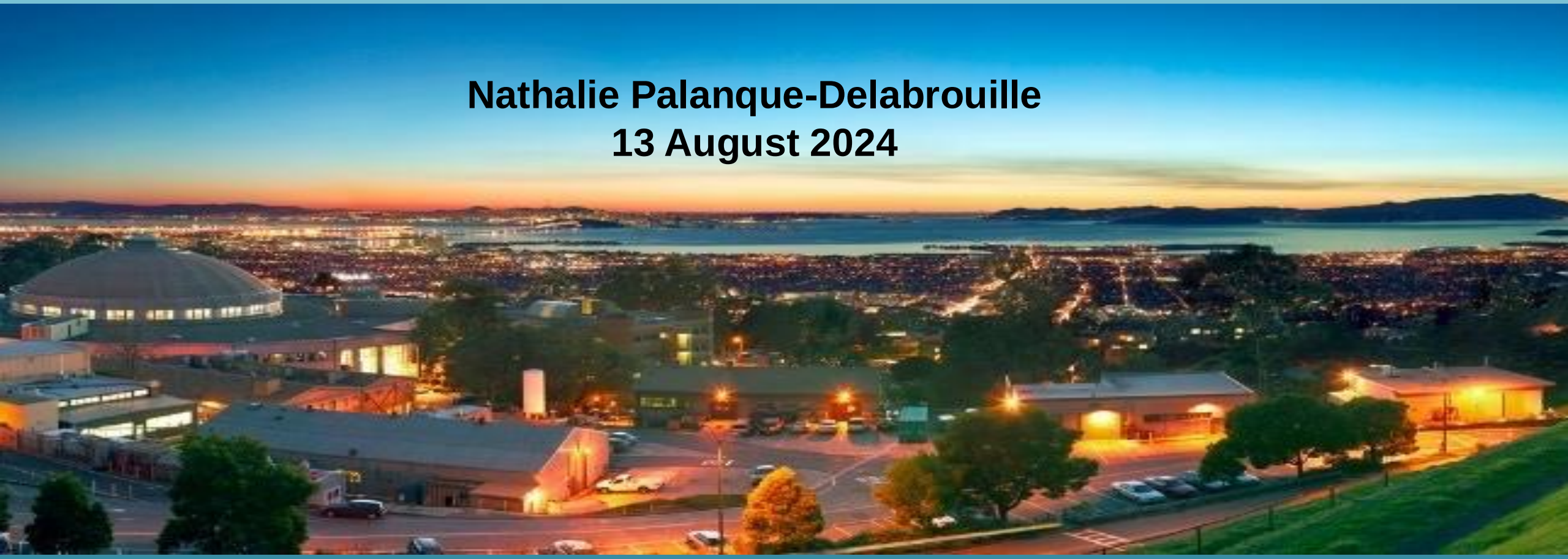
Presentation of the PHYSICS DIVISION



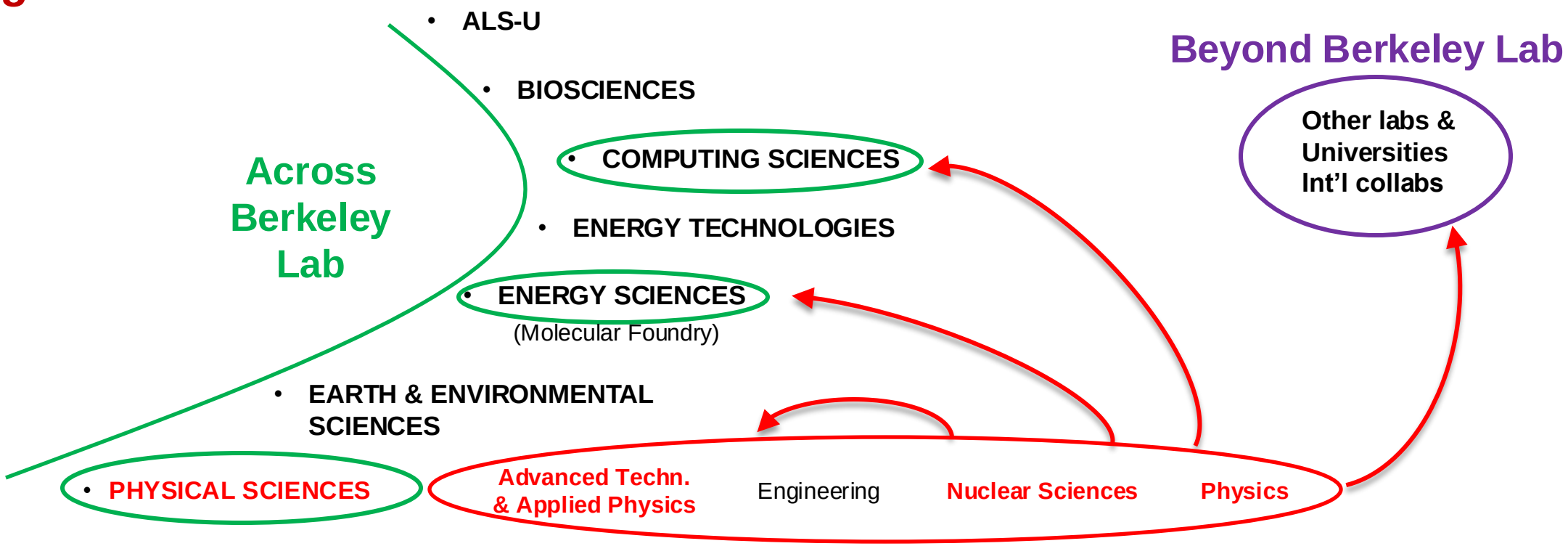
**Nathalie Palanque-Delabrouille**
**13 August 2024**

BERKELEY LAB

U.S. DEPARTMENT OF ENERGY | Office of Science

# Berkeley Lab at a glance

- **LBNL**: large (>$1B) multi-purpose DOE lab, 3500 employees
- **Strong connections**




- **Physics Division**: 1 of LBNL's 22 scientific divisions, but 9/16 of its Nobel Prize awardees!

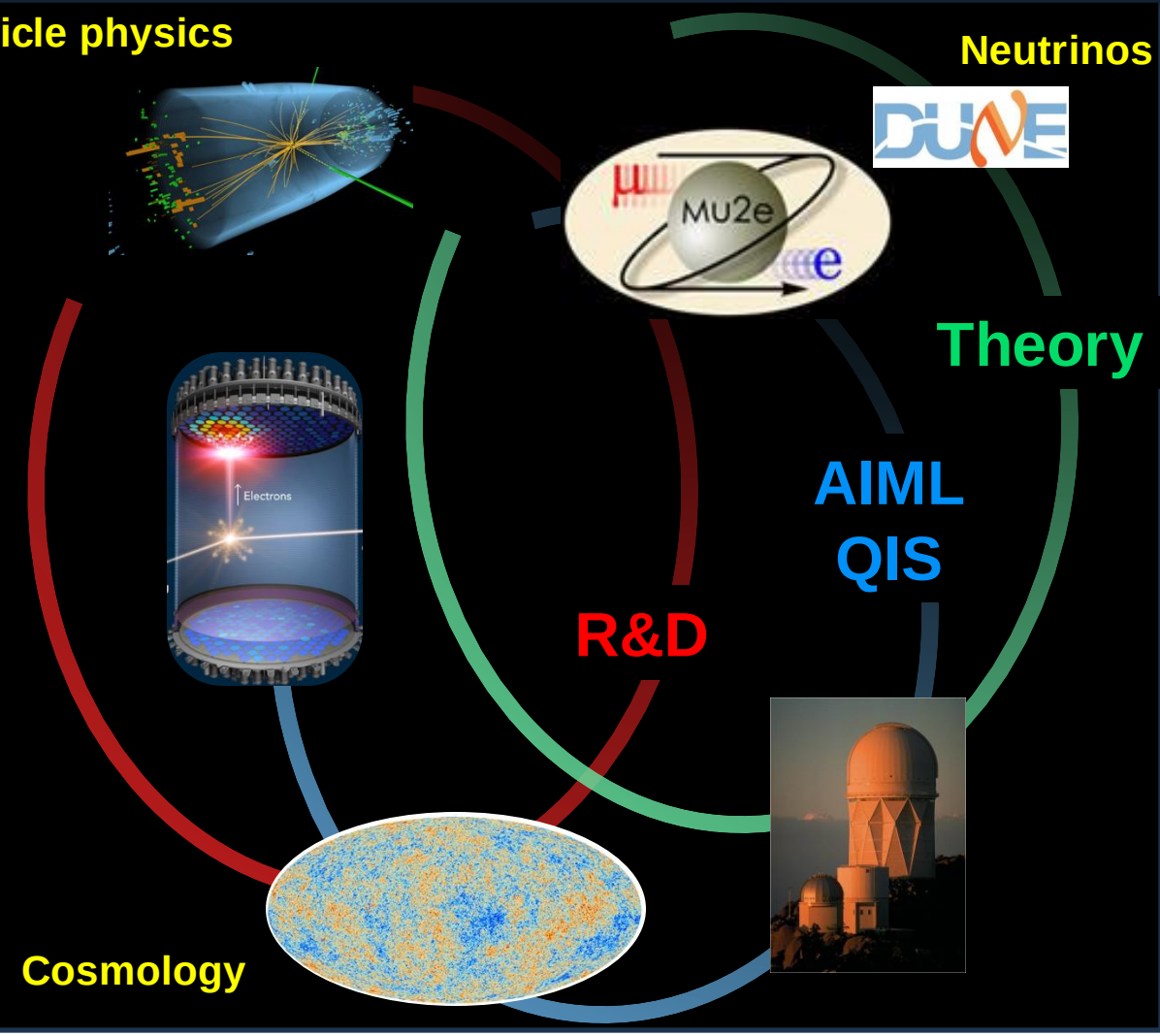
# Physics Division: particle physics & cosmology

**Mission**:

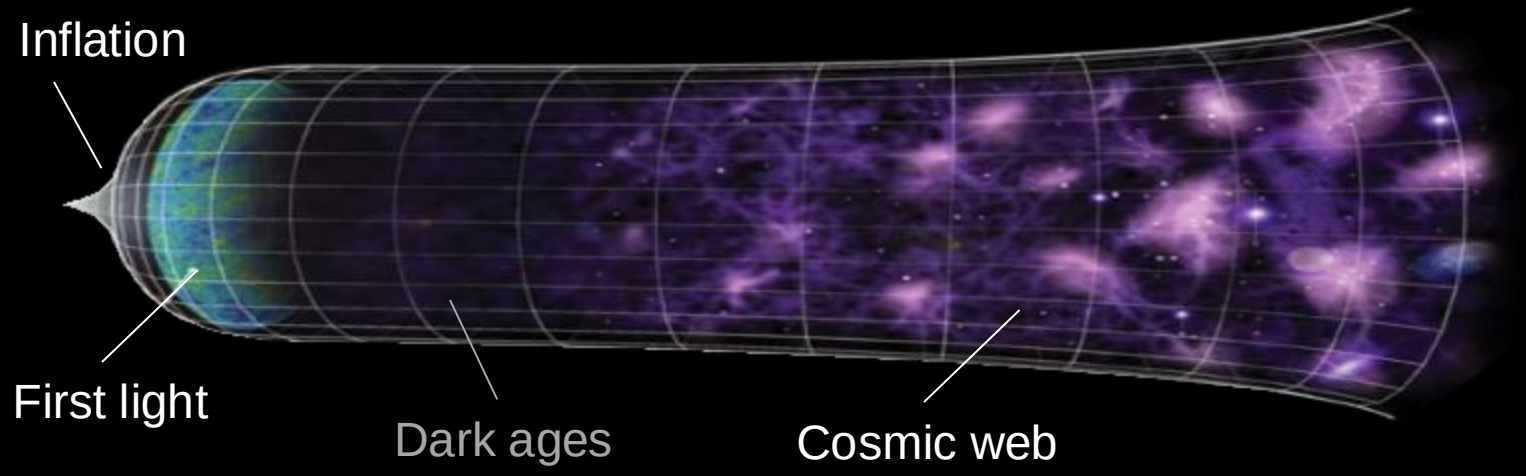
Explore nature of the Universe at its largest and smallest scales to understand its fundamental constituents, history and evolution

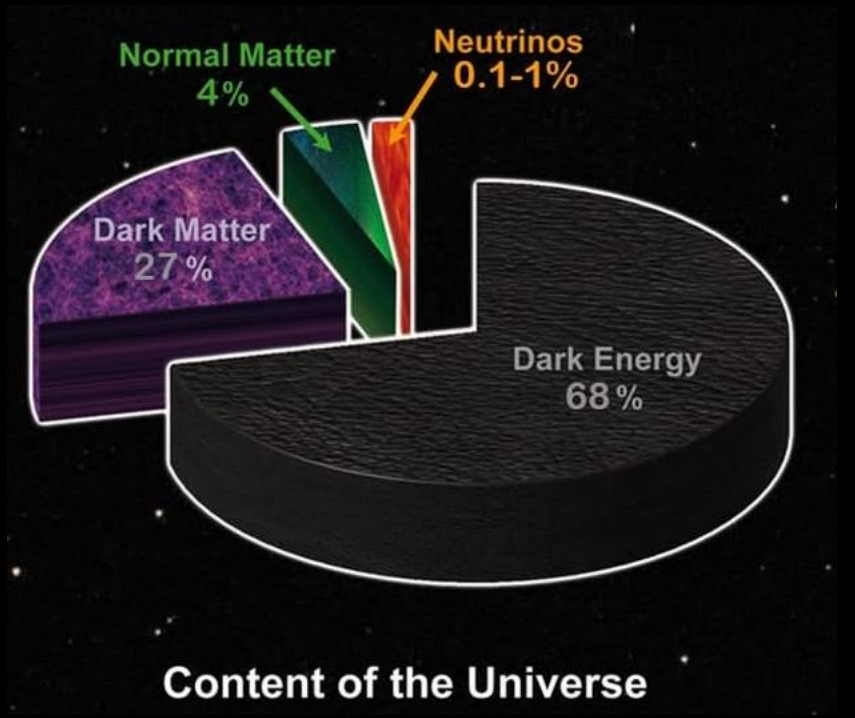
**Approach**:

- Innovative instrumentation and computation
- Outstanding scientific staff, close connection with UC Berkeley
- Leading design and construction of large experiments with international collaborations

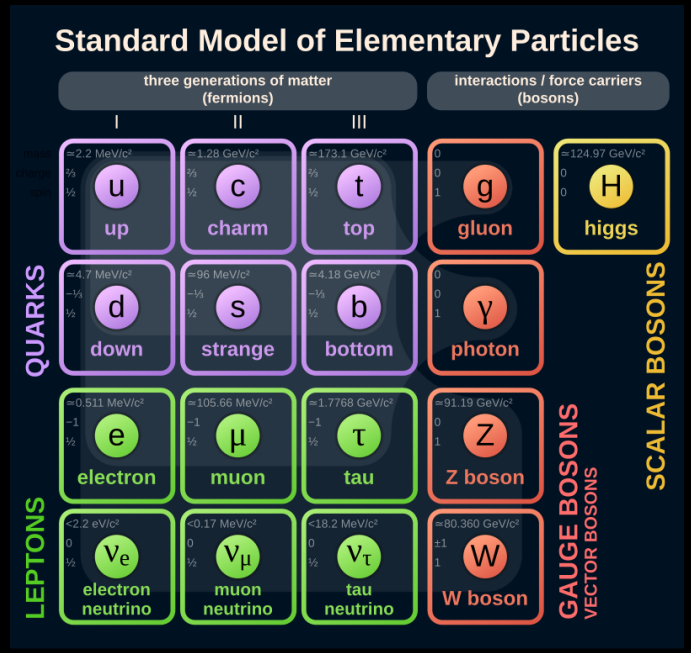


# Unveiling the nature of our Universe



# The standard model of particle physics and beyond



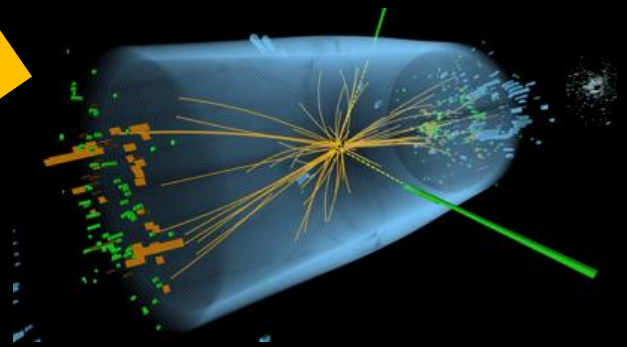

Contributing to

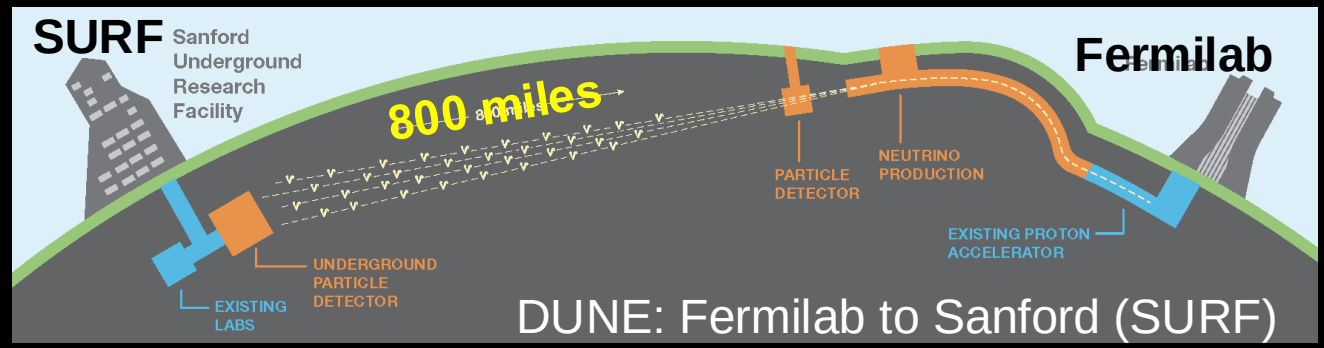
- international collider experiment at CERN – ATLAS
- Flagship US neutrino experiment – DUNE

⟹ understand Standard Model of Particle Physics … and missing parts …

Chen-Ju Lin

Simon Pagan Griso
Nikki Apadula



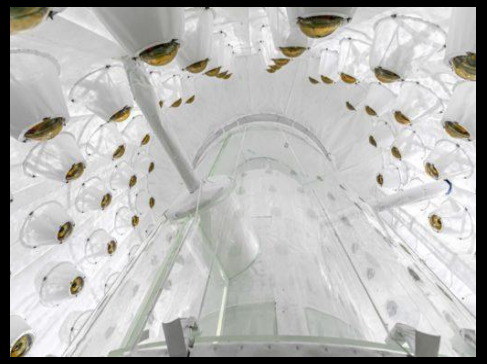


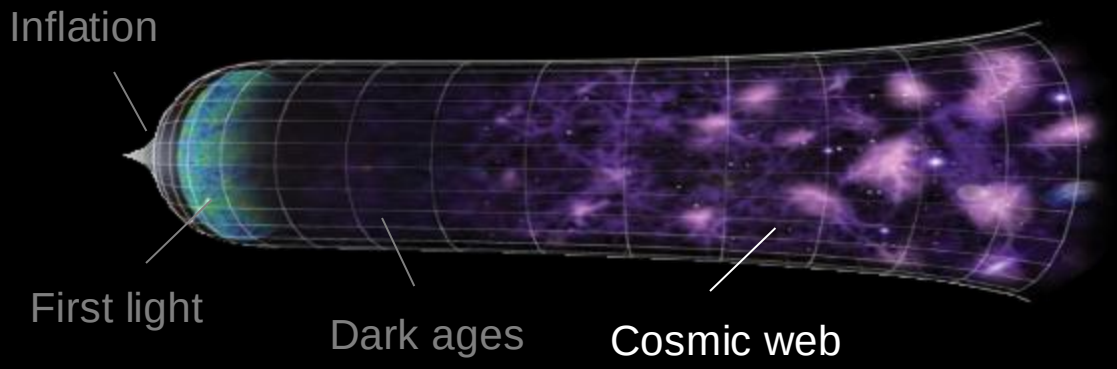
# Leading research on Dark Matter

Lead Lab for Lux-Zeplin (LZ) experiment

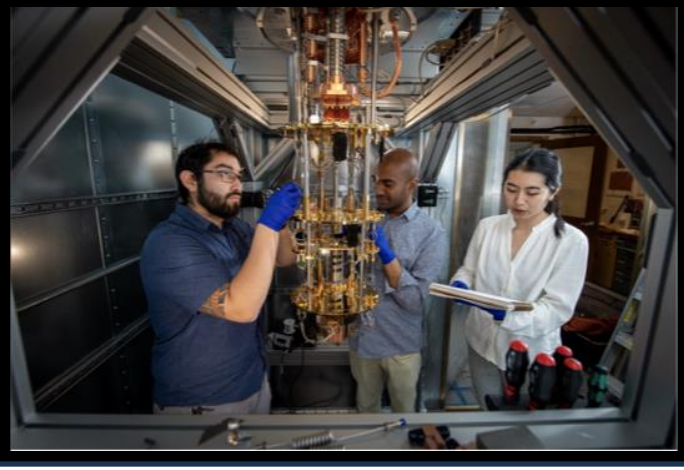
Searching for extremely rare interactions of dark matter particles in detector

- 7-tonne liquid Xenon detector
- 1 mile deep underground in South Dakota mine!
- World-leading exclusion limits

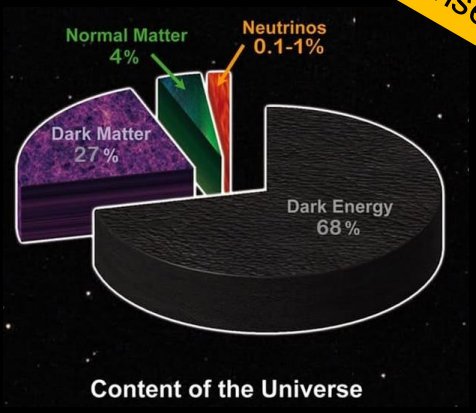





Developing new detection techniques for light-mass dark matter particles (use of quantum detectors)

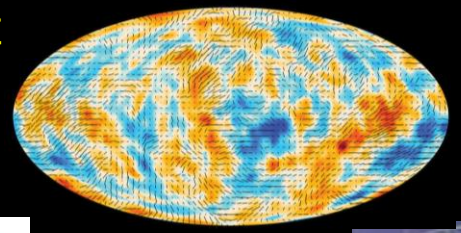


Peter Sorensen

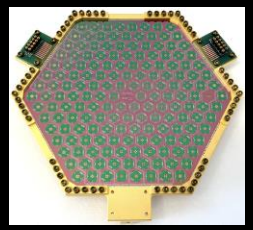


# Leading research on the first instants of our Universe

Lead Lab for CMB-S4 experiment

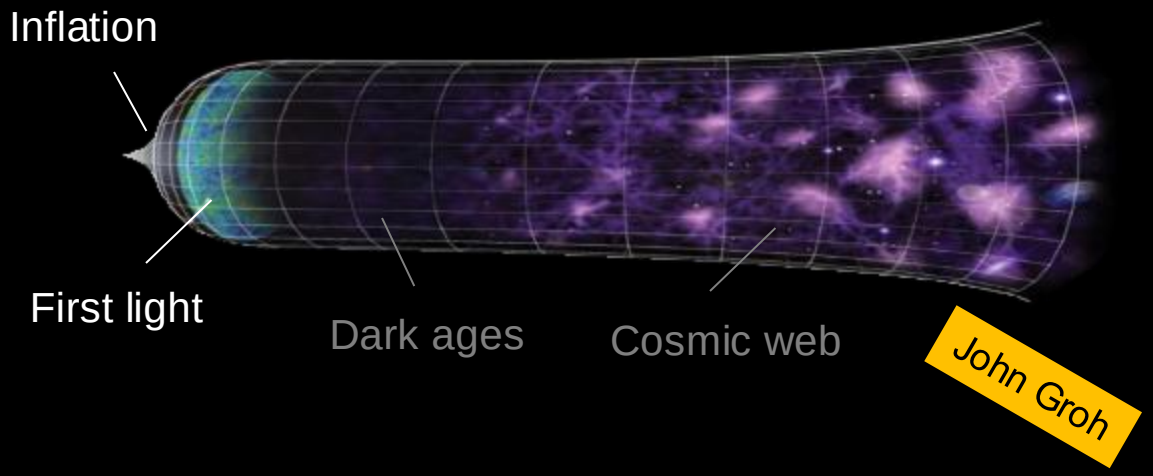


Expertise on
- Simulations
- Survey design
- Detectors



Experiments in
- South Pole & Atacama desert

⟹ study inflation and history of the early Universe




South Pole Observatory

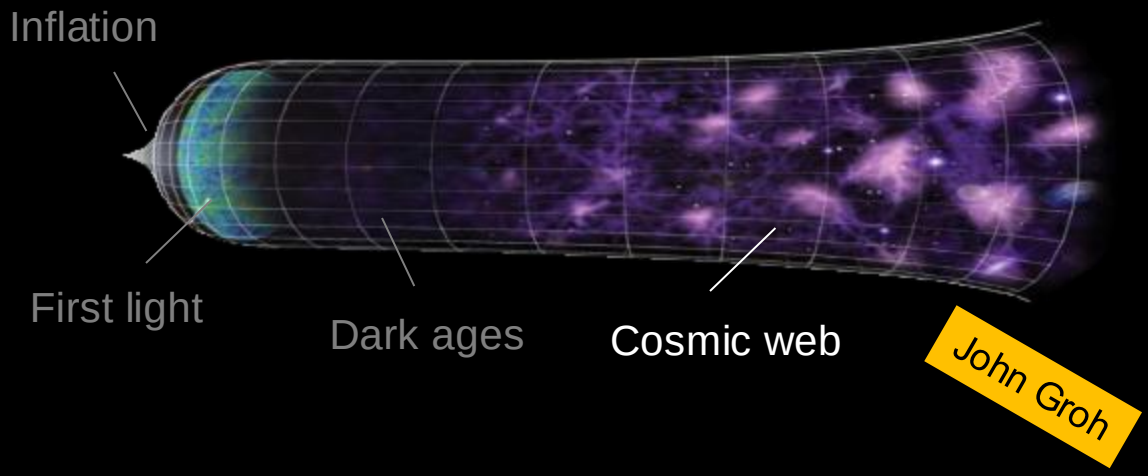
Atacama desert (Chile)

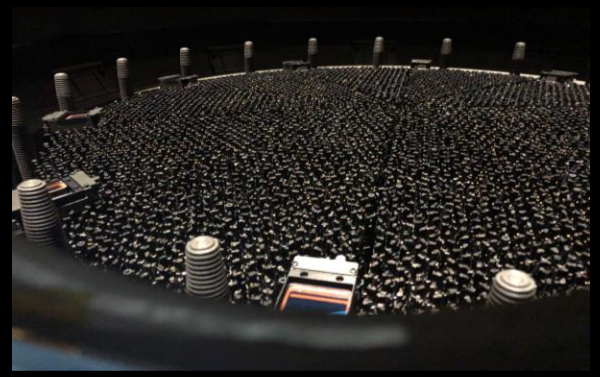
# Leading research on Dark Energy

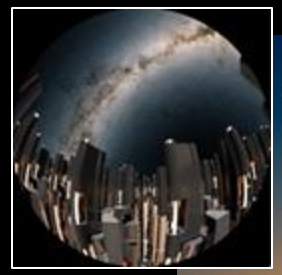
Lead Lab for DESI – Dark Energy Spectroscopic Instrument

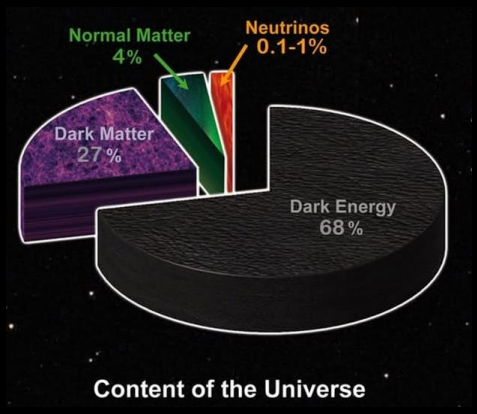
Mapping the Universe in 3D
- With 40 millions galaxies and quasars
- Using 5000 robots

To measure imprint of early Universe on galaxy distribution
⟹ Dark energy







# Enjoy your visit!

Building 50 patio

Theory-Dark Matter
lunch
discussion

# Thank you!