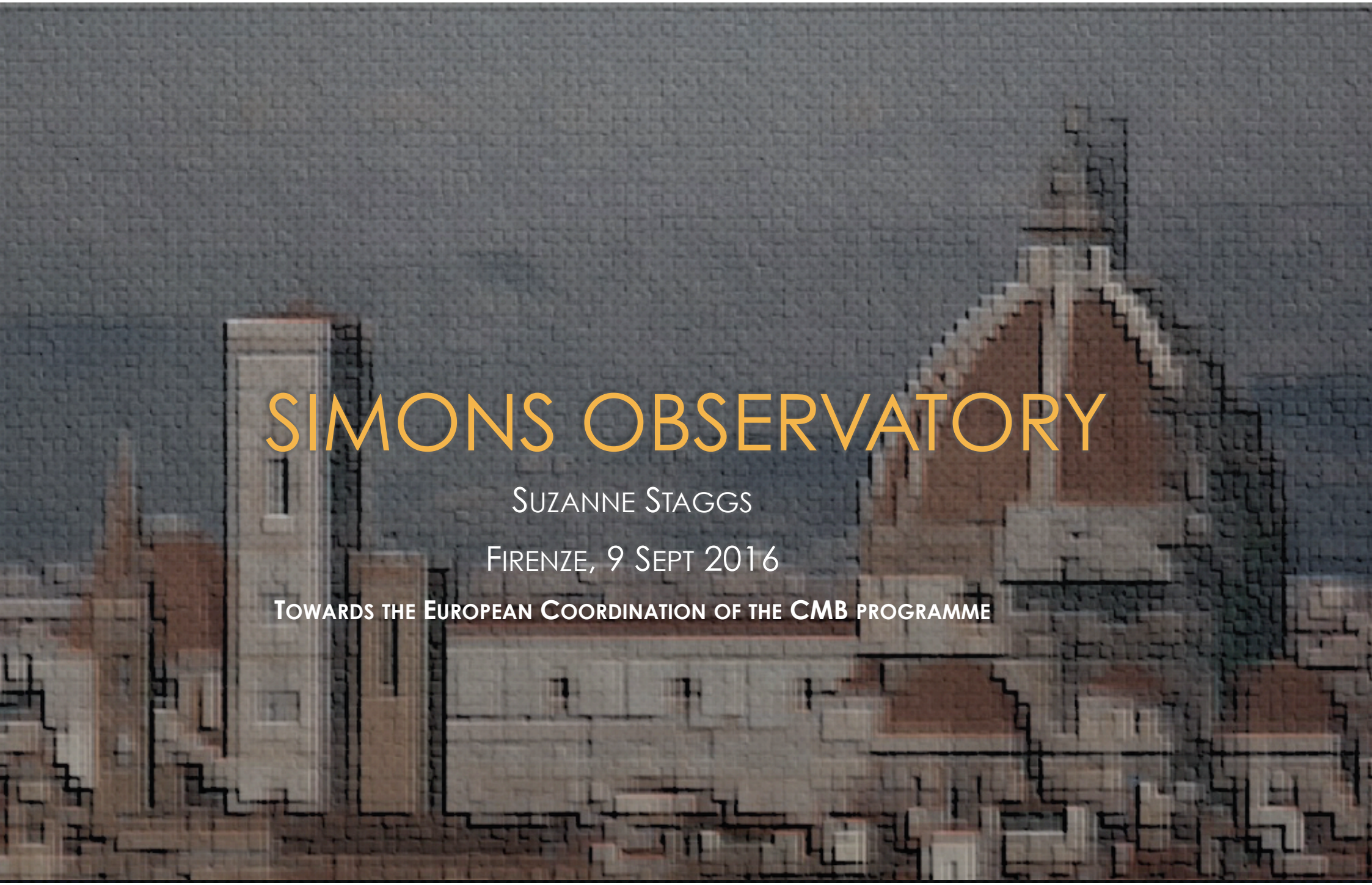


SIMONS OBSERVATORY

Suzanne Staggs

Firenze, 9 Sept 2016

Towards the European Coordination of the CMB programme

Collaboration

- 8 Countries
- 45+ Institutions
- 150+ members

United States

- Carnegie Mellon University
- Columbia University
- Cornell University
- Dunlap Institute/Toronto
- Florida State
- Haverford College
- Johns Hopkins University
- Lawrence Berkeley National Laboratory
- NASA/GSFC
- NIST
- Princeton University
- Rutgers University
- Stanford University/SLAC
- Stony Brook
- University of California - Berkeley
- University of California – San Diego
- University of Colorado
- University of Illinois at Urbana-Champaign
- University of Michigan
- University of Pennsylvania
- University of Pittsburgh
- West Chester University

Canada

- CITA/Toronto
- Dalhousie University
- Dunlap Institute/Toronto
- McGill University
- University of British Columbia

Chile

- Pontificia Universidad Catolica
- University of Chile

Europe

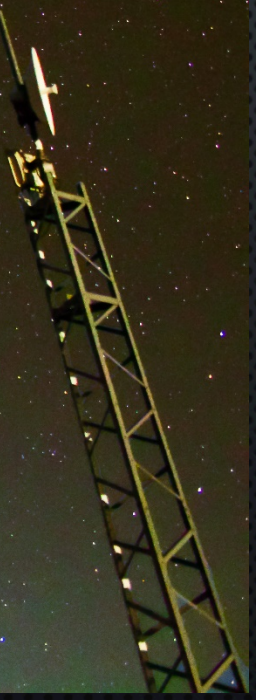
- APC - France
- Cardiff University
- Imperial College
- Manchester University
- Oxford University
- SISSA – Italy

Japan

- KEK
- IPMU

South Africa

- Kwazulu-Natal, SA




MONS OBSERVATORY SITE
5200 m

MONS OBSERVATORY SITE

A

MONS OBSERVATORY SITE

A

CLASS

ACT

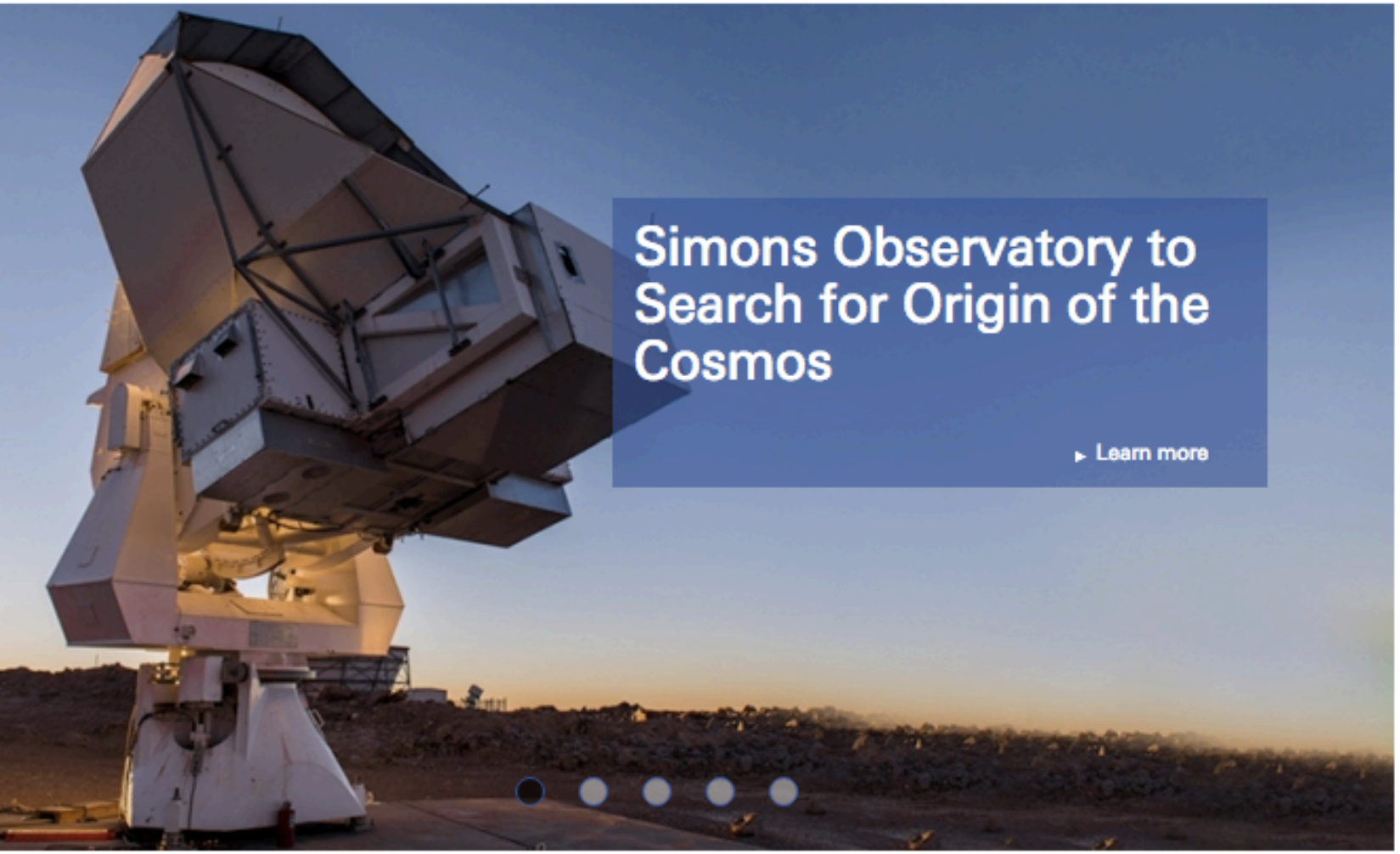
POLARBEAR/SIMONS ARRAY

MONS FOUNDATION

ing Research in Basic Science and Mathematics

SIMONS SOCIETY OF FELLOWS | DATA RESOURCES | FOUNDATIC

ATHEMATICS & PHYSICAL SCIENCES | LIFE SCIENCES | AUTISM RESEARCH | EDUCATION & OUTREA



MAY 2016

WHAT IS THE SIMONS OBSERVATORY?

GROUND-BASED CMB OBSERVATORY IN CHILE, UNDER DEVELOPMENT

ACT + SIMONS ARRAY TEAMS ++

SIMONS FOUNDATION FUNDING: $40M

UNIVERSITY & LAB FUNDING: $5M

- UCSD
- BERKELEY/ LBNL
- U PENN
- PRINCETON

Collaboration

- 8 Countries
- 45+ Institutions
- 150+ members

United States

- Carnegie Mellon University
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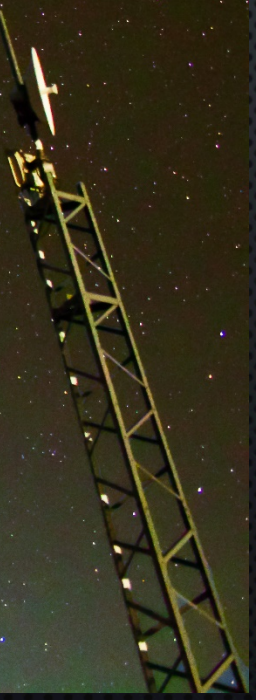


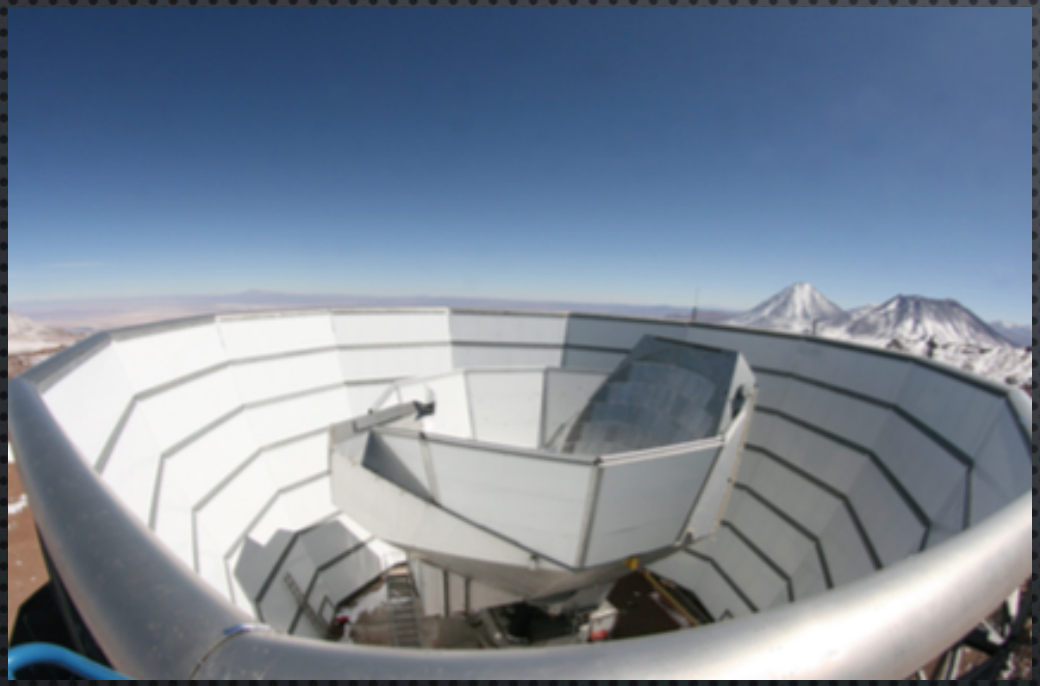
THE SIMONS OBSERVATORY COMBINES THE ACT AND SIMONS ARRAY TEAMS

Simons Array

ama
nology
scope

CT & the Simons Array will operate independently with current NSF/MSIP awards (until 2018/2019).
or now: ACT & the SA will develop and begin sharing site infrastructure.
LASS is not currently part of the Simons Observatory. We will work to share infrastructure.

ATACAMA COSMOLOGY TELESCOPE (ACT)

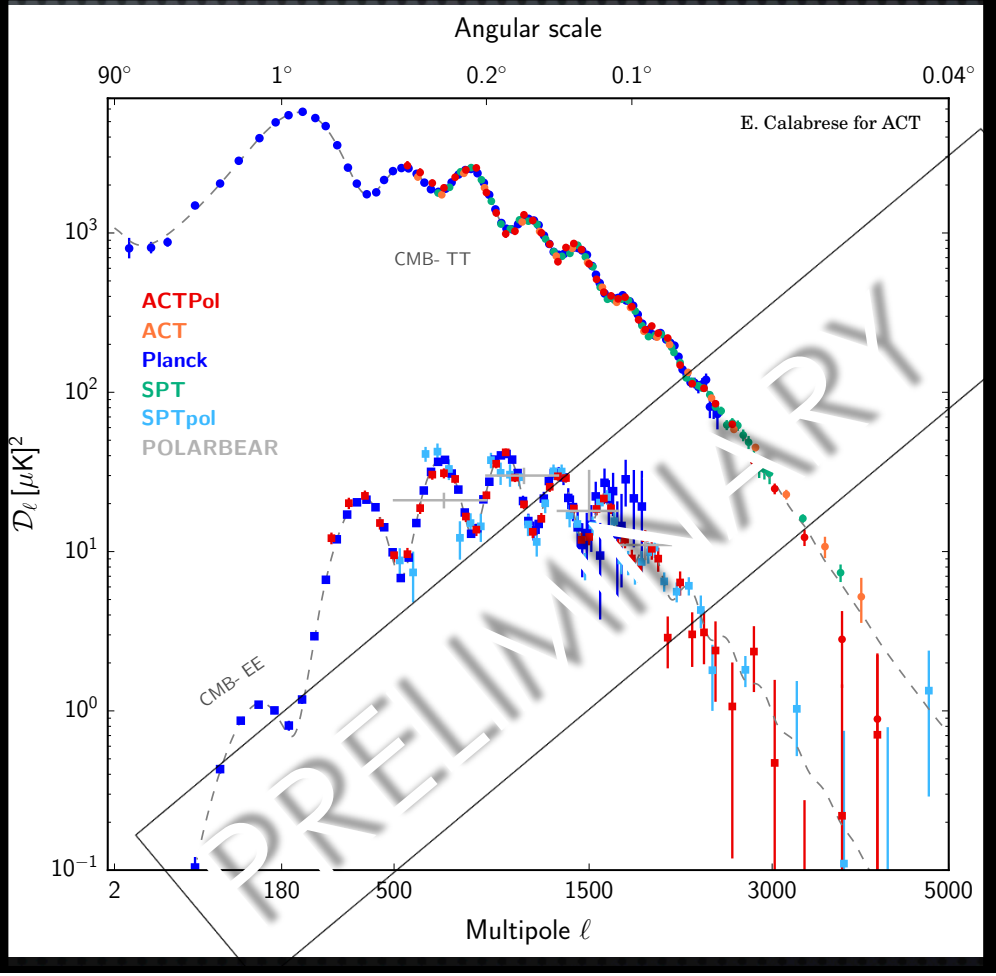


ACT: 6m telescope at 5200 m in Chile
ACTPol Camera: 2013-2015, 150 & 90 GHz
1.4' at 150 GHz

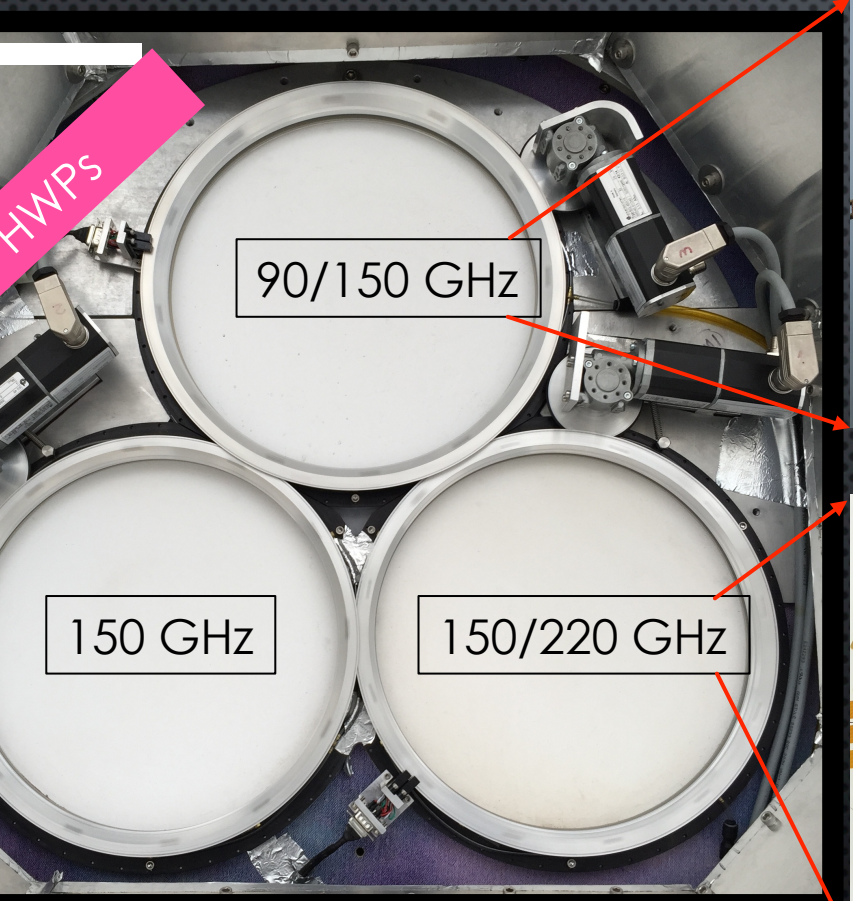
D56 Field: ~ 650 deg^2 , @ δ ~ -3°, RA ~ 15°

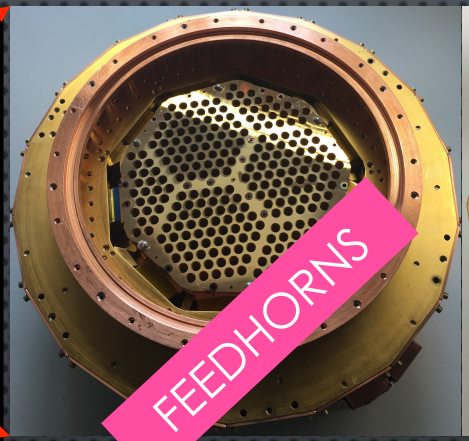
PRELIMINARY ACTPol SPECTRA

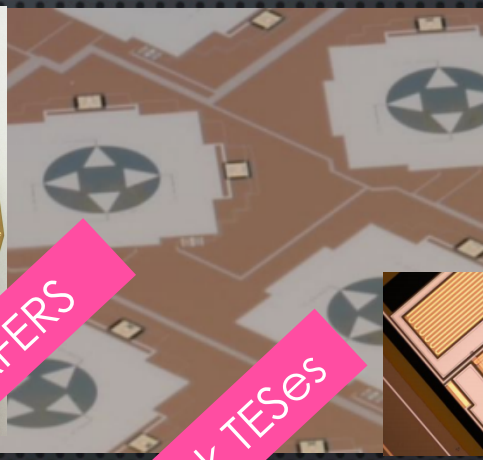
D56 Field
(<15% of the ACTPol data)

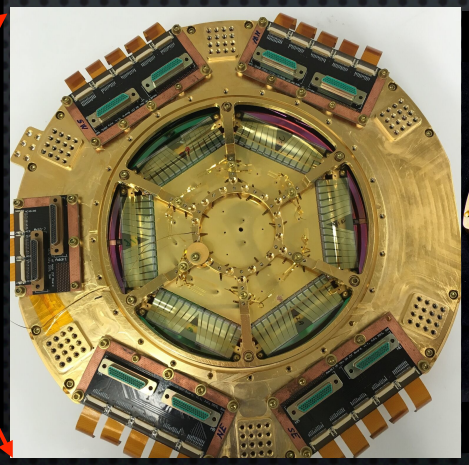


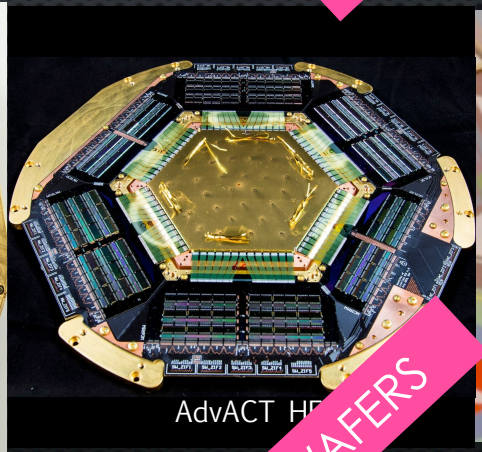
ATACAMA COSMOLOGY TELESCOPE
HWPS & MULTICHROIC DETECTOR ARRAYS

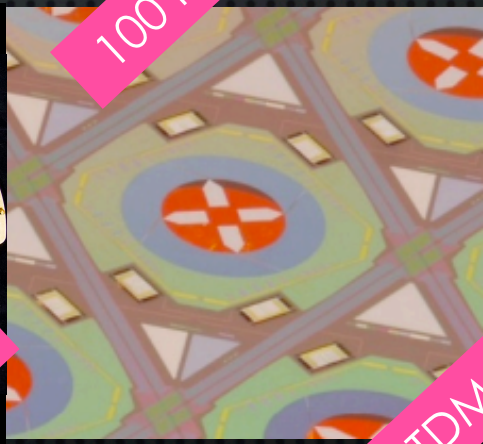












Rotating Half Wave Plates (8 Hz Modulation) not installed in this picture

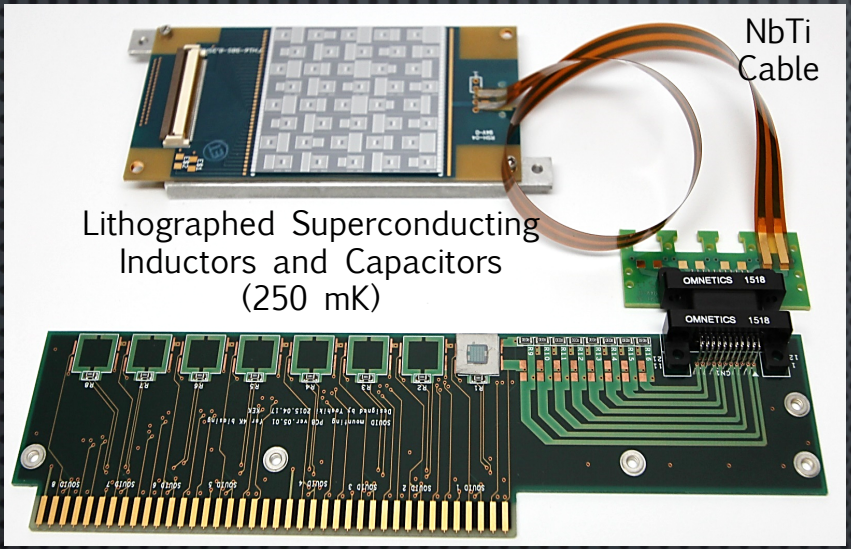
90/150 GHz installed for 2015, and 150/220 GHz instal[illegible] in July 2016

SIMONS ARRAY (STAGE-3)

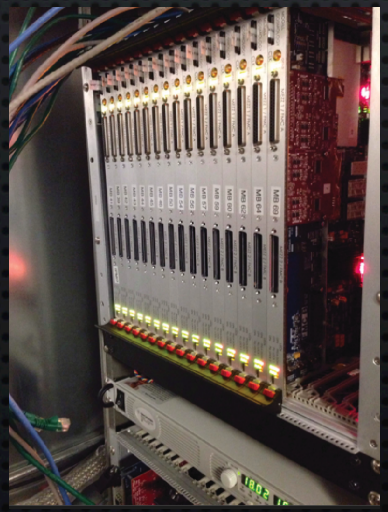
Simons Array (= 3x POLARBEAR-2)

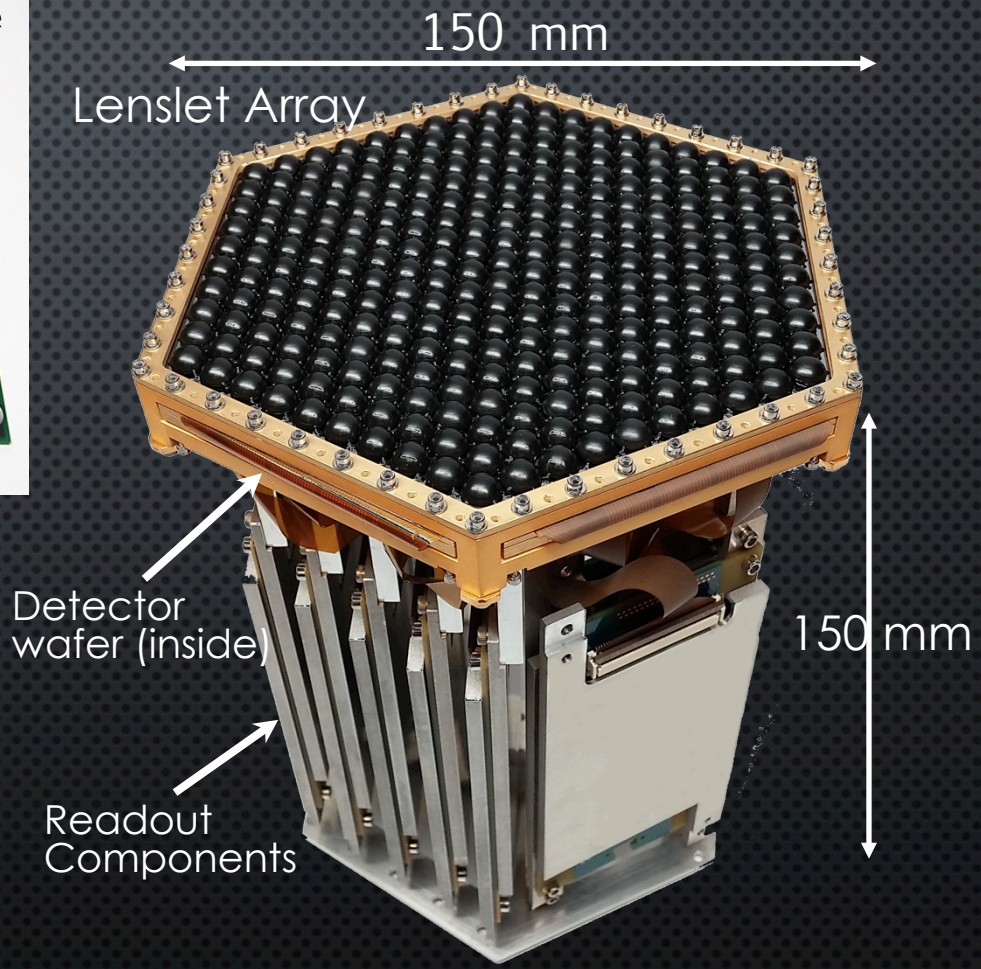
- 22,764 bolometers
- Resolution : 3.5’ @150GHz
- 4 frequency bands (95/150/220/280 GHz)
- Deep + Wide sky surveys (f_{sky}=65% visible)

SIMONS ARRAY FOCAL PLANE AND READOUT



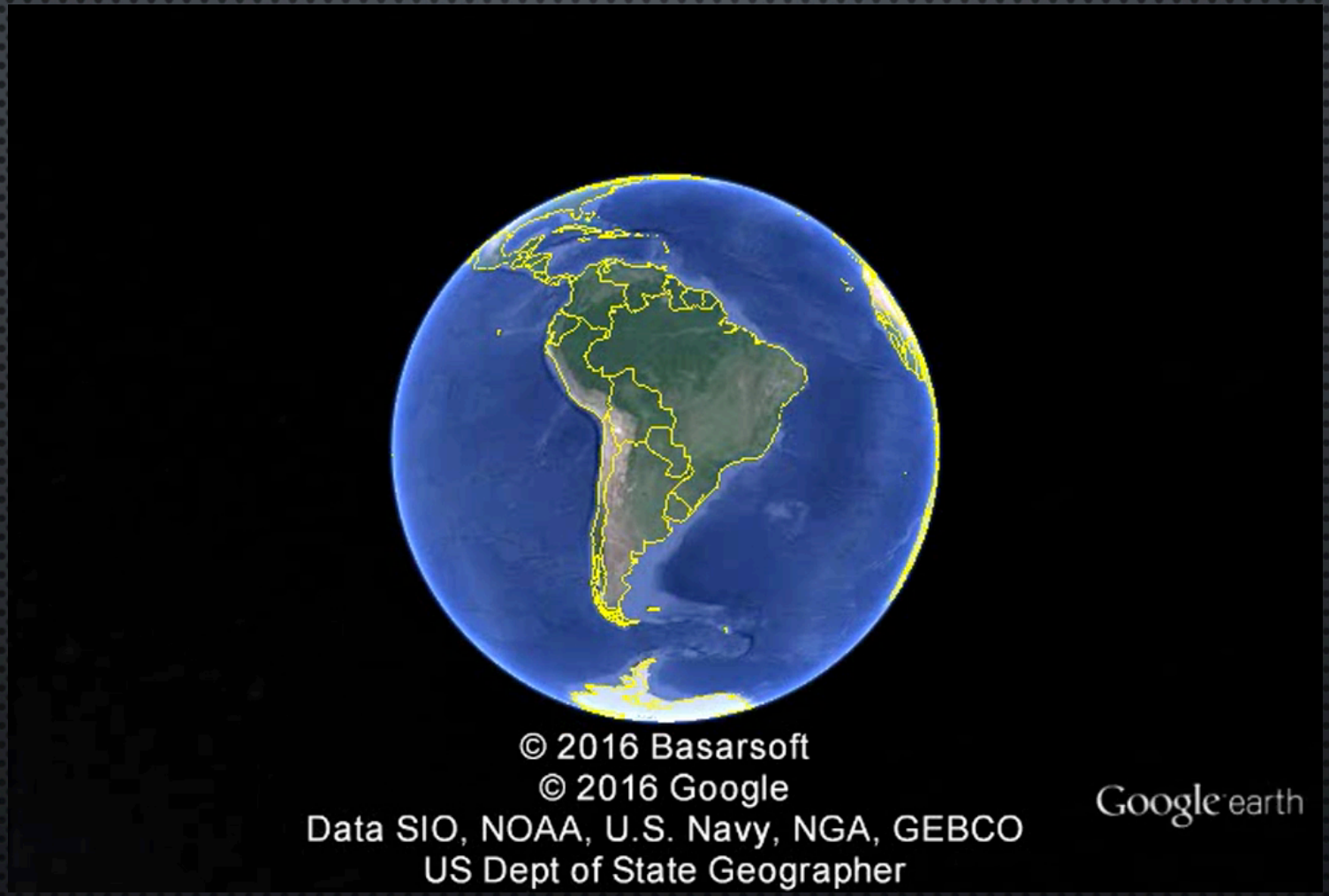
SQUID Printed Circuit
Board (4 K)





Detector Module Photograph

WHY CHILE?

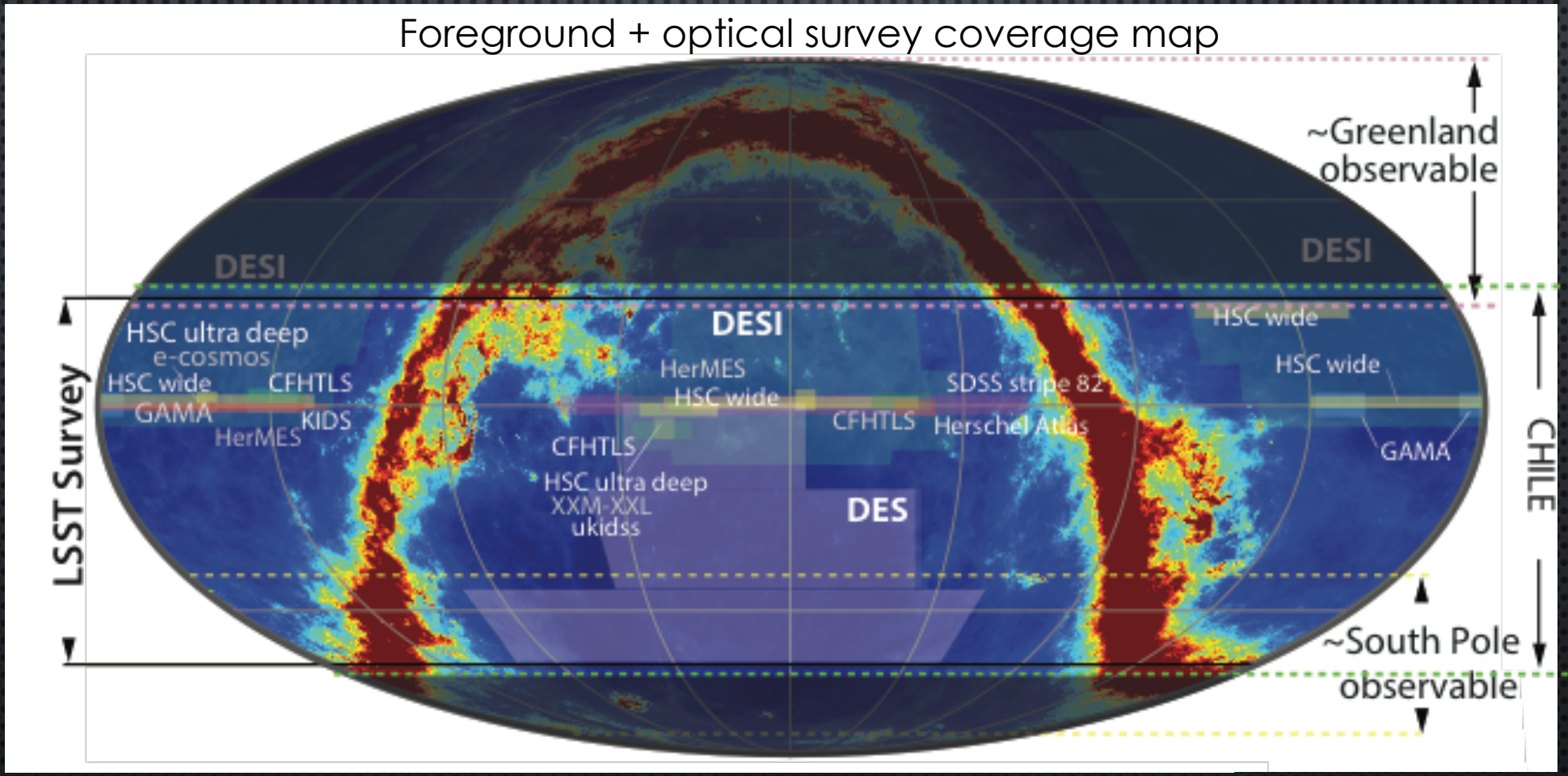


- Mid latitude site (23° south): access to over half the sky.
- High (5,200 m) and dry: **Exceptional Observing**

Movie courtesy of Mark De

WHY CHILE?

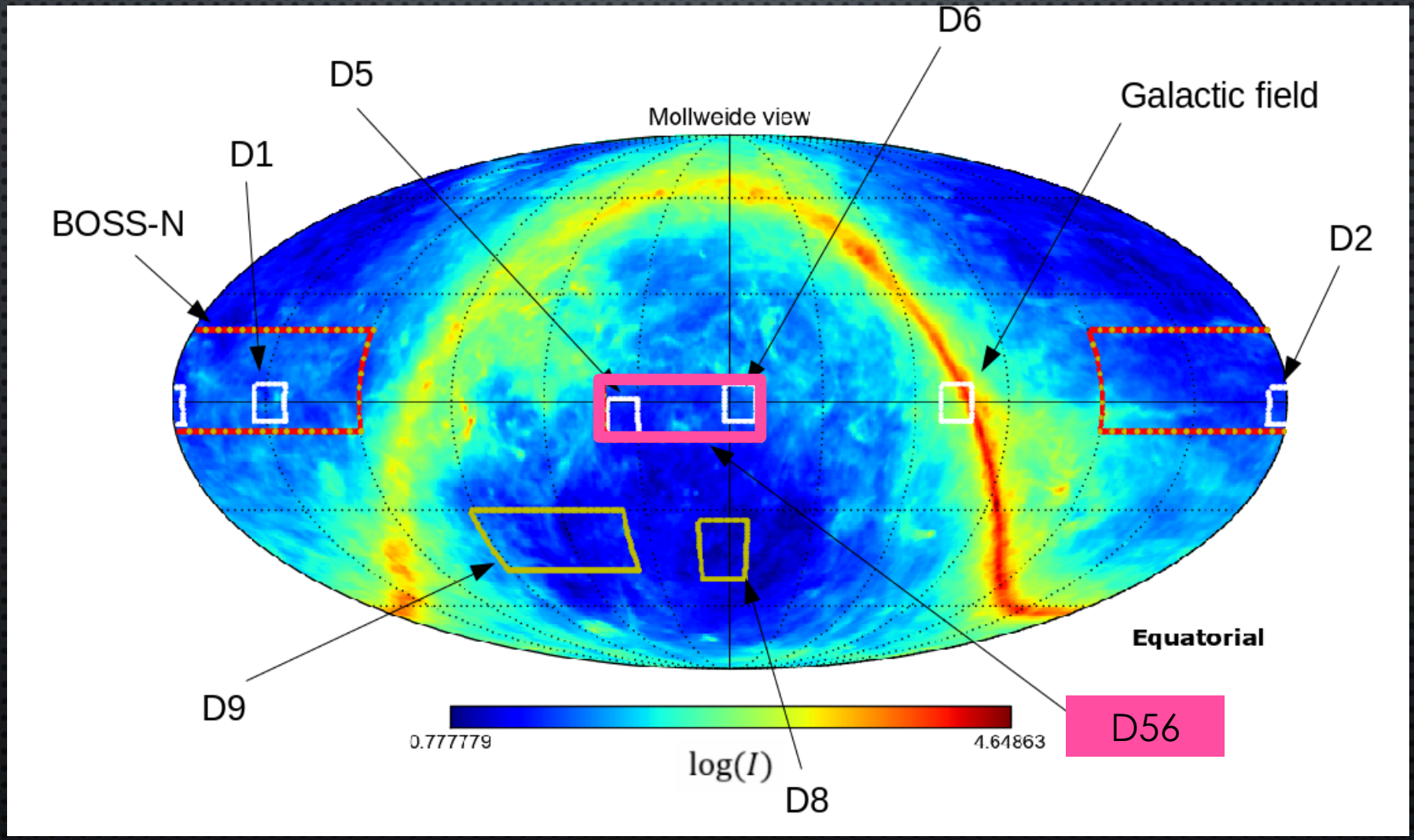
Foreground + optical survey coverage map



Lots of sky visible

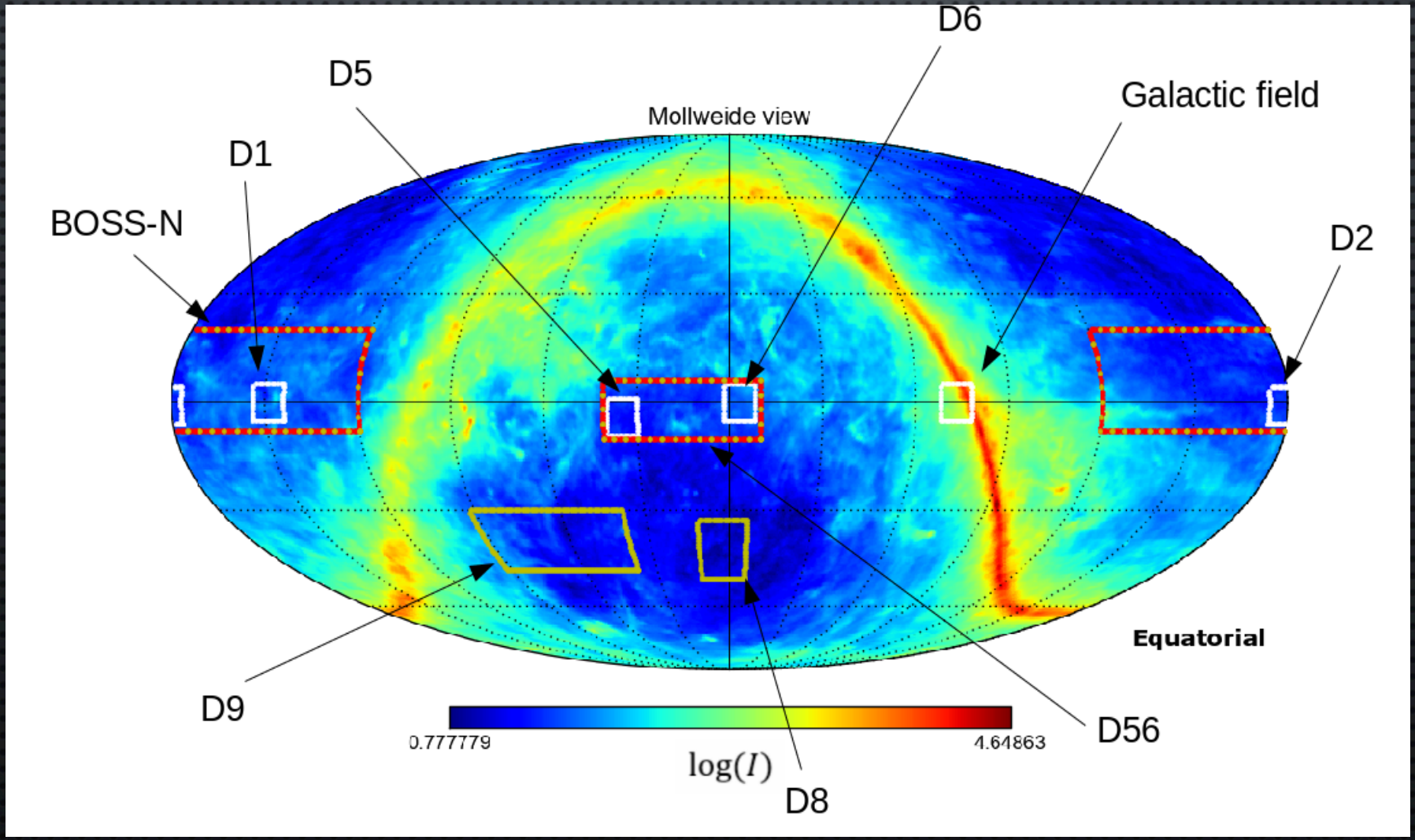
Overlap with optical surveys for cross-correlation work (ANTHONY CHALLINOR TALK YESTERDAY)

ACTPOL FIELDS (2013-2015)



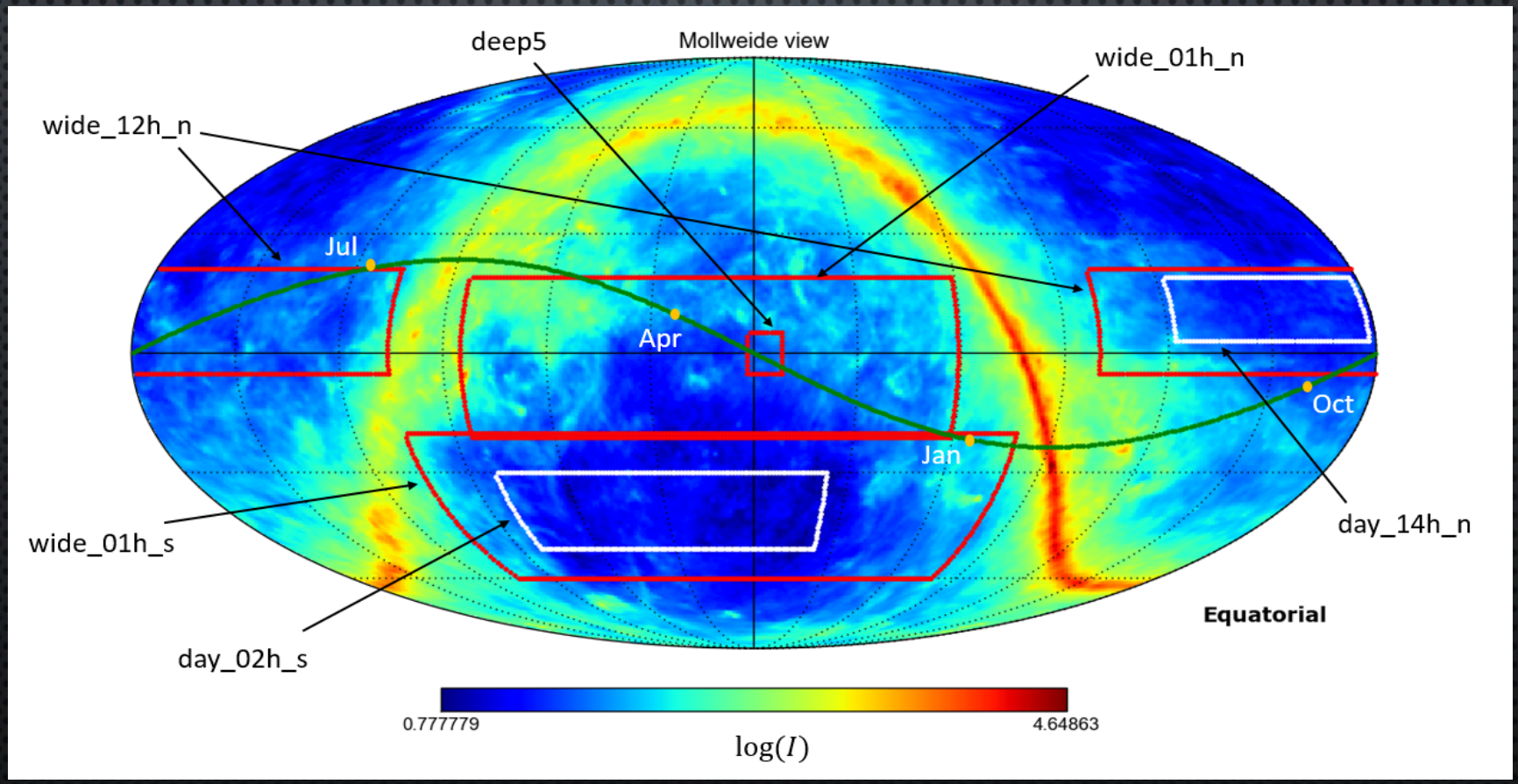
de Bernardis et al, 2016; arXiv: 1607.

HALF THE SKY??



de Bernardis et al, 2016; arXiv: 1607.

ADVACT FIELDS
17,000 deg^2
~ HALF THE SKY!



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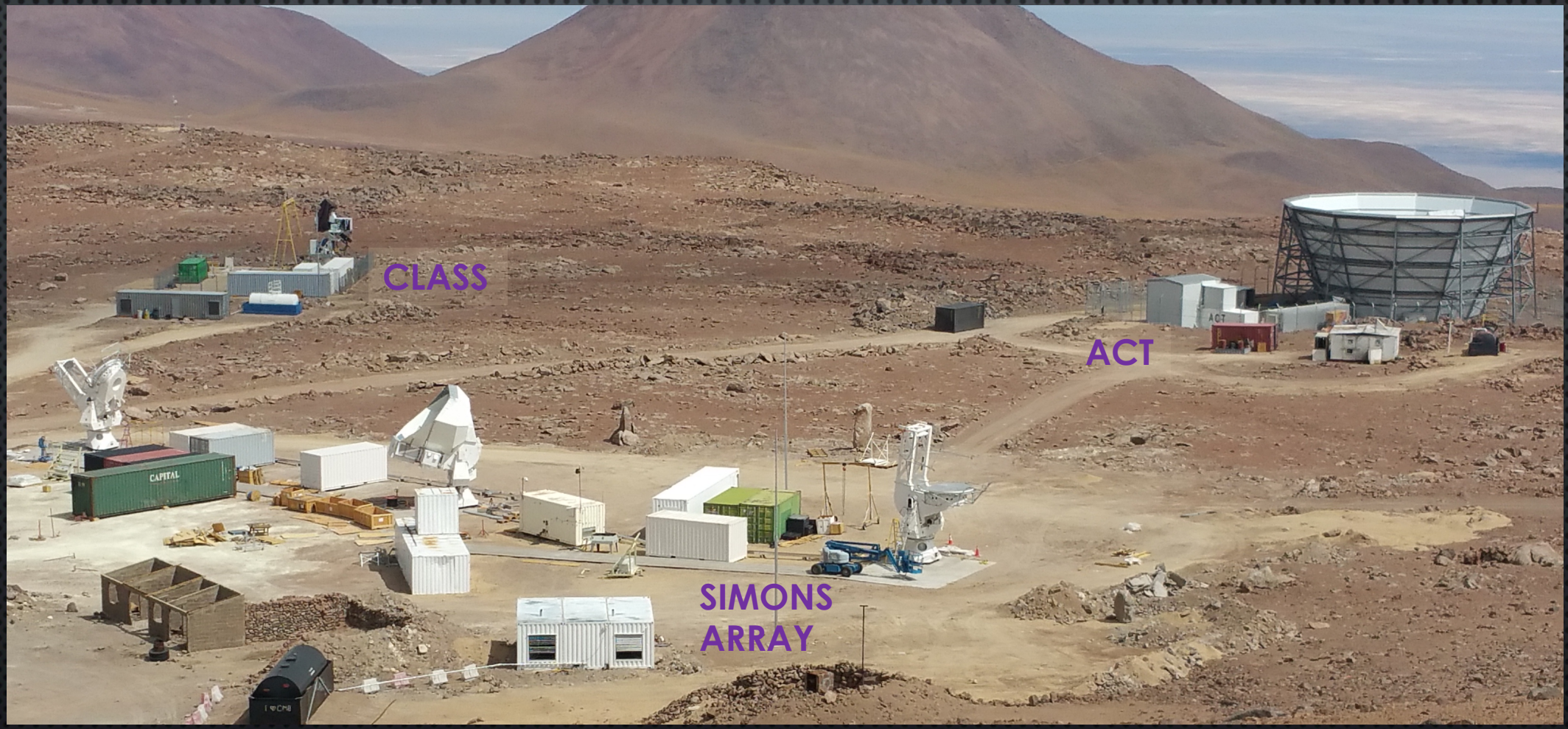
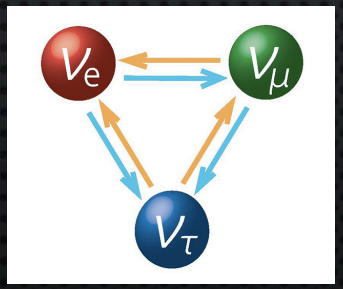
WHY CHILE?

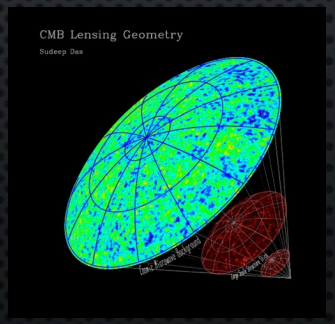


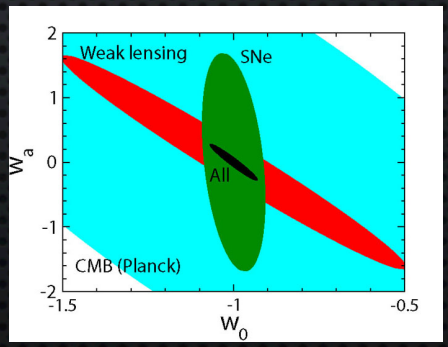
- Existing (and growing!) facilities.
- Significant infrastructure available: ALMA, mining
- Easy access: < 24 hours door to site.

SIMONS OBSERVATORY GOALS

- PRIMORDIAL GRAVITATIONAL WAVES (B-MODE TENSOR FLUCUTATIONS)*
- NEUTRINO MASS, N_{eff} , DYNAMIC HISTORY (w, modified gravity)* via:
  - CMB lensing
  - Cross-correlations
  - Cluster survey to trace matter; kSZ to trace velocity fields
- OTHER WINDFALLS -- primordial magnetic fields, parity violation







* See yesterday's talks from Ringeval, Challinor, Carlstrom

SIMONS OBSERVATORY GOALS

The Simons Observatory will:

- incorporate several new telescopes at the site in Chile and
- deploy new cameras with state of the art detector arrays.

An overarching goal is to help set the stage for CMB-S4

SIMONS OBSERVATORY PLANS

- New telescopes.
  - Sizes and configuration TBD.
- Significant Infrastructure Upgrades.
  - Power, internet, and logistics.
- Technology Development:
  - Detectors, Optics, Telescopes, Receivers.

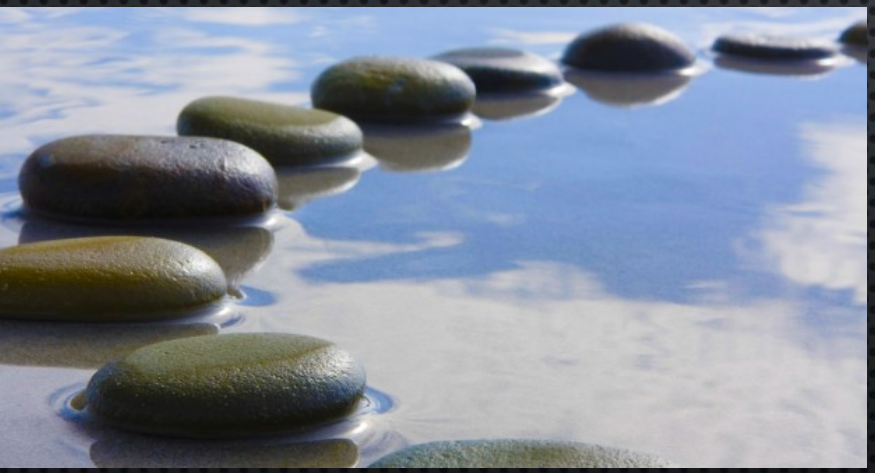
- Coordinate the telescope and receiver designs to take advantage of the scale of the project.

The Simons Observatory and S4

SIMONS OBSERVATORY: STEPPING STONE TO FUTURE CMB S4 CHILE SITE

imons Observatory prototypes to **accelerate** S4 process

- S4-capable telescopes, shielding, cold optics
- S4-capable cryostats, focal planes, muxing



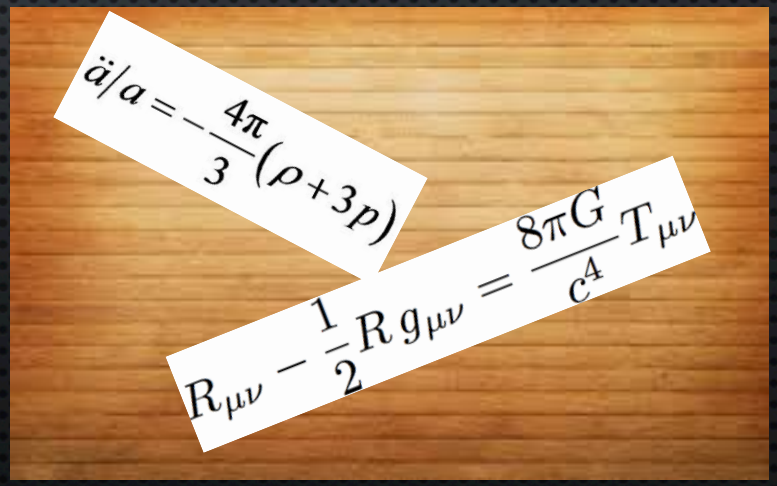
- Prototyping jumpstarts the S4 Chile site, but aims to **aid** CMB-S4 globally
- Work designed to **complement** CMB-S4 funding from NSF and the DOE

The Simons Observatory Structure & Planning

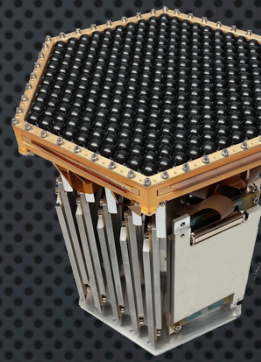
- Mark Devlin: spokesperson
- Brian Keating; director
- Project Manager: identified
- Planning Committee: providing oversight of boards
- Science & Technical Boards: under way, guiding Working Groups

THE SCIENCE BOARD

- In the context of S4, what are the goals of the SO?
- What sensitivities are needed vs l and f for those goals?
- Work with Technical Board to optimize configuration
- Working Groups:
  - Time Domain
  - Measuring r
  - Parameters from high-l
  - Lensing
  - Clusters/SZE
  - Extragalactic Sources
  - Optimization

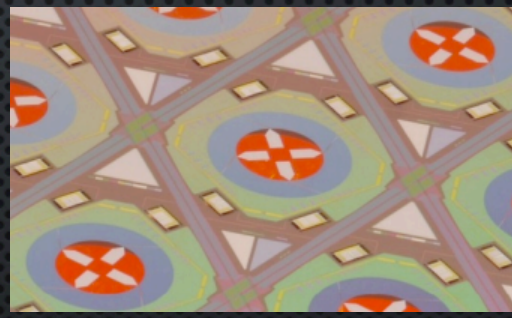


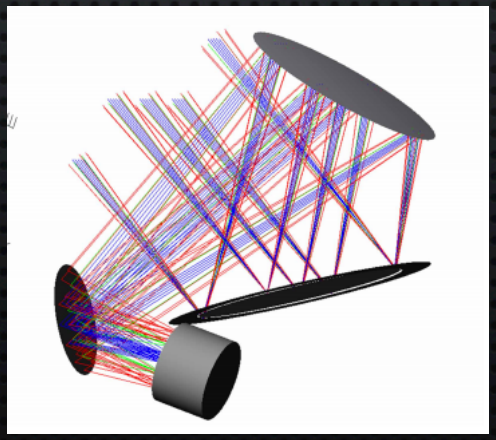
THE TECHNICAL BOARD



Review status of existing technologies
Identify enabling technologies for early study
Work with Science Board to optimize configuration
Working Groups:

- Cryogenics and Interfaces
- Cameras and Cold Optics
- Detectors and Readouts
- Large Aperture Telescopes
- Small Aperture Telescopes
- Site





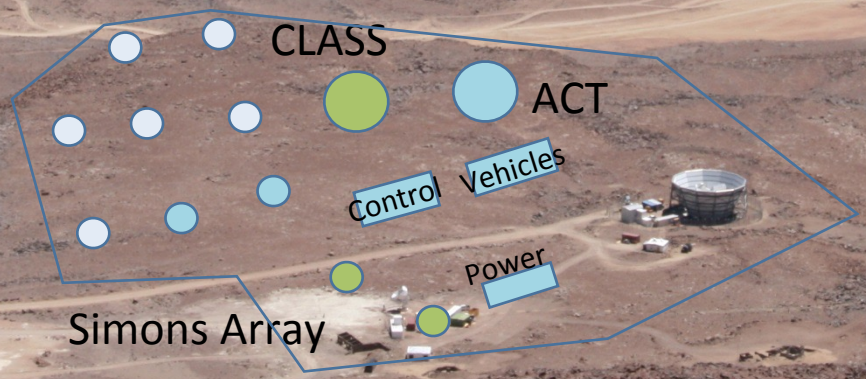
SIMONS OBSERVATORY INFRASTRUCTURE

ALMA

Infrastructure in Preparation for CMB S4.

- 500 KVA power plant
- Combined control room
- Telescope/receiver staging building
- High bandwidth internet connection to ALMA

Two Site Engineers + Technician



Existing

Simons Observatory Phase 1

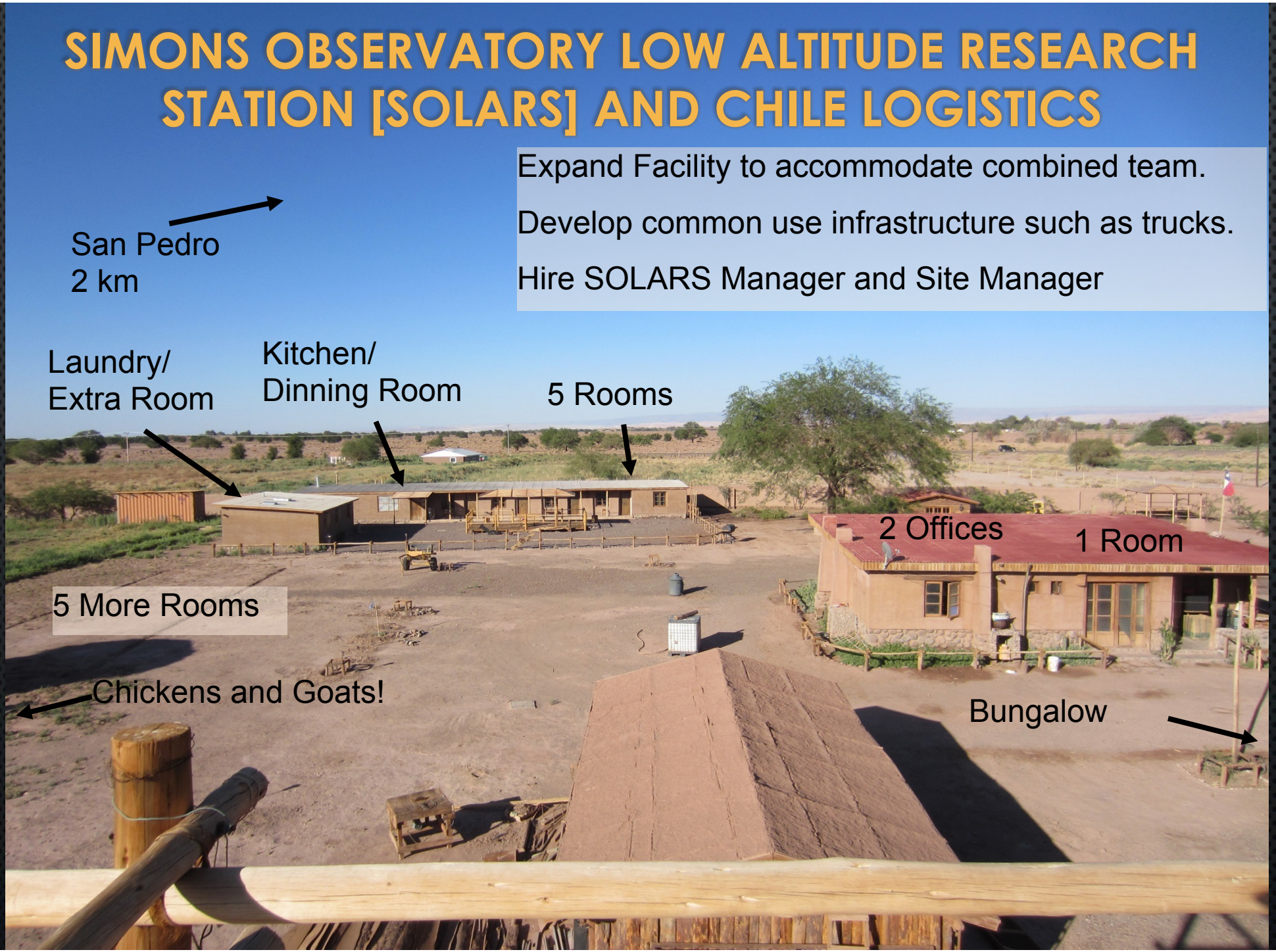
Pads for Simons Observatory Phase 2 and CMB S4

SIMONS OBSERVATORY LOW ALTITUDE RESEARCH STATION [SOLARS] AND CHILE LOGISTICS

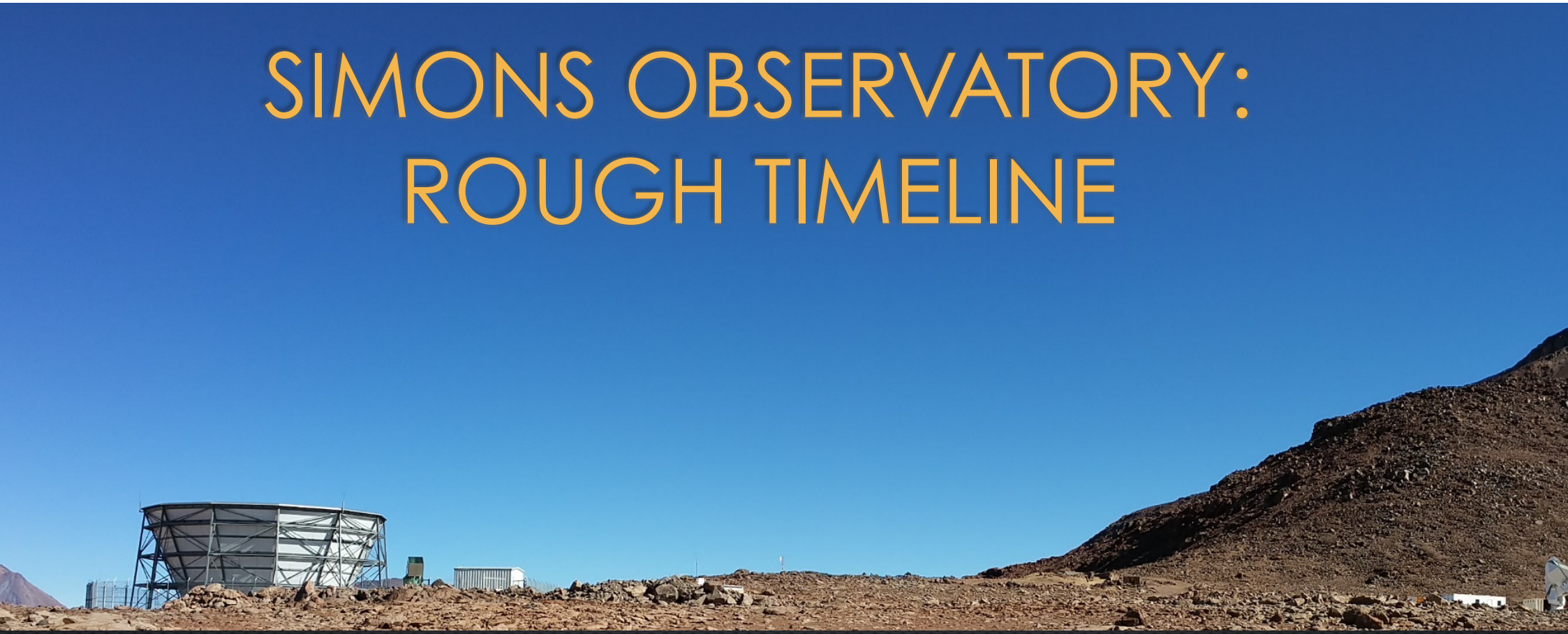
Expand Facility to accommodate combined team.

Develop common use infrastructure such as trucks.

Hire SOLARS Manager and Site Manager

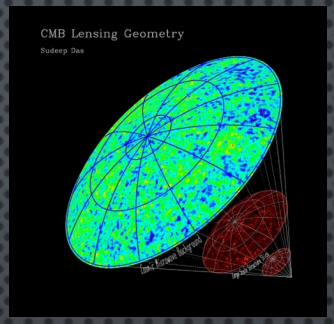


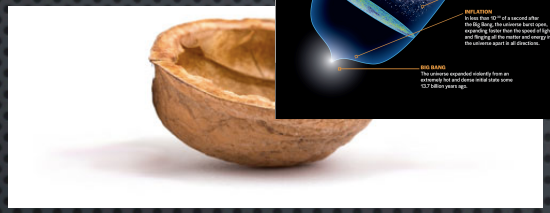
SIMONS OBSERVATORY: ROUGH TIMELINE



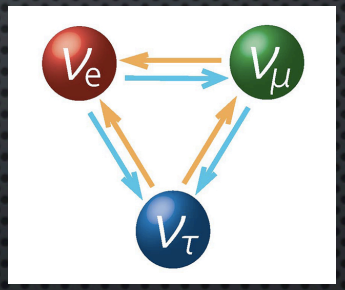
anning and Technology Development: 2016-2017
ogrades to the site infrastructure: 2016-2018
onstruction and installation of telescopes by end of 2020.
oduction of new CMB-S4-type receivers with partially filled foca
anes by end of 2020.
oserving: 2021-2022

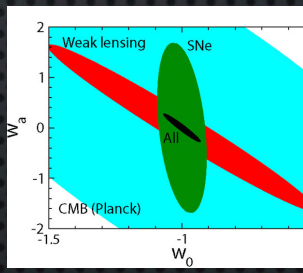
MONSOBSERVATORY

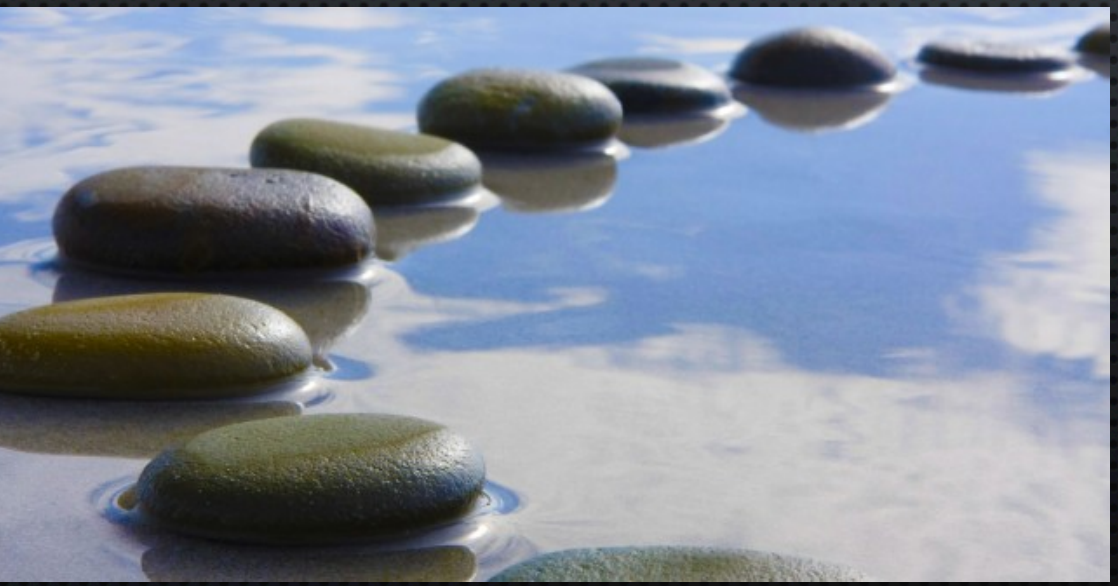




END SLIDE







https://simonsobservatory.o