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# CMB-S4

Next Generation CMB Experiment

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## March/Berkeley Meeting Report

Ken Ganga

This is an update to our earlier report on S3/4:

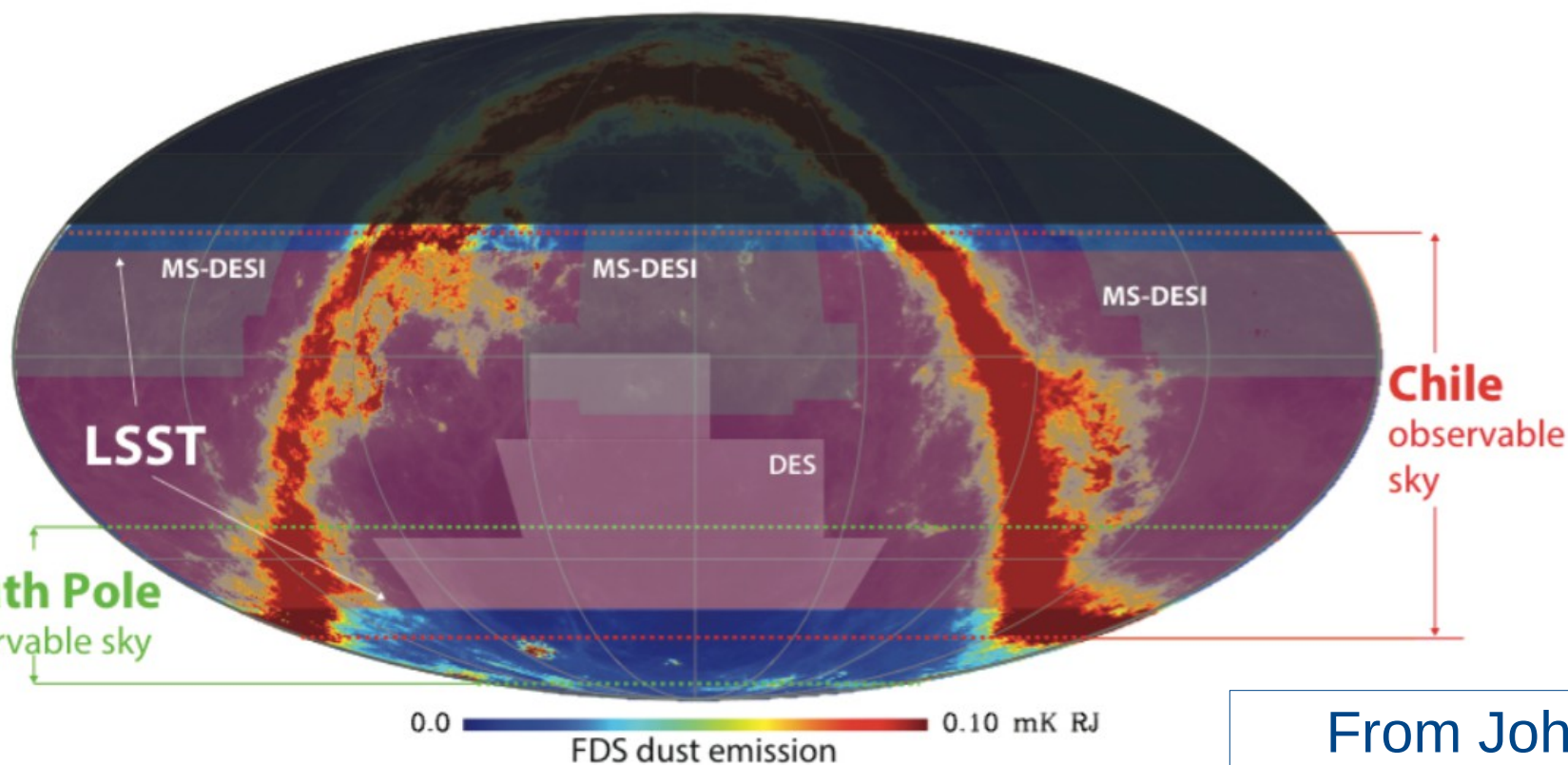
<http://prospective.planck.fr/uploads/Main/X1-Ganga-2015-11-26%20S4.pdf>

# Baseline S4 Sky Coverage

Coverage from Chile and South Pole

70% of the sky, overlapping the large optical surveys

**Greatly enhance DES, DESI and LSST science by overlapping sky**



SPT has a 10m primary,

→

$$1.22 \cdot \lambda / D \\ \sim 0.8'$$

ACT has a 6m primary,

→

$$1.22 \cdot \lambda / D \\ \sim 1.4'$$

From John Carlstrom  
AAAC January 28, 2016

Possibly add northern site for full sky coverage: Tibet? Greenland?  
May provide opportunity for international partner.

# The Science Book is Being Written

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- [https://cosmo.uchicago.edu/CMB-S4workshops/index.php/File:Cmbs4\\_scibook-160329.pdf](https://cosmo.uchicago.edu/CMB-S4workshops/index.php/File:Cmbs4_scibook-160329.pdf)
- Its purpose is to set the CMB-S4 scientific goals and (eventually) the instrumental configuration required to achieve them
  - Participation is open. To do so,
    - Contact the emails at the start of each chapter, or sign up at:
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_de](https://cosmo.uchicago.edu/mailman/listinfo/s4_de)
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_inflation](https://cosmo.uchicago.edu/mailman/listinfo/s4_inflation)
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_neutrinos](https://cosmo.uchicago.edu/mailman/listinfo/s4_neutrinos)
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_forecasting](https://cosmo.uchicago.edu/mailman/listinfo/s4_forecasting)
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_lensing](https://cosmo.uchicago.edu/mailman/listinfo/s4_lensing)
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_skymode](https://cosmo.uchicago.edu/mailman/listinfo/s4_skymode)
      - [https://cosmo.uchicago.edu/mailman/listinfo/s4\\_telescopes](https://cosmo.uchicago.edu/mailman/listinfo/s4_telescopes)
  - When the goals are defined, the instrumental configurations can be addressed

# Angular Resolution

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- Balance between “small” versus “large” apertures
    - Experiments like BICEP can be replicated “fairly easily”, but it's difficult to imagine replicating SPT
    - There is interest in the Niemack focal plane solution
  - $r$  &  $\tau$  versus  $\Sigma m_\nu$  &  $N_{\text{eff}}$ 
    - There is some “covariance” from  $\tau$  and delensing
  - Numbers of detectors per focal plane versus numbers of focal planes
    - If you're looking for  $r$ , you want to cover a small area (though large enough to measure  $\ell \sim 75$ ) until you detect something, then increase area
    - If you're looking for structure, which you detect fairly easily, you want to cover as much area as possible
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# Atmosphere

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# Site

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- With or without waveplates
    - This seems to be different for South Pole vs. Chile
    - This has implications for data formats
  - Denis Barkats & Abby Vieregg are starting a program to map the spatial structure of the atmosphere at the South Pole & Greenland
  - DOE will fund only the cameras
    - NSF is still funding operations
  - For the moment, there are only Chile & the South Pole
    - Note: it isn't really optimal to observe a single, small patch from Chile
    - There was less discussion of Greenland & Tibet at this meeting than at the last meeting
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# Balloons

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- The second Spider flight is planned for the end of 2017 with a 285 GHz channel.
  - EBEX has been re-proposed to cover 150-360 GHz
  - There seems to be some acceptance that balloons should be used for observations which cannot be done from the ground (for reasons similar to those presented in our last update). So they will “probably” focus on:
    - Higher frequencies
      - BFORE has been proposed as an ultra-long-duration balloon campaign in three bands from 270 to 600 GHz
    - Larger angular scales
      - There is a movement towards perhaps using balloons to try to measure  $\tau$  (with an “archeops-like” scanning strategy; but see CLASS)
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# Some Unfiltered French Possibilities

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- An independent experiment “associated” with S4?
    - E.g., QUBIC and/or it's progeny?
  - A standalone telescope like others?
    - Copy a Polarbear telescope?
  - Individual contributions to individual experiments?
    - E.g., readouts for some experiment using TESs?
    - Analyses, as is being done already by many in French community (forecasting, analyses, dust expertise, etc.)
  - Develop an independent site?
    - Greenland telescope? Argentina?
  - Buy “tickets”?
    - Like some in the French community did for BOSS?
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