

Participation in US-led efforts

4th ASI/COSMOS Workshop Physics Department, University of Milano

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PolarBear/Simons Array: Data Analysis

- SISSA is part of the Simons Array since 2014
- Polarbear becoming the Simons Array (3 telescopes)
- Members, Tasks & Roles:
 - Nicoletta Krachmalnicoff: Foreground Characterization
 - Davide Poletti: Map-Making and Component Separation
 - Carlo Baccigalupi: Management Board





ACTPol - AdvACTPol: Site Management

- F. Nati was Site Manager at the ACT site in Chile (2014)
- Installed new arrays, observations, support for all operations
- Collected data doubled during and after his campaign



Simons Observatory

Set of telescopes in addition to ACT and POLARBEAR/Simons Array

LAT:

1 x 6 m aperture telescope coupled to over 30,000 transition-edge sensor bolometers Angular scales between 1' and tens of degrees

Baseline 7 optics tubes with dichroic pixels:

- 1 x 27/39 GHz
- 4 x 90/150 GHz
- 2 x 220/270 GHz

SAT:

3 x 42 cm aperture refractive telescopes, coupled to an additional 30,000+ detectors (27/39, 90/150, 220/270 GHz)

Located in the Atacama Desert at an altitude of 5190 m, 10% sky coverage

Approximately 20% of CMB-S4 mapping speed.

\$73M Project Budget. Construcion ends 2021. Observations through 2026.



Simons Observatory (+ ACT + POLARBEAR (SA))





How to effectively contribute to a ~75M\$ program with >200 people involved from dozens of institutions, based on ongoing, world-leading ground telescopes? Good strategies could be

- Additional instruments using the scalability of the SO design and leveraging on the massive work already done for design, logistics, organization, simulations;

- Improve on frequency coverage. Sky is "more complicated" than before, so one can extend coverage at low freq, ie STRIP-like focal plane to control over synchrotron;

- Instruments with alternative design, technologies, systematics control;

- Systematics are emerging above random noise. Contributing with calibrators not yet included in the project;

- Contributing with more ordinary work that would help the project to be on track.

Proposal developed by a European (so far, mostly UK) consortium for a major CMB instrument at the SO site in Chile

UK (M. Brown + several), France (APC), Italy (SISSA)

New optics tubes for LAT would mostly improve S/N ratio of lensing potential reconstruction

New set of SATs would improve sensitivity to *r* by a factor 1.5 or 2

Existing contributions to SO from Italy

SISSA is member institution for the Simons Observatory since the beginnin following the PolarBear/Simons Array membership since 2014.

Members: Carlo **Baccigalupi** (Management Board), Nicoletta **Krachmalnicoff**, Francesca Perrotta, Davide **Poletti**, Anirban **Roy**.

Co-leads in Foregrounds in AWGs: Nicoletta Krachmalnicoff, foreground modeling and Davide Poletti: Map-Making and component separation **WGs:** Foregrounds, SAT B-modes, LAT Power Spectrum, Lensing and 3pt, SZ and sources, Likelyhood and theory

Milano - Bicocca is applying member institution for SO, and Federico **Nati** is AdvACTPol member and SO Member since 2014.

WGs: Calibration, Sensitivity, Systematics (Calibration sources, systematic effects, DAQ (Housekeeping electronics and readout, thermometry, warm electronics), Site Managment

CMB-S4

Current participations to CMB-S4 from Italy

C. Baccigalupi, Sissa: Organization, Simulations F. Nati: Housekeeping readout

Potential new efforts from Italy

Similarly to what mentioned for SO, additional instruments, i.e. a low frequency array for South Pole LAT to observe Bicep2 region or a STRIP-like focal plane to be re-used at SPT

Balloon-borne mission for monitoring foregrounds

- Map polarized emission at 250 350 600 GHz from the stratosphere

- Few arcmin resolution, 20% sky coverage
- US led proposal BFORE not funded, see Niemack M. et al. 2015, Bryan S. et al. 2017.

Image from Niemack et al. Journal of Low Temperature Physics 2016, V. 184, 3–4

Participation to balloon-borne projects: BLAST-TNG.

- 2.5 meter Carbon Fiber Mirror, On-axis Cassegrain telescope
- Cryogenically cooled MKID dual polarization sensitive detectors sensitive in three bands: 250, 350, 500 µm
- ~3000 pixels
- FOV: 22 arcminutes
- Diffraction limited resolution: 25", 35", 50"
- Will produce deep maps from less than 1 to 20 deg²
- 28 day flight
- Flight from Antarctica, Dec 2019
- Successor to the BLAST and BLAST-Pol experiments which flew 5 times from 2005-2012

BLAST-TNG Observing Plan

- 28 day flight from McMurdo
- Many clouds, many inclinations
- Objects of different size scales
- Scan speeds > 0.1 deg/s
- Maps up to ~10 deg2
- 350 hrs (58%) Cold Molecular Clouds
- 100 hrs (17%) Mapping Diffuse ISM
- 150 hrs (25%) Shared-Risk Targets

UPenn, February 2018

Palestine, Texas, July 2018

McMurdo, Antarctica, Jan 2019

