



Italian CMB Experiments

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on behalf of the Italian CMB community



Overview

1. Italy is involved *with a leading role* in 3 important CMB-related experiments, aiming at precision measurements of key features of the CMB:
 - a. OLIMPO – a balloon-borne instrument to measure the interaction between the CMB and Galaxy Clusters with an innovative spectroscopic instrument. <http://planck.roma1.infn.it/olimpo>
 - b. LSPE – a balloon-borne instrument to measure CMB polarization at large angular scales. <http://planck.roma1.infn.it/lspe>
 - c. QUBIC – a ground-based instrument to measure CMB polarization with bolometric interferometry. <http://qubic.in2p3.fr/QUBIC/Home.html>
2. Here we review mainly the first two instruments, with focus on:
 - a. Scientific potential
 - b. Original characteristics
 - c. Position in the international effort
 - d. Strategic role in the space-based effort for the CMB

OLIMPO

TBD, including:

1. Short Science description,
2. Importance of SPECTRAL measurements of the SZ-effect (degeneracy removal in cluster parameters estimates, slope-meter @ 220 GHz, Patchy spectral distortions of the CMB)
3. Sinergy with ground based surveys (at high frequency OLIMPO has the same angular resolution as popular 6 - 10m dishes used for ground-based SZ surveys at 140 GHz: ACT, SPT etc.) and X-rays suverys
4. Collaboration, Instrument description, focus on new technologies
5. Nice pictures of HW and system ready to be launched
6. Data analysis challenges

OLIMPO

OLIMPO Payload integrated @ the launch site – Longyearbyen – 5/July/2014



Side A : shiny and smiling !

OLIMPO



Side – B : dark, complex HW and heavy work

OLIMPO as a precursor of forthcoming space-missions

TBD, including:

1. Methodology (DFTS) demonstrator for Millimetron
2. Demonstrator of new detectors, to be used in forthcoming missions
3. Extension of BLAST at lower frequency
4. Polar ballooning in the northern hemisphere

TBD, including:

1. Very short Science description, importance of large-scale measurements of B-modes (inflation, reionization and primary peaks, no lensing, foregrounds)
2. Importance of foregrounds monitoring at high frequency (>200 GHz cannot be done from the ground), bands dithering.
3. Sinergy with other experiments (high frequency - large scales niche)
4. Collaboration, Instrument description, focus on new technologies: Italian TESs, multimode technology, cryogenic HWP rotator, ...
5. Nice pictures of HW and sub-systems
6. Data analysis challenges

LSPE as a precursor of forthcoming space missions

1. Importance of large scales (no measurements from the ground before the next space mission ...) ; data needed to test and qualify new, specific analysis methods and foregrounds removal in the relevant frequency range
2. Reaching $r=0.01$: key for future strategy
3. Test of large cryogenic HWP and filters
4. Test in near-space of Italian TES detectors & readout, to be proposed for forthcoming space missions
5. Qualify methods for operation in extreme environment
6. Polar ballooning in the winter darkness: a unique opportunity for astronomy

TBD, one slide mentioning:

1. Bolometric interferometry (and its potential for space missions)
2. Collaboration and Italian contributions: rotating HWP, main cryogenic system, corrugated feedhorns arrays (pictures)
3. Sinergies between LSPE and QUBIC
 - a. Technology: , large aperture cryostat, rotating HWP (Pictures)
 - b. Science: complementary multipoles and frequency coverage
4. Concordia station in Antarctica: the best site in the world for ground-based CMB
5. Data analysis challenges

Conclusion

- Italy is leading two important CMB experiments, OLIMPO and LSPE on stratospheric balloons
- ASI plays a pivotal role for both.
- Their finalization is top priority for this community, to
 - Obtain high quality data for the Italian CMB community
 - Maintain the Italian position in the field in the short term after Planck
 - Qualify experimental methods and devices needed for forthcoming space missions
 - Demonstrate, with scientific results, scientific ballooning in polar regions, a strategic asset for Italy and Europe.