

# COSMOS

## Cosmic Orbital and Suborbital Microwave ObservationS



# WP 3-6X1: Future balloon borne CMB experiments

Paolo de Bernardis  
Dipartimento di Fisica, Sapienza

Bologna, INAF-IAFS  
11/04/2017

# WP 3-6X1: Future balloon borne CMB experiments

## Obiettivi del WP :

- First Year, t0+6 months • Review of ISD polarization models and data • Review of CMB polarization models and data • Review of spectral distortions of the CMB • Simulation of atmospheric effects in polarization and spectral emission/anisotropy
- First Year, t0+12 months • Review of the spectrum of the residual stratospheric atmosphere • Review of state-of-the-art detection technology • Review of available polarimetric techniques • Review of available spectral measurements techniques • Review of available stratospheric-flight opportunities and capabilities
- Second year, t0+18 months • Preliminary design of a payload for an S4-level high-frequency polarization survey on a stratospheric balloon • Preliminary performance/cost optimization • Assessment of the feasibility of absolute spectral measurements • Assessment of the feasibility of differential spectral measurements
- Second year, t0+24 months: • Design and construction of prototypes of selected key subsystems for the polarization measurement

## WP 3-6X1: Future balloon borne CMB experiments

# Deliverables

- Optimized payload configuration (telescope, polarimeter, detectors, scanning) for CMB polarization surveys at high frequency
- Optimized observations plan and performance estimate
- Flight requirements
- Optimized payload configuration (telescope, spectrometer, detectors, reference, scanning) for spectral-spatial anisotropy or absolute spectrum measurements
- Optimized observations plan and performance estimate
- Flight requirements
- **All collected in the balloon feasibility study document.**

WP 3-6X1: Future balloon borne CMB experiments

## Obiettivi del WP per RA1 :

- *Review of ISD polarization models and data **useful for a new-generation balloon mission***
- *Review of CMB polarization models and data **useful for a new-generation balloon mission***
- *Review of spectral distortions of the CMB **useful for a new-generation balloon mission***
- *Simulation of atmospheric effects in polarization and spectral emission/anisotropy **useful for a new-generation balloon mission***

## WP 3-6X1: Future balloon borne CMB experiments

### a) Review of ISD polarization models and data

- *Physics of the ISD (short, references)*
- *Dust proxies (short, references)*
- *ISD data (references, critical discussion on their accuracy)*
- *Template models (PSM et al., short, references)*
- *Shortcomings of template models and statistical estimate of their impact*
- *3D models*
  - *Statistical*
  - *“Geographical”*
  - *Mixed*
- *“Best” model for new balloon-borne polarization survey and for satellite polarization (full-sky) survey. Same for spectral surveys.*
- *Power spectra versus maps. Power spectrum of residuals. Non-gaussianity of residuals.*
- *Estimate of the effect of angular resolution, polarimetry angle accuracy, sensitivity, spectral coverage and resolution (both targets)*

WP 3-6X1: Future balloon borne CMB experiments  
b) Review of CMB polarization models and data

- *Well known and consolidated: short review with references, definition of observables, sample power spectra, sample polarization maps and stacking.*
- *The problem of BB spectrum amplitude (primordial and reionization peaks). “Reasonable” assumptions.*
- *Signal levels for different instrument configurations and sensitivities – sample/cosmic variance and sky coverage – Polarization sampling.*

WP 3-6X1: Future balloon borne CMB experiments

c) Review of spectral distortions of the CMB

- *Isotropic and anisotropic spectral distortions: short review of the physics; references.*
- *Sample spectra, spectral regions of interest in different cases*
- *Comparison to dust (a) and atmospheric (d) spectra*
- *Separation feasibility (template fitting, and more) from a balloon platform*
- *Separation feasibility from a satellite platform*

WP 3-6X1: Future balloon borne CMB experiments

d) Simulation of atmospheric effects in polarization and spectral emission/anisotropy

- *Background (spectral) from residual atmosphere at balloon altitude. Models and sample spectra*
- *Stability of the background and 3D distribution; modulation by pendulation*
- *Polarization effects (Zeeman of  $O_2$ , ice crystals, etc.)*
- *Polarization conversion in optical systems*
- *Optimal observation bands for a balloon platform (both polarization and spectral distortions)*
- *Monitor bands and their efficiency*



## WP 3-6X1: Future balloon borne CMB experiments

- *Persone già coinvolte:*  
*Battistelli, Buzzelli, Columbro, de Bernardis, De Gasperis, Lamagna, Masi, Piacentini*
- *In pratica:*
  - *Circolare questa presentazione alla mailing-list e chiedere*
    - *Ulteriori interessati*
    - *Integrazioni / emendamenti*
- *Organizzazione scrittura a partire da subito dopo Pasqua.*
- *Teleconferenze bi-settimanali per monitorare l'avanzamento e facilitare la cross-fertilization.*