10.2.8 WP 4-6X1: Next generation of CMB space missions

PROJECT: **Studi di Cosmologia**		**WP REF.: 4-6X1**
WP TITLE: **Next generation of CMB space missions** **SUB-CONTRACTOR**: **INAF-IASF / Bologna** **START EVENT**: KO **END EVENT**: RF **WP MANAGER**: **Reno Mandolesi**		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:01/09/2016

1. OBJECTIVE

The current inflationary models and the state-of-the-art of CMB polarization observations (mainly based on Planck and BICEP/Keck results) point towards the need of a complementary approach of space projects, focussed on CMB analysis, and of sub-orbital observations for precise, multifrequency (including low frequencies) foreground treatment and very high resolution mapping in order to be able to detect and characterise primordial B-mode polarization from a stochastic background of gravitational waves with a primordial perturbation tensor-to-scalar ratio r=T/S around 10^{-3}. The main object of this WP is aimed at:

- Definition and design implementation of a next CMB space mission.
- Definition and read-map implementation of sub-orbital (ground and balloon) experiments/projects/facilities to complement space mission.

2. INPUTS

- Contract and Technical Annex.
- Work plan & Schedule.
- Planck Data; data from other CMB projects and from radio-far-IR projects.
- Planck Software pipeline, simulations, component separation methods/Software.
- Input from other WPs **:**
    - Project Management
    - SZ signal extraction from future CMB data
    - New point sources detection methods
    - Future ground-based CMB experiments
    - Support to data analysis for LSPE/STRIP
    - Future balloon borne CMB experiments
    - Support to data analysis for LSPE/SWPE
    - HW/SW infrastructure for future CMB experiments
    - RF Testing for future CMB experiments
    - CMB calibration and SRT
    - Strategic solutions for new CMB detectors
    - Readout electronics for future CMB missions
    - Astroparticle and Fundamental Physics

- Inflationary gravitational waves
- Non Gaussianity from Inflation
- Foreground modeling and removal
- CMB weak lensing reconstruction.

3. TASKS

- Analysis of theoretical cosmological models and of their observational feasibility.
- Analysis of foreground and foreground residual limitation and of observational needs.
- Analysis of systematic effects of their potential residual; design of minimization/trade-off approaches in space mission and sub-orbital projects.
- Definition and design of optimal space mission in terms of frequency coverage, sensitivity, resolution, observational strategy, cryogenic solutions.
- Definition of optimal set of ancillary observations in terms of frequency coverage, sensitivity, resolution to complement space observations.
- Definition of optimal prototypal chain of pipeline for space mission data analysis and science extraction.

4. OUTPUTS

- Definition of optimal CMB space mission (orbital and sub-orbital) focussed to polarization, compatible with allocated resources.
- Definition of feasible approaches to other CMB scientific targets (spectral distortions, cross-correlation of anisotropies and distortions) and of a road-map towards their observational study.
- Assembling of ground based information for foreground control.
- Identification of state-of-the-art technology for mission implementation.

5. SCHEDULE

According to the FTE of scientists at Bologna Unit involved and interested in this WP (C. Burigana, A.-G. de Rosa, G. de Zotti, F. Finelli, G. Malaguti, N. Mandolesi, M. Massardi, G. Morgante, D. Paoletti, T. Trombetti) and considering that one TD researcher will be acquired and fully dedicated to this WP project, a feasible schedule is summarized below.

First Year, T0+6 months

- Ingesting of available tools and data sets.
- Design and simulation planning.
- Otuline of future CMB space missions in the orbital&sub-orbital frameworks

First Year, T0+12 months

- Definition and implementation of interfaces with other WPs.
- Ingestion and preliminary analysis of input from other WPs.

Second year, T0+18 months

- Optimization activity.
- Ancillary observations planning.
- Preliminary road-map definition.

Second year, T0+24 months:

- Advanced road-map definition.
- Definition of feasible scientific targets.
- Preliminary definition of prototypal chain of pipeline.

Third year, T0+30months:

- Preliminary design and implementation definition.

Third year, T0+36months:

- Optimal design and implementation definition in the Orbital/sub-orbital framework

Road map for the future.