10.2.12 WP 6-6X1: Strategic solutions for new CMB detectors

PROJECT: **Studi di Cosmologia**		**WP REF.: 6-6X1**
WP TITLE: **Strategic solutions for new CMB detectors** **SUB-CONTRACTOR**: **Dip. Fisica / Università di Genova** **START EVENT**: KO **END EVENT**: RF **WP MANAGER**: **Flavio Gatti**		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:01/09/2016

1. OBJECTIVES

In the last decade we have observed a rapid development of detectors for the GHz and THz of the electromagnetic spectrum motivated by the needs of higher performing instrument for investigating the CMB features at the finest level. IR and Radio astronomy as well high resolving power molecular spectroscopy have multiplied the efforts of the instrument scientists in improving the already established detectors as well as introducing new detection concepts.

Presently a large number of new and interesting detection concepts are envisaged and tested at some level, while well established ones are exploited in many configurations for large area focal plane instruments.

Over a long timescale this give a quite puzzling scenario in which high TRL devices which requires complex associated technologies, e.g. cryogenics and electronics, have to be compared with low TRL but promising devices in terms of performance and simpler operating techniques.

This WP would like to make an up to date assessment of the status, the short and long term expectations coming from the study of the different approaches to the detection issue, their technologies, the impact on the instrument performance, design and operation. This study will try give the most updated strategic plan in different timescale for detector development projects aiming to nulling the technology gap with other countries.

2. INPUTS

- Detector design and performance of present and past CMB experiments
- Design Study Reports of detector for CMB and Astrophysics
- Specification from WP Future Groud-Based CMB experiments
- Specifications from WP Future balloon borne CMB experiments
- Specifications from WP Next Generation CMB space missions
- Specifications from WP Readout electronics for future CMB missions

3. TASKS

Main collaborations: INFN –Pisa, Uni Roma1, Uni Milano

Detectors for GHz and THz with demonstrated or projected NEP or NET in the interesting range for CMB investigations ranges from TES, KID, HEB, SIS, SIN which are under different good level of investigations, the Paramagnetic and Magnetic Penetration Depth Bolometer , that are tested at prototype level and new concept with nanostructured hetero-structure, e.g. quantum point and quantum point contact.

The tasks are:

- Survey of the present detector concept technologies
- Evaluation of superconducting devices based on transport properties: present and future projection.
- Evaluation of devices based on magnetic properties: present and future projection.
- Evaluation of nanostructured devices: present and future projection.
- Trade off study among detector parameters and ground, balloon, space based CMB experiment requirements.
- Trade off study of the detectors and readout electronics

4. OUTPUTS

Deliverables

- Survey of the present detector technology for application to CMB studies
- Present and Future projection of the CMB detector technologies
- Present and Future of the detector for CMB: a strategic study for the next experiments.

5. SCHEDULE

First Year, t0+6 months

- Survey of the present detector technology.

First Year t0+18 months

- Study of superconducting devices based on transport properties
- Study of devices based on magnetic properties.
- Study of devices based on nanostructured.

Second year, t0+24 months

- Study of the impact on the readout electronics

Second year, t0+30 months

- Trade off study among detector parameters and CMB experiment requirements
- Study of others possible detector concepts and detection methodologies

Second year, t0+36 months:

- Critical study for a strategic plan for mid and long term for detector development for future CMB experiments