10.2.15 WP 8-6X1: Inflationary gravitational waves

PROJECT: **Studi di Cosmologia**		**WP REF.: 8-6X1**
WP TITLE: **Inflationary gravitational waves**		**Sheet**: 1 **of** 1
SUB-CONTRACTOR: **Dip. Fisica e Astronomia / Università di Padova**		
START EVENT: KO		**Issue Ref**: 1
END EVENT: RF		**Issue Date**:01/09/2016
WP MANAGER: **Nicola Bartolo**		

1. OBJECTIVES

- Inflationary parameter forecasts for future B-mode surveys
- Joint analyses: CMB and interferometers
- Component separation methods for B-mode maps
- Study of theoretical implications for Inflation

2. INPUTS

- Grid of target inflationary models for gravitational waves and their predictions for the expected signal
- Planck (and other CMB experiments) data
- Synthetic mock data

3. TASKS

Main collaborations: Ferrara, RM2, SISSA

The exploitation of CMB B-mode data has the primary goal to probe the existence of primordial gravitational waves which are a smoking gun of inflation.

One of the aims of this WP is to understand how to optimally exploit future (and present) CMB data to constrain the parameter space of inflationary models.

The WP will be characterized by three main levels. An investigation of theoretical predictions, accompanied by forecasts for future space, ground an balloon-born CMB experiments, with particular focus, as far as the forecasts are concerned, on specific instrumental characteristics of a given CMB experiment, systematics and component separation methods. The forecasts activity will include an analysis of the complementarity between CMB and other possible future measurements of the inflationary stochastic background of gravitational waves (e.g., direct detection experiments like LISA). The second main task of this WP will be to develop an analysis pipelines for B-mode data in forthcoming CMB experiments, to constrain the parameter space of inflationary models. We will make use of mock datasets accounting for realistic conditions. A major part of the WP will be also devoted to the development of new component separation methods, in strict connection to the WP on primordial non-Gaussianity. Here the issue is to separate the primordial B-mode signal from the foregrounds, especially galactic dust. Since the foreground component is highly non-Gaussian (and anisotropic), we plan to build algorithms of foreground cleaning based on non-Gaussianity estimators with directional dependence, originally developed for measurements of primordial non-Gaussianity (such as estimators of needlet bispectrum and trispectrum).

The goals of the second task will allow us to perform an analysis on present CMB data to calibrate and test the tools developed, in such a way to prepare for future data analyses.

According to the results we find, a study of implications for models of inflation will be drawn. Finally we aim to perform a study of inflationary models beyond the standard power spectrum analyses to test non-Gaussian signatures in the gravitational wave signal (in connection with the non-Gaussianity WP)

and to test features beyond the standard scenarios (like e.g., parity breaking features and deviations from the standard consistency relations for the amplitude of the inflationary gravitational waves).

4. OUTPUTS

Deliverables

- Combined inference of Early Universe parameters (amplitude of primordial gravitational waves, amplitude and spectral index of primordial curvature perturbations, from available datasets (also in combination with the primordial non-Gaussianity WP results) from available datasets
- Forecasted constraints on the inflationary parameter space according to the characteristics of a given (future) CMB experiment
- Algorithms for B-mode component separation methods
- Forecasts about complementarity between CMB and other possible future observables (e.g., direct detection experiments like LISA).

5. SCHEDULE

First Year, t0+6months

- Theoretical predictions, forecasts and study of theoretical implications for inflation

First Year, t0+12months

- Theoretical predictions, forecasts and study of theoretical implications for inflation
- Preparation of analysis pipelines for B-mode data in forthcoming CMB experiments, to constrain the parameter space of inflationary models
- Data analyses on available datasets, to be used also as a cross-check

Second year, t0+18months

- Preparation of analysis pipelines for B-mode data in forthcoming CMB experiments, to constrain the parameter space of inflationary models
- Development of component separation techniques for polarized foregrounds (especially B-mode), based on estimators targeted to measurements of directional primordial non-Gaussianity (in strong connection with the non-Gaussianity WP)

Second year, t0+24months:

- Development of component separation techniques for polarized foregrounds (especially B-mode), based on estimators targeted to measurements of directional primordial non-Gaussianity (in strong connection with the non-Gaussianity WP).

Third year, t0+30months:

- Development of component separation techniques for polarized foregrounds (especially B-mode), based on estimators targeted to measurements of directional primordial non-Gaussianity (in strong connection with the non-Gaussianity WP).
- Forecasts about complementarity between CMB and other possible future observables (e.g., direct detection experiments like LISA); forecasts on constraints on the inflationary parameter space w.r.t. to specific instrumental characteristics of a given CMB experiment, systematics and component separation methods.

Third year, t0+36months:

- Analyses of inflationary models beyond the standard power spectrum analyses to test non-gaussian signatures in the gravitational wave signal (in connection with the non-Gaussianity WP) and to test features beyond the standard scenarios (like e.g., parity breaking features and deviations from the standard consistency relations for the amplitude of the tensor modes)