PROJECT: **Studi di Cosmologia**		**WP REF.: 4-6X2**
WP TITLE: HW/SW infrastructure for future CMB experiments **CONTRACTOR**: **INAF-OATs** **START EVENT**: KO **END EVENT**: RF **WP MANAGER**: **Andrea Zacchei**		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:01/06/2017

OBJECTIVE

- Provide to the whole Italian CMB community a software infrastructures
- Assure the availability of the software infrastructure
- Allow to the whole Italian CMB community the access to the Planck data to be used as cross check
- Provide support to the LSPE data analysis

Timeline

- Requirement definition (verify what is required by different WPs): T0+6months
- Environment set-up: T0+8 months
- Dedicated storage acquisition: T0+4 months
- Code development / integration / run: T0+6 months (start of the activity)
- Code development / integration / run: T0+36 months (end of the activity)
- Simulation runs respect the requirements: T0+12 months (first Run), then one run every 6 month (linked to code development)

Activity

Supporting of LSPE is ongoing, realization of instrument web interface is in development by LSPE software contract using COSMO CMB infrastructure. SSD (Software Design Document) will be issued in draft form before the end of June. We expect to have the first realization of the entire interface during the summer to be then connected to the necessary algorithm for scientific analysis.

Collection of the requirements needed by the *COSMO CMB community* is ongoing for what regards simulation and data analysis. Based on Planck experience a cluster composed by 400 Cores, 16 GB/core connected with Infiniband at 40 Gbps is in realization and will be made available, upon request, in September 2017. This will constitute the main computation queue, an addition queue for test and development, inherited from the Planck project, composed by 240 cores, Infiniband 40 Gbps and 6 GB/core RAM is in installation (we are moving from previous location) and will be made available, upon request, during the summer.

We are still working inside the Planck project for the products delivery, this is delaying the cleaning of the Planck dedicated storage that will be used as facilities for the *COSMOS project*. We expect to conclude the planck activity during August/ September 2017, allowing us to clean and made available about 200 TB of free space and the planck data starting from timelines to Maps.

The definition of the profile, *bando*, to hire a code developer specialist is ongoing, we expect to issue the request during this summer and be able to have him working on the project at full time in autumn.

Personnel

- A. Zacchei (WP responsible)
- M. Frailis (Infrastructure)
- S. Galeotta (Code development)
- M. Maris (science interface)
- GianMarco Maggio (System Manager)
- TD (to be hired) (Code development/ integration)

PROJECT: **Studi di Cosmologia**		**WP REF.: XXXX**
WP TITLE: Foregrounds and lensing (Sub packet of Foreground modeling and removal) **CONTRACTOR**: **xxxxxxxxxxxxxx** **START EVENT**: KO **END EVENT**: RF **WP MANAGER**: Pierluigi Monaco		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:01/09/2016

1. OBJECTIVE

- provide a large set of simulations of the large-scale structure as a foreground to the CMB;
- use methods based on Lagrangian Perturbation Theory to accurately sample the cosmological parameter space;
- extend these methods to different classes of cosmological models.

2. INPUTS

- Requirements on the simulations: volume, resolution, sky area to be covered, cosmology, number of realizations.

3. TASKS

We will provide suite of simulations of the large-scale structure of the Universe that will be devoted to the study of CMB lensing and, more in general, of the cross-correlation between CMB and tracers of the large-scale structure. These simulations will be based on Lagrangian Perturbation Theory and, as such, will provide the flexibility to accurately sample cosmic variance by generating a large number of realizations of the same cosmological model, while also exploring different classes of cosmological models. Coupling these simulations with a halo model will allow us to account for the contribution from non-linear structures to large-scale CMB lensing. At the same time, populating simulations with different tracers through semi-analytical models of galaxy formation will allow us to study the cross-correlation of CMB with large-scale surveys.

4. OUTPUTS

- a large set of simulations of large-scale structure as a foreground to the CMB

5. Timelines

- Code development: T0+24 months
- Mock production for LambdaCDM: starts at T0+12months and end at T0+24 months
- Mock production for other cosmological models: start at T0+18months and end at T0+36 months

6. Personnel

- Pierluigi Monaco (WP responsible)
- TBN (to be nominated)

PROJECT: **Studi di Cosmologia**		**WP REF.: XXXX**
WP TITLE: SZ and point sources (ALREADY Included in the SZ signal extraction from future CMB data WP) **CONTRACTOR**: **xxxxxxxxxxxxxx** **START EVENT**: KO **END EVENT**: RF **WP MANAGER**: Stefano Borgani		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:01/09/2016

1. OBJECTIVE

- Provide to the Italian CMB community raw data from cosmological hydrodynamic simulations of galaxy clusters
- Produce idealized maps of the Sunyaev-Zeldovich effect (Compton-y parameter) from these simulations
- Include realistic level of noise and beam size, as appropriate for different instruments (e.g., OLIMPO, future CMB missions) at the relevant frequencies

2. INPUTS

- Specification of noise level and beam size for the relevant instruments
- OLIMPO SRD

3. TASKS

We will provide advanced cosmological hydrodynamical simulations of galaxy clusters, which will include astrophysical processes, such as radiative cooling, star formation and the effect of feedback from supernovae and AGN. These simulations, which will reproduce basic X-ray observational properties of the intra-cluster medium (ICM), represents the starting point to produce detailed maps of pressure and of the Compton-y parameter, by including both the thermal and the kinematic components. These maps will be "observed" in realistic conditions, by producing SZ mock observations at different frequencies, beam smearing, realistic level of signal-to-noise, contaminating backgrounds and point sources. These SZ mock observations will be analyzed with the aim of assessing the capability of future CMB experiments to measure the thermal and dynamical properties (i.e. bulk motions and turbulence) of the ICM. Producing the same maps in the X-ray band will further allow exploring the synergies between the next generation of mm and X-ray telescopes in tuning galaxy clusters as precision tools for cosmology.

4. OUTPUTS

- Pressure and Compton-y maps of simulated clusters at different redshifts
- Mock SZ observations

5. Timelines

- Hydrodynamical simulations: T0+1months (start): T0+24 months (end)
- Production of idealized maps: T0+6months (starts): T0+24 months (end)
- Production of mock SZ observations: T0+12months (start); T0+36 months(end)

6. Personnel

- Stefano Borgani (WP responsible)
- TBN (to be nominated)

PROJECT: **Studi di Cosmologia**		**WP REF.: XXXX**
WP TITLE: Subpacket of Astroparticle and fundamental physics **CONTRACTOR**: **xxxxxxxxxxxxxx** **START EVENT**: KO **END EVENT**: RF **WP MANAGER**: Matteo Viel		**Sheet**: 1 **of** 1 **Issue Ref**: 1 **Issue Date**:01/09/2016

1. OBJECTIVE

- Measure/constrain the neutrino mass
- Measure/constrain dark matter properties
- Measure/constrain relativistic effects at the largest scales

2. INPUTS

- Planck data
- Large Scale Structure data
- Codes for performing statistical analysis for cross-correlations
- Software for developing the likelihood code and implement likelihood analysis
- N-body simulations for non-linear regime of structure formation

3. TASKS

Quantitative constraints on the neutrino masses will be provided from a comprehensive analysis of LSS data sets by exploiting the cross-correlation signal between different LSS tracers and the CMB. The cross-correlation between CMB and LSS tracers will be further used in order to measure the ISW effect and relativistic effects at the largest scales both in standard and non-standard cosmological models with particular emphasis to the high redshift (z=2-6). Signatures of decaying and annhilating dark matter will be investigated by looking at the impact on the reionization history and at the overall impact on the diffuse extragalaxtic gamma ray background and its cross-correlation with CMB. State-of-the-art modelling of the expected signal will be performed by completing the results obtained from public available codes (CAMB, CLASSgal, etc.) with the results of N-body and hydro simulations to model the mildly non-linear regime.

4. OUTPUTS

- Constraints in terms of neutrino mass
- Constraints on small scale properties of dark matter
- Large scales assessment of relativistic effects
- Likelihood codes to be implemented in standard MCMC codes

5. Timelines

- neutrino masses: T0+1month (start);T0+18 months (end)
- cross-correlation of LSS with CMB: T0+1month (start); T0+36 months (end)
- non-linear modelling of the signal: T0+1month (start);T0+18 months (end)
- impact on reionization history: T0+18months (start); T0+36 months (end)

6. Personnel

- Matteo Viel (WP responsible)
- TBN (to be nominated)