

Notice of Intent for submissions for input to the Astro2020 Decadal Survey

Notice of intent to submit white papers on activities, projects, or state of the profession considerations to the Astro2020 Decadal Survey

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2. Type of Activity:

Ground Based Project

3. Description of the nature of the idea and its goals (limit to 750 words)

- Description

The European Low Frequency Survey (ELFS) is a project developed within the European Coordination for Cosmic Microwave Background Polarization Experiments (ECMBC Coordinators -- wiki.e-cmb.org). The ECMBC aims at coordinating ground-based CMB polarization experiments supported by European institutions and developing them into a new plan for the mid-term (now to mid next decade) and for the long-term (second half of the next decade). The project's main target is to deploy and operate two novel CMB observatories, one in the Northern and one in Southern Hemispheres, with locations to be determined, covering the entire sky, in a frequency range extending from the C to the W bands. European cryo-HEMT technology has reached top-level performance for low frequency applications, and major progress is being achieved at higher frequencies with KID and TES detectors. Research laboratories located in France, Germany, Italy, Spain and UK are developing new instruments, either already in operation or expected to deliver impacting results in the near future. Specifically, new CMB polarization data are either available or soon-expected by a number of probes, such as the S-PASS and C-BASS Radio Surveys, the measurements of the QUIJOTE Telescope, the CCAT-prime Large Telescope, the forthcoming LSPE project combining ground-based and balloon-borne observations, the NIKA2 project developing detectors for SZ measurements, and the QUBIC bolometric interferometer.

These probes are delivering novel results concerning the Cosmic Microwave Background polarization, while shedding new light on the astrophysical processes in our own Galaxy related to Galactic Synchrotron and Anomalous Dust Emission, and populations of extra-Galactic Radio Sources. These results drive the modelling of polarized low frequency foregrounds for all planned observatories (from the ground, balloon and space) targeting the CMB polarization B-modes from primordial gravitational waves and lensing. Concerning the former point, recent evidence from the quoted observatories call for accurate measurements of the Galactic polarized synchrotron in order to be able to disentangle the B-modes from diffuse Galactic foregrounds, expected to dominate at all frequencies and in all sky regions, on super-degree and degree scales where the cosmological signal is expected.

The ELFS project is strategic and complementary to major efforts already on-going worldwide. In particular, this plan is intended as a European contribution to the ground-based CMB-S4 project, as well as a low-frequency complement to future space missions such as LiteBIRD.

- Implementation

The implementation of the project would proceed in two phases. In the short-to-mid-term, the analysis of acquired data and the deployment of the instruments currently being developed will proceed in parallel with the design and prototyping of the ELFS telescopes and the detector arrays. In the 5-40GHz range, these will be based on HEMT low noise amplifiers and digital polarimeters, ensuring continuous frequency coverage with high frequency resolution. In the 90-120GHz range we will use KID detectors building on already mature technology.

The second phase of the project will include the definition of the ELFS observing sites, the development of the deployment of the new 6-meter class telescopes and/or re-use of existing ones, followed by the actual observations and analysis in phase with the quoted complementary efforts from the ground and space.

All aspects of this Project need to be implemented in close connection among groups working on science case, hardware, simulations, and data analysis. Robust scientific requirements need to be specified to ensure that the ELFS instruments will serve as a powerful CMB probe as well as a monitor of Low Frequency Foregrounds, with an optimal degree of complementarity to the current US efforts from the ground and to planned satellite projects currently involving space agencies in Japan, the US, and the EU. In particular, we are keen to implement instrument/telescope interfaces to be standardized with US-S4 facilities, to maximize potential synergy and flexibility.

We plan to submit proposals to the European Research Council (Synergy Grant 2019 or 2020), for supporting the first phase. At the same time, we will bring the project to the attention of National funding institutions currently supporting on-going experiments in a coordinated effort. In the long term we plan to approach the European Strategy Forum on Research Infrastructures (ESFRI) for the ambitious long term plan.

4. Web link (if applicable)

wiki.e-cmb.org

5. Copyright Notice

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