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Polarized Galactic Emission Mapping: helping to unfold the veil of the Cosmic Microwave Background

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In the context of the new era of Cosmic Microwave Background Polarization (CMBP) experiments, it is important to have reliable templates of the polarized foregrounds contaminating the CMBP. This is specially true for the for the Planck Surveyor Mission (ESA, 2007) and for the near-future B-mode polarization probes. The Galactic Emission Mapping collaboration aims to measure the polarization state and Stokes components at low frequencies (5-10 Ghz) of the galactic synchrotron radiation using an antenna covering the North Hemisphere and another the South Hemisphere. Together, the joint coverage should produce a reliable template of the synchrotron polarization in 80% of the sky.

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1. The Galactic Emission Mapping collaboration

Experiments like Planck Surveyor will require well estimated templates of polarized synchrotron (affecting the Planck Low Frequency Instrument 30 -90 GHz) and polarized dust emission (affecting the Planck High Frequency Instrument 100-800 GHz). Existing polarization templates (for low frequencies - synchrotron) rely on a semi-empirical approach of extrapolating polarization substructure information from small sky area surveys with theoretical assumptions of depolarization of the synchrotron observed templates [4]. Furthermore, correlations of the WMAP first-year data with available foreground templates show another physical component appearing to be important - spinning dust emission which was not accounted for in the data processing analysis [5]. Thus, with foreground estimation as one of the main tasks currently being pursued by CMB teams, the Galactic Emission Mapper[1] (GEM) -- was upgraded towards polarized foreground cartography at 5 GHz (C. Tello, in preparation) with the development of a new high-sensitivity pseudo-correlator

[1] USA site: http://aether.lbl.gov/www/projects/gem
Brazil site : http://www.cea.inpe.br/~cosmo/GEM/index_gem.htm

receiver. It will map the polarized synchrotron radiation (polarized at a maximum of ~60% level) where this emission is dominant down to a sensitivity of 0.5mK.

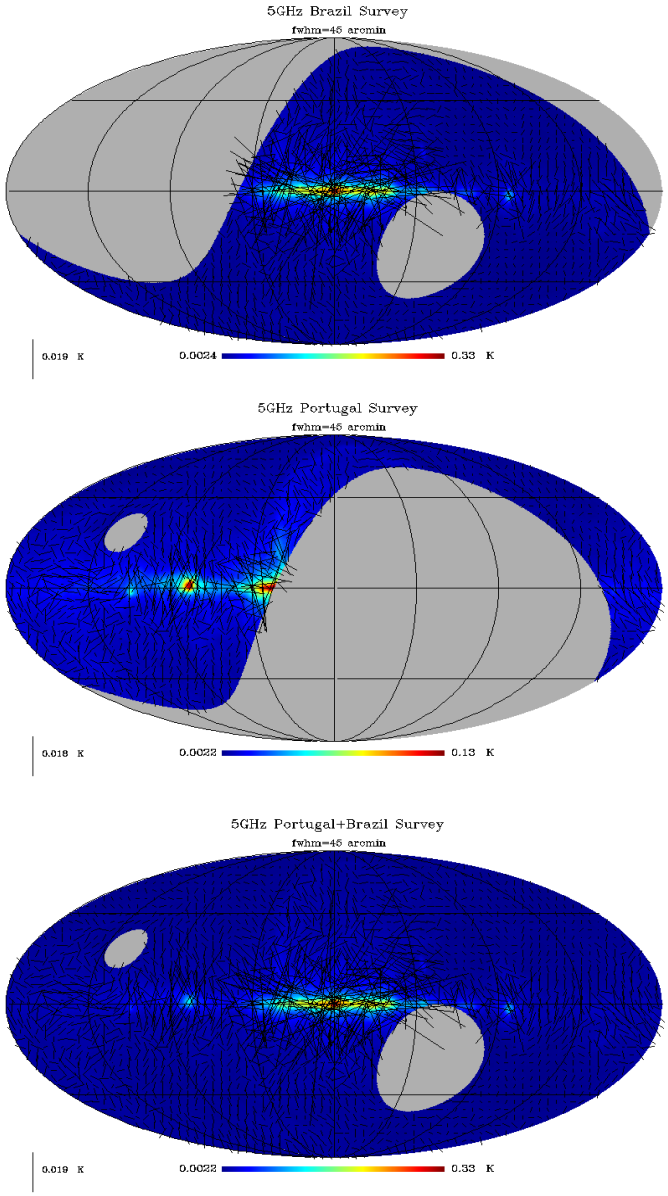

Fig.1 – Simulated synchrotron maps at 5 Ghz. The top figure represents the South Hemisphere coverage (Brasil antenna), the middle figure represents the North Hemisphere coverage (Portugal antenna) and the bottom figure is the joint coverage. All maps have a resolution of 45 arcmin.

At the same time, continuous work on the receiver will prepare the upgrades towards 10GHz observations, where some signal from spinning dust is expected to appear mixed to synchrotron emission. At a later stage, by 2007, GEM-Brazil and GEM-Portugal maps will be merged to produce the biggest

sky templates of the polarized synchrotron components (~80% sky). These templates will shed light on the synchrotron polarization fraction and substructure at scales down to 0.5º, covering a range of scales important for B-mode searching and allowing a better polarized foreground subtraction from large sky data sets such as the Planck Surveyor maps.

Acknowledgments

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