Minutes: Galactic Science Working Group Telecon
8/8/17

Attendance: L. Fissel, D. Chuss, S. Hanany, T. Jones, F. Santos, I. Stephens, P. Ashton, B. Hensley, G. Novak, B. Burkhart

The CMB Probe has as its primary science, the detection and characterization of B-modes to r~0.0001. Auxiliary science is beneficial.
Above 600 GHz, detector technology likely needs to be added due to the gap frequency of Nb superconducting transmission lines in baseline sensors.
The probe will measure the full sky, which is a unique capability for submm polarimetry.

The 1.4 m mirror proposed in EPIC-IM is probably maximal. This gives the 1' resolution at 850 GHz that is likely important to Galactic Science. Also the sensitivity limits in the EPIC table may be assuming a 4K cooled telescope (DC to check this). If for cost reasons CMBProbe utilizes a 30K cooled telescope that will decrease the sensitivity in the sub-mm bands.

The time scale for the Probe (under guidance from NASA) is a Phase A start in 2023. This means a 10 year horizon until data.

Science points to consider (from the group):

Star Formation

-It should be stressed that the grain alignment science is tied to the desire to understand magnetic fields in star formation, though it was also mentioned that the dust physics may be useful for foreground cleaning. This would involve future overlap with the Foregrounds Working Group.

-CMP probe can be seen as a crucial piece of the puzzle in connecting large scale fields to those in star forming cores
CMBP—> Single dish (SCUBA2/SOFIA/Toltec)—> ALMA

- 0.1 pc seems to be a compelling scale. This corresponds to 1' resolution for clouds out to the distance of Orion, or 2.5' for the nearest clouds (d~150 pc). This may allow a probe of the sonic and decoupling (neutrals/ions) scales. How many clouds are close enough for this to be true for?

Diffuse ISM

A_v<0.1 would allow us to study the HI to H_2 transition (which takes place at ~ 1 A_v) in great detail.

As far as the possibility of optical/NIR polarimetry + GAIA scooping CMBP's Galactic Science ISM case: lack of background stars would render this low-resolution. Also, Opical/NIR polarimetry is difficult in low A_v regions because of intrinsic star polarization. It was suggested that Dan Clemens be consulted on this.

All sky nature of CMBP mission enables good statistics.

We would want to match the angular resolution of GALFA (Arecibo HI survey with 4' resolution), and upcoming HI surveys which may have slightly better resolution (e.g. with the FAST telescope), so our target resolution should be a few arcminutes.

Polarization Spectrum

The polarized SED and unpolarized SED are good tools to extract info about dust populations (polarized dust SED vs total intensity SED). Some support for FTS here. Does large beam make this untenable?

Arcminute resolution would be important for studying polarization efficiency of star forming regions. These studies are needed to use the CMBP data to test predictions of magnetized star formation theory.

External Galaxies

Out to 10 Mpc we can use 1' beam to get >10 measurements across a galaxy.
We expect ~1000 galaxies can be surveyed.
M33, M31, M82, SMC, and LMC would be well-measured.

Again, the all sky nature makes this extensive look at the magnetic fields in other galaxies useful. One could imagine surveying all candidates and using SOFIA/ALMA/ Toltec to follow up.

Other Topics

- low column density structures like high velocity clouds
- IR Dark Clouds
- GMC's

Next Steps

1. Parameter table (sensitivity, spatial resolution, frequency coverage)
2. Group to suggest references to consult
3. Next telecon- late Aug/early Sept.