

Notes on Maps to Cell session:

Discussion points:

- Second edition of science book
 - Joel - 2nd ed Science book – coherent presentation of broad science case of CMB-S4 Recent ones (like technical book) - only talked about science for key science drivers that agencies will judge us upon. 2nd ed is to include those key science points, but also everything else
 - Q: Is there a uniform standard for forecasts to be included? Or can they be diverse? Ans: Plan to use clearly defined survey models – more uniform and sophisticated than the first book
- Advertise [DRAFT](#) at meeting!
- Open call for forecasting areas/ideas
 - Input from the audience!
 - New developments since 2016?
 - Current projects by others in group
 - Ideas from Snowmass?
 - Some ideas + previous Maps2Cell [brainstorming list](#):
 - Neff + Y_p forecasts need to be updated [Joel: should we consider specific models that modify BBN? F-Y: Nfluid, Nfree-streaming, Neff that changes those and Neff changing between BBN and CMB] FY volunteers!
 - See also [Snowmass WP](#) (The Physics of Light Relics)
 - See also [Snowmass WP](#) (Synergy between cosmological and laboratory searches in neutrino physics: a white paper), including neutrino scenario table
 - Tensions (e.g. early dark energy, self-interacting neutrinos, primordial magnetic fields) – if persist with what significance will S4 detect these? [Ben: Timeline of S4 is a ways off . Not sure tension space will persist that long. // Those tensions are 10 years old // Kev - talk about science w/o pinning to tensions]
 - Possible Nonthermal neutrinos [see, e.g. work by Kev, Joel, George F., Evan]
 - Things CMB-S4 can say about neutrinos: m_{ν} , Neff, but also L_{ν} , self-interactions, fraction of $\sim eV$ steriles that have thermalized (Kev says: see papers by [Lunardini](#), Hannestad (2010, 2011) [Joudaki](#)+ (2012) and even [Abazajian](#)+ (2004). .)

- Update dark matter forecasts (e.g. Vera, Kim, . . .)
<http://arxiv.org/abs/1806.10165> [Kim: Should be discussed. Partial overlap with Neff, but also new possibilities. FYCR: Forecasts for DM-DR interactions are happening now. Joel: Also DM freezein – see linked WP below]
 - See also [Snowmass WP](#) (Dark Matter Physics from the CMB-S4 Experiment)
 - See also [Snowmass WP](#) (The Physics of Light Relics)
 - Will overlap with lensing as well as power spectra
 - DM scenario table similar as for neutrinos?
- Other high-ell BB (e.g. non-inflationary GWs - Marilena & Zach thinking about, birefringence [Maps2Cell, Low-ellBB, Maps2Other] – Mudit Jain, vector modes)
- New physics with secondaries? (Ostriker-Vishniac in CI, see for neutrinos <https://arxiv.org/abs/1702.00676> , Roncarelli, Villaescusa, Baldi, OR axions [2109.13268](#), Farren, Grin, Hlozek, Jaffe et al, [1902.01868](#) Hagstotz, Mota et al, or modified gravity [1805.11607](#) [Baldi group], Silvestri et al <https://arxiv.org/pdf/1510.08844.pdf>)
 - [Talk at CMB-S4 Spring Collaboration Meeting 2020 by Ben on “Science Beyond Neff”](#) [Ben: Should we be doing model independent forecasts, such as for peak positions or other aspects of power spectra?]
- Science Task list - [Science Task List](#)
 - Joel: This is not key science list for key papers. This is a public list identifying tasks required to deliver broad science of CMB-S4. You might point to this when writing a proposal, supporting why you want to do X. Want the task list to be a complete accounting of what is needed to achieve science in this group.
 - Comment: current projects not on this list. Resp: Maybe they should be. Though focus of the list has been data products not forecasting.
- Current projects
 - Beams [Will there be a statement about how well beam needs to be known for science? Not at the moment.
 - John R asked for science impact of beams, T->P leakage, bandpass uncertainty
 - Fiducial Neff forecasts + DRAFT tool (proposed)
 - Sensitivity of forecasts to fg modeling (proposed)

- Power spectrum pipelines
 - SO pipelines?
 - others?
- Instrument model/survey needs
 - Currently used in forecasts (from Srimi):
 - Noise model from PBDR [So far parametric Nell curve at each frequency, not using scan strategy maps, just assuming uniform map depth]
 - Extragalactic foreground model from SPT
 - Galactic foreground spectrum from pysm [Do we want/need more foreground realizations?]
 - Footprint from hit maps
 - What is needed for better forecasts?
 - What is needed for testing pipelines?
 - The Data Challenge 1 is nearly complete for CHLAT and provides a much more detailed picture of the signal transfer function and noise in the wide survey maps. Example noise maps can be retrieved **today** from `NERSC:/global/cfs/cdirs/cmbs4/dc/dc1/staging/`. This is a temporary directory; the maps will be packaged in a nicer form and a web interface will be provided. These noise simulations have several advantages over survey footprint and N_{ell} from PBDR:
 - Include realistic noise modes and correlations
 - Include scanning-strategy induced patterns
 - Account for seasonal variation of PWV, available sky and instrument sensitivity
 - Analysis of these maps should provide feedback to data management: the filter stack is not set in stone
- Other discussion

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