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: mnu, Neff, but also L_nu, self-interactions, fraction of ~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 Cl, 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 Srini):
        - 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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