



# Overview of the CMB-S4 Science Book, Second Edition

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(he/him)

CMB-S4 Collaboration Meeting  
April 3-6, 2023



# CMB-S4 Science Book, First Edition has been very successful

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## CMB-S4 Science Book First Edition

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CMB-S4 Collaboration

August 1, 2016

- Posted on arXiv October 10, 2016 (<https://arxiv.org/abs/1610.02743>)
- 1397 citations as of April 4, 2023 ([inSpire](#))
- Laid groundwork for core science case
- Explored a range of possible configurations

# Why write a Second Edition?

- The First Edition is nearly 7 years old - the landscape has evolved
- We have a Preliminary Baseline Design - projections can be more concrete
- The design-driving Science Goals and Science Requirements have been defined, vetted, reviewed, and polished
  - Primordial Gravitational Waves and Inflation
  - Light Relics
  - Galaxy Clusters
  - Transients
- The scientific opportunities are more thoroughly understood
- A great deal of exciting science is simply not covered in First Edition
  - For example, the word 'transient' does not appear in the First Edition

# What are the goals of the Science Book, Second Edition?

- The main goal of the CMB-S4 Science Book, Second Edition is to provide a more complete picture of the broad range of exciting science that CMB-S4 will deliver
- Design-driving Science Requirements will serve as a foundation
  - We are not seeking to change these core Science Goals / Science Requirements
  - The Science Book, Second Edition will provide a compelling justification and rationale for the Science Requirements in order to most effectively frame them in a way that speaks to the broader community and to review panels (**See Science Requirements Messaging Session on Thursday**)
- The Second Edition will organize and codify the wide variety of capabilities enabled by CMB-S4, many of which have only become fully understood in the past several years
- Forecasts will be updated to use consistent and realistic treatment of instrument and survey

# What was covered in Science Book, First Edition?

1. Exhortations
2. Inflation
3. Neutrinos
4. Light Relics
5. Dark Matter
6. Dark Energy
7. CMB Lensing
8. Data Analysis, Simulations & Forecasting

## Notable Omissions:

- Transient Science
- Galactic Science
- CMB Secondaries
- Cross-Correlation Science

See Science Book, Second Edition Kickoff Session on Thursday

# What will be covered in Science Book, Second Edition?

- Design-driving Science Goals and Science Requirements, with sharp justification accessible to broad audience
  - Primordial Gravitational Waves and Inflation
  - Light Relics
  - Galaxy Clusters
  - Transients
- Science targets enabled by Measurement Requirements that are not design-driving
  - One example is measurement of the sum of neutrino masses
- Wide range of astrophysical science targets
- Synergies and cross-correlations with other surveys
- Much more! - We welcome ideas from CMB-S4 members and the community



# Who will organize and write the Second Edition?

- The goal of CMB-S4 Science Book, Second Edition is to capture the scientific vision of the whole CMB-S4 community, and we hope for broad involvement
- A Second Edition provides an opportunity to re-engage with CMB-S4 members and to bring in new expertise to broaden the scope
- The Science Council and Executive Team will serve to shape and organize the efforts
- Contributions and forecasts are welcomed from analysis working groups, from individuals, and from ad-hoc groups

# What will be required for the Second Edition?

- Write up of design-driving Science Requirements can reference and borrow from existing documents that already contain up-to-date treatment (DSR, PBDR, etc.)
- Broad engagement will help to ensure that the Second Edition gives a nearly complete picture of the exciting and wide-ranging science that CMB-S4 will enable
  - While the science case will continue to evolve, we hope that the Second Edition will be sufficiently complete that we will have real data before a Third Edition would be required
- New forecasts will utilize consistent set of forecasting assumptions based on a particular design (i.e. the Preliminary Baseline Design)
  - Analysis working groups will establish standards and facilitate new projections



# Second Edition provides opportunity to advertise science case

- Second Edition will build on success of First Edition
- It will utilize the consistent and thorough treatment developed for DSR and PBDR
- The Science Book, Second Edition allows for a much broader science scope than the DSR and PBDR, which were focused on a narrower set of science targets by design
- It will collect and codify the developments in the field over the past several years
- There are natural opportunities to re-engage our own members, to build bridges with other collaborations where opportunities for synergies exist, and to make our case to communities that may not be aware of the capabilities of CMB-S4



# Get engaged with Science Book, Second Edition

- Pitch your ideas for topics to be included in the Second Edition to analysis working groups
- Spread the word to colleagues, collaborators, students, etc. who may want to get engaged
- Suggestions, comments, feedback, etc. are welcome
  - Executive Team ([et@cmb-s4.org](mailto:et@cmb-s4.org))
  - Science Council ([sc@cmb-s4.org](mailto:sc@cmb-s4.org))