Mid-Scale Research Infrastructure (MSRI) Design Proposal: Consortium Proposal for CMB-S4 Design Development

John Carlstrom, Julian Borrill, Jim Yeck
The new NSF-wide MSRI program solves a long standing programmatic NSF funding gap.

Provides a mechanism for funding the implementation of projects for which the costs exceed the $6M cap of the NSF Major Research Infrastructure (MRI) program and fall below the $70M minimum of the Major Research Equipment and Facilities Construction (MREFC) program.
NSF Mid-Scale Research Infrastructure program (MSRI)

RI-1: proposals for Implementation and Design

- **Implementation** projects ($6M - $20M) may comprise any combination of equipment, infrastructure, computational hardware and software, and necessary commissioning.
- **Design** projects ($0.6M - $20M) includes planning (preliminary and final design) of research infrastructure with an anticipated total project cost that is appropriate for future Mid-scale RI-1 ($6M-$20M), Mid-scale RI-2 ($20M-$70M) or Major Research Equipment and Facilities Construction (MREFC) class (>70M) investments.

*(note: CMB-S4 will be an MREFC-class investment)*
RI-2: proposals are for immediate implementation only:

• Targets projects falling into the void between the $20 million cap of RI-1 and the minimum award funded by the MREFC Program, currently $70 million.

• Projects require high states of readiness for implementation, i.e., those that have already matured through previous developmental investments. Accordingly, Mid-scale RI-2 does not support pre-implementation (early-stage design or development).
John Carlstrom (PI) with Jim Yeck and Julian Borrill submitted preproposals from UChicago on Feb 19th. (Full proposals by invitation only, due May 20)

- Requests two years of support for NSF portion of Interim Project Office, starting Oct 1, 2019

- Proposed activities to prepare for NSF MREFC Preliminary Design Review in mid-2021 (aligned with DOE CD-1)
CMB-S4 MSRI R1 Design Proposal

Total request $3.6M

- 3 FTE (tbd) of project engineering WBS support
- Partial salary for NSF Interim Project Office people
- Travel, meetings, incl. ad hoc and annual reviews
- AUI subcontract for Chilean site legal and project execution planning (PI: Adam Cohen)
- Postdoc (tbd) for simulation support
- Education and Outreach coordinator (tbd)
- Note: R&D funding not allowed in MSRI R1 Design Proposals
Coordination with other MSRI R1 proposals

CMB-S4 MSRI R1 DP pre-proposal includes language about coordinating with three other R1 pre-proposals, should they be funded:

1. PI K. Arnold (UCSD) for implementing a hybrid photovoltaic/diesel power system at the Chilean CMB site. This would be a pathfinder for meeting CMB-S4 power needs.
Coordination with other MSRI R1 proposals

2. PI J. Kovac (Harvard) for design of a delensing LAT suitable for deployment to the South Pole, and implementation of infrastructure for continuing the BICEP Array project, and for extending the life-cycle of the MAPO observatory. These would be compatible with benefits to CMB-S4

3. PI T. Herter (Cornell) for implementing receivers on the CCAT-prime telescope in Chile. This telescope could in principle be used for CMB-S4 and its design is the basis of the CMB-S4 Chilean LAT reference design. We would coordinate with them for understanding the performance of the telescope.
Back up
Interim Project Office Organization

- **DOE High Energy Physics**
- **DOE/NSF Joint Coordination Group**
- **NSF Astronomy Physics Polar Programs**

- **Integrated Project Steering Committee**
- **pre-Project Development Group**

- **Interim Project Director** Jim Yeck
  - Project Manager - R&D/C&S: Brenna Flaugher
  - Project Manager - L2 Subsystems: TBD
  - Project Systems & Controls: Kathy Bailey
  - Project Development: Mark Reichanadter
  - Chilean Site Legal Planning: Adam Cohen
  - Education & Public Outreach: TBD

- **Spokespeople**
  - Julian Borrill & John Carlstrom
  - Technical Coordinators
    - Jeff McMahon & Abby Vieregg

- **INTERIM PROJECT OFFICE**

- **CMB-S4 COLLABORATION**

**DETECTORS**
- C: Chang, Irwin, Suzuki
- P: TBD

**READOUT**
- C: Ahmed, Bender
- P: TBD

**MODULES**
- C: Benson
- P: TBD

**LARGE APERTURE TELESCOPES**
- C: Niemack, Padin
- P: TBD

**SMALL APERTURE TELESCOPES**
- C: Kovac, Kusaka
- P: TBD

**DATA ACQUISITION & CONTROL**
- C: Newburgh, Whitehorn
- P: TBD

**DATA MANAGEMENT**
- C: Crawford, Hasselfield
- P: TBD

**INTEGRATION & COMMISSIONING**
- C: Arnold, Ruhl
- P: TBD

**CHILE SITE**
- C: Arnold
- P: TBD

**SOUTH POLE SITE**
- C: Ruhl
- P: TBD

**D&R Coordination:** Reichanadter
Tasking for MREFC Preliminary Design Phase:

- Produce construction estimate based on preliminary design
- Update operations cost estimate
- Develop site-specific preliminary design, environmental assessments/impacts
- Develop plan to achieve production capabilities of enabling technologies
- Produce bottom-up cost and contingency estimates, update risk analysis
- Develop Project Management Control System
- Develop preliminary operations cost estimate
- Develop Educational Outreach and Broader Societal Impact plan
- Update the PEP to the appropriate level for preliminary design review