

## CMB S4: Gatekeeper of Dark Complexity

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CMB measurements have unique and almost completely model-independent sensitivity to new light degrees of freedom. As a result, whole classes of dark sectors and dark matter models should produce a signal at CMB S4. Non-detection would severely constrain the space of possible solutions for fundamental puzzles like the nature of dark matter or the hierarchy problem. Positive detection would confirm physics beyond the Standard Model and lend strong motivation to non-minimal dark sectors, and I will outline the variety of exciting new astrophysical and cosmological signals that could be generated by such scenarios: formation of mirror stars and their signals in optical, X-ray, gravitational lensing or gravitational wave observations; direct detection of atomic dark matter with dark plasma screening effects in terrestrial experiments or stellar cooling; and combining full MHD N-body simulations of atomic dark matter with measurements of galactic structure to determine the forces active in the dark sector.

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