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The Simons Observatory: next-generation CMB telescopes and science goals

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The Simons Observatory (SO) is a new cosmic microwave background experiment being built on Cerro Toco in Chile, due to begin observations in 2024. SO will measure the temperature and polarization anisotropy of the cosmic microwave background in six frequency bands, from 27 to 280 GHz. The initial configuration of SO will have three small-aperture 0.5-m telescopes (SATs) and one large-aperture 6-m telescope (LAT), with a total of 60,000 cryogenic bolometers. Our key science goals are to characterize the primordial perturbations, measure the number of relativistic species and the mass of neutrinos, test for deviations from a cosmological constant, improve our understanding of galaxy evolution, and constrain the duration of reionization. The SATs will target the largest angular scales observable from Chile, mapping $\sim 10\%$ of the sky to a white noise level of $2\ \mu\text{K-arcmin}$ in combined 93 and 145 GHz bands, to measure the primordial tensor-to-scalar ratio, r , at a target level of $\sigma(r)=0.003$. The LAT will map $\sim 40\%$ of the sky at arcminute angular resolution to an expected white noise level of $6\ \mu\text{K-arcmin}$ in combined 93 and 145 GHz bands, overlapping with the majority of the LSST sky region and partially with DESI. With up to an order of magnitude lower polarization noise than maps from the Planck satellite, the high-resolution sky maps will constrain cosmological parameters derived from the damping tail, gravitational lensing of the microwave background, the primordial bispectrum, and the thermal and kinematic Sunyaev-Zel'dovich effects, and will aid in delensing the large-angle polarization signal to measure the tensor-to-scalar ratio. The survey will also provide a legacy catalog of 16,000 galaxy clusters and more than 20,000 extragalactic sources. This talk will present the science goals of SO and the recently approved plans to upgrade the current design (SO:UK, SO:JP and Advanced SO).

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