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Towards fundamental physics from cosmological surveys

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Surveys of the cosmic microwave background and large galaxy surveys of the next decade carry immense promise for measurements of new physics beyond the Standard Models of cosmology and particle physics. However, these observations are complicated by multiple sources of systematics, either intrinsic, observational, or instrumental, which must be carefully controlled in order to make reliable inferences from the data about fundamental physics. In this talk I will show how some of these real-world effects impact the data. I will present an example of how spatially-varying observing conditions impact measurements of fundamental physics (such as primordial non-Gaussianity) from galaxy surveys, and discuss techniques that can be used to control these systematics. I will present a comprehensive survey of the capabilities of future CMB experiments, taking account of Galactic foregrounds and the effect of lensing by intervening large-scale structure. Incorporating these effects, I will present forecasts for the constraining power of these experiments in terms of inflationary physics, the neutrino sector, and dark energy parameters.

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