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Detecting Astrophysical Transients with Cosmic Microwave Background Experiments

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Ground-based cosmic microwave background (CMB) experiments are being developed with more complex designs, capable of producing more sensitive and higher-cadence maps of the CMB. In studying this relic millimeter-wave radiation from the epoch of recombination, it becomes possible to constrain parameters which describe the formation of our Universe. Beyond the initial motivations of making precise CMB maps of intensity and polarization, these experiments are developing methods to observe time-varying astrophysical phenomena, referred to as “transients”. In the millimeter regimes observed by CMB experiments, it is possible to observe stellar flares, gamma ray burst afterglows, active galactic nuclei, novae, and gravitational wave events (such as neutron star mergers). With methodology applied to moving phenomena, it is even possible to observe Planet Nine if it exists. Through creating a well-characterized static background and removing noise, it becomes possible to find transient phenomena as a byproduct of long-duration scans of the same area of sky. This presentation reflects work done to assess the viability of an upcoming month-long observation in which Simons Array (a CMB experiment which observes in millimeter wavelengths) and TESS (Transiting Exoplanet Survey Satellite, which observes in optical wavelengths) survey an overlapping area of sky in search of stellar flares. Additional information regarding the future of transient observations and the impact of interference from satellite constellations is also discussed.