

SF2A 2026

S14 : Astrophysical foregrounds for precision cosmology

Title : BATMAN v Foregrounds: Dawn of Coherence

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Small-scale measurements of the cosmic microwave background (CMB) probe not only primordial anisotropies but also several extragalactic components, notably the thermal and kinetic Sunyaev–Zel’dovich (tSZ, kSZ) effects and the cosmic infrared background (CIB). The BATMAN project aims to model and exploit, within a coherent framework, both primordial and extragalactic spectra to constrain the cosmological model, the reionization epoch, and the astrophysics of large-scale structure.

Extragalactic signals are typically treated as foregrounds, modeled with fixed templates while marginalizing over their amplitudes. I will show how assumptions about these template shapes can affect both cosmological and foreground parameter constraints in a joint analysis of Planck, SPT, and ACT data.

Beyond their role as contaminants, these signals carry valuable cosmological information that can be used to tighten constraints on the underlying model. I will present a halo-model-based framework that provides a unified description of the tSZ, kSZ, and CIB signals, and illustrate the resulting improvements in constraints on reionization and hot gas properties from combined Planck+SPT analyses.

Our ultimate goal is to enable a consistent analysis of all current CMB datasets while jointly incorporating cosmological and astrophysical information from large-scale structure