Transients in CMB Surveys

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CMB Surveys

- higher sensitivity comes from more detectors or more concentrated survey
- sensitivity to point sources reduced as beam size gets larger
Fuzzy Diffuse Stuff (CMB) & Bright Dots (Galaxies & Clusters)

Benson et al 1407.2973
“CMB surveys” = ”Surveys”

- **Cosmology**: 38% (largest section)
- **Galaxy Clusters**: 37%
- **Submillimeter Galaxies**: 16%
- **Instrumentation**: 10%

Breakdown of citations to SPT.

Trend not new, but deeper surveys see more.
A mm-wave galaxy survey

Extragalactic Sources

Figures from Joaquin Vieira
CMB survey cadences

- observations stretch over several years 90, 150, 220 GHz, Stokes I/Q/U at resolution of 1-2’

- instantaneous field of view measured in square degrees; e.g., Simons Observatory FOV diameter ~8 deg

- sampling at 100 Hz within a given field of view (FRBs?)

- coverage on a single pixel for several minutes per observation set (forecast <10 mJy)

- repeat ~daily [total sky coverage, repeat cadence, etc., depends on survey]
mm-wave Transient Astronomy

SPTPol saw something blip for ~6 days detected in post-processing, years after it happened)

1% chance of fluke

SPT work in progress: real-time analysis (Whitehorn) FRB search (Harrington)

Whitehorn, Natoli et al; 1604.03507
The changing mm-wave sky: some targeted mm-wave follow-up

lots of GRBs have been observed to have detectable flux for S4

typical uncertainties of a few mJy per day
mm-wave transients in the local universe

1 mJy at $z \sim 0.2$ at 150 GHz = $10^{41}$ erg/s
1 mJy at 60 Mpc at 150 GHz < $10^{39}$ erg/s

Laskar et al 1808.09476
mm-wave transients in the local universe

- 1 mJy at z~0.2 at 150 GHz = $10^{41}$ erg/s
- 1 mJy at 60 Mpc at 150 GHz < $10^{39}$ erg/s

Ho et al 1810.10880
“CMB” Surveys

• ~mJy per day transient sensitivity over ~1/2 sky at mm wavelengths for future surveys (e.g., CMB-S4)
  • comparable depth over few % of sky or 5-10x less sensitive over comparable area for current surveys
  • Nathan Whitehorn (UCLA) building a rapid detection pipeline for SPT-3G; would a ~daily public archive be useful?

• possible sources: GRBs, TDEs, Novae, SNe, Stellar Flares, Solar System Objects, Blazars what else?