

Non-Gaussian radio galaxy sims with Websky!

Zack Li, Princeton

Bright radio galaxies are **everywhere** in our maps.



ACT f90

ACT f150

Naess et al. 2020.

Fornax A



ACT+Planck f090 - f150 Radio+Optical

Naess et al. 2020.

Cutting-edge sims: agreement with all current astrophysical data, halo-model correlations with LSS.



It's known that radio galaxies are **heavily biased**, and this causes problems like cluster fill-in.



tSZ, radio, CIB all trace the large scale structure, so they're all correlated.



Radio sources hide *small scale physics*.

Figure: **Lensing** convergence contours, overlaid over simulated radio galaxies



Radio sources hide *small scale physics*.

150 GHz plot from Sehgal et al. 2009



Planck didn't have to worry about this.

But we want SZ, v, DM....

More understanding of radio galaxies

= more small scale CMB

Jets! Lobes! Cores!









on average, ~1% polarized





Learn from our data!

Future high resolution CMB will be deep *radio source* surveys with intensity and polarization

Learn from other data!

Multiwavelength coverage with VLA, LOFAR, ... someday SKA

We have made ready-to-use mock radio galaxies, correlated with the large-scale structure.



Websky: simulated catalogs and maps of radio galaxies Zack Li, Giuseppe Puglisi, Mat Madhavacheril, Marcelo Alvarez (in prep)

Forward simulations with Websky: full sky peak patch sims!

12288³ particles 15.4 Gpc

Full sky extragalactic foregrounds



(Halos) + (Radio Galaxy Model)





Useful for • Compton-y sims Cluster finding Lensing reconstruction biases

We mask the point sources!

Are we masking clusters and other secondaries?



Planck 2015

Current model: Sehgal et al. 2009



Radio galaxy morphology



FR I



FR II

Perley, Willis and Scott (1979)

The Radio Luminosity Function at 151 MHz, at z < 0.3



XGPaint.jl

generate non-Gaussian realizations of extragalactic foregrounds (CIB/radio)

Really fast, not yet documented very well.

We reproduce the source counts from Sehgal, with our halos from Websky.



The Sehgal 2009 models don't fully agree with new data, for example **the spectral index**.



Li et al. (in prep)

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Use these mock radio galaxy catalogs to answer your foreground fears!

Get in touch to get the catalogs! zq@princeton.edu

Example use: Fabbian, Carron, Lewis, Lembo (2020). Lensed CMB power spectrum biases from masking extragalactic sources.