# Testing WMAP data via Planck radio source and SZ catalogues

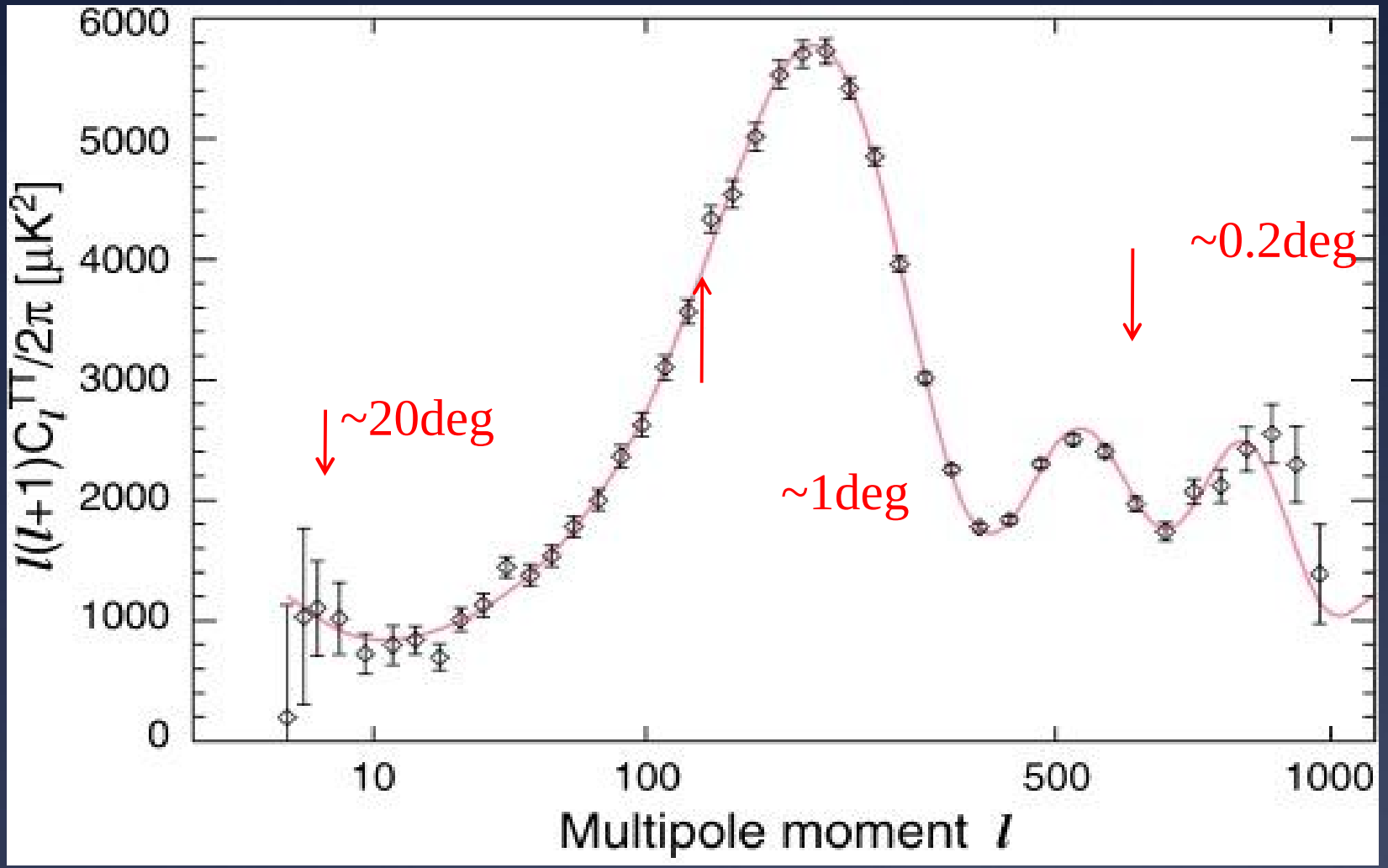
Tom Shanks
Durham University

Sawangwit & Shanks 2010, MNRAS, 407, L16
Whitbourn et al 2011, arXiv:1107.2654

# Overview

- ΛCDM – the pros and cons
- ΛCDM – a simpler alternative?
- ΛCDM escape route via WMAP beam smoothing?
- WMAP – Planck radio source + SZ anomalies
- WMAP – non linearity + timing offset explanations

# WMAP Power Spectrum




"Fourier" analysis of CMB ripples

⇒Spatially flat Universe

+ matter is CDM dominated

(Hinshaw et al. 2003, 2006, 2008, Spergel et al. 2003, 2006, 2008)

Wavenumber

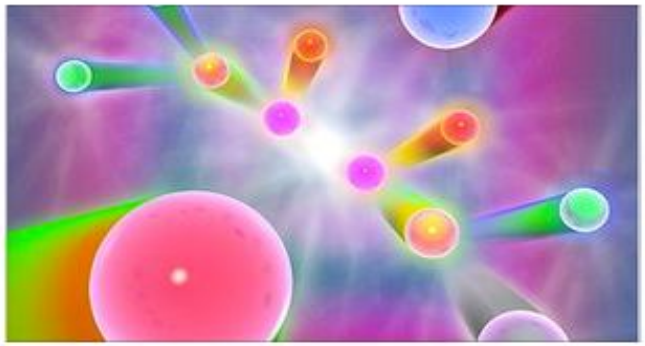
And yet.....

27 August 2011 Last updated at 07:41

# LHC results put supersymmetry theory 'on the spot'

By Pallab Ghosh
Science correspondent, BBC News

**Results from the Large Hadron Collider (LHC) have all but killed the simplest version of an enticing theory of sub-atomic physics.**



Supersymmetry predicts the existence of mysterious super particles.

Researchers failed to find evidence of so-called "supersymmetric" particles, which many physicists had hoped would plug holes in the current theory.

Theorists working in the field have told BBC News that they may have to come up with a completely new idea.

Data were presented at the Lepton Photon science meeting in Mumbai.

They come from the LHC Beauty (LHCb) experiment, one of the four main detectors situated around the collider ring at the European Organisation for Nuclear Research (Cern) on the Swiss-French border.

According to Dr Tara Shears of Liverpool University, a spokesman for the LHCb experiment: "It does rather put supersymmetry on the spot".

The experiment looked at the decay of particles called "B-mesons" in

Related Stories

Higgs boson range narrows at LHC

Electron particle's shape shown

Collider produces 'mini-Big Bang'

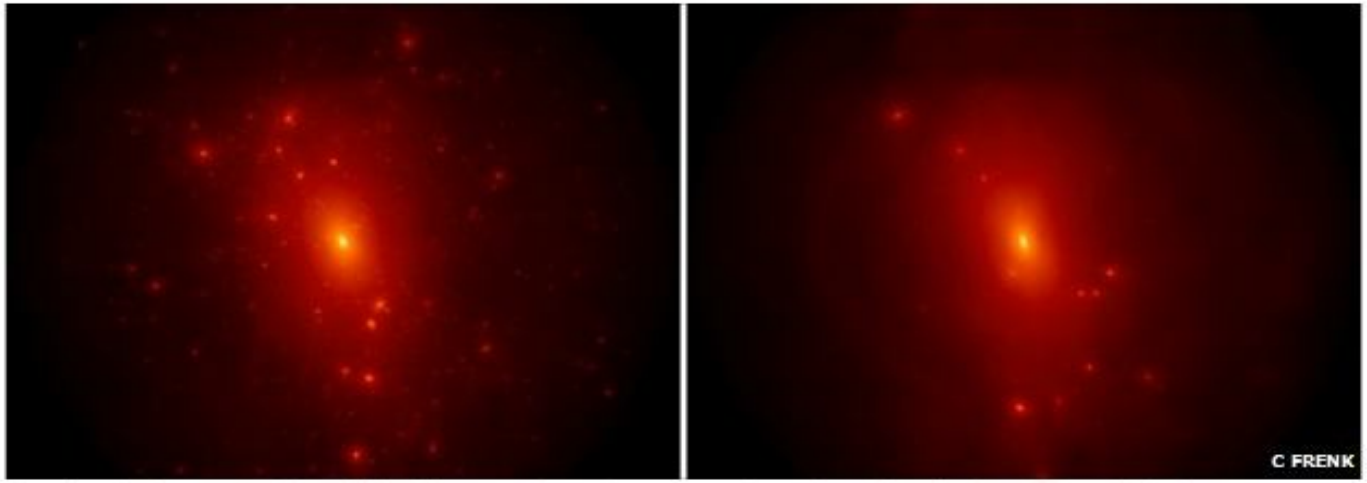
# AQUARIUS ΛCDM Galaxy Simulation

16 September 2011 Last updated at 18:47



# Dwarf galaxies suggest dark matter theory may be wrong

By Leila Battison
Science reporter, Bradford




Dwarf galaxies around the Milky Way are less dense than they should be if they held cold dark matter

**Scientists' predictions about the mysterious dark matter purported to make up most of the mass of the Universe may have to be revised.**

Research on dwarf galaxies suggests they cannot form in the way they do if dark matter exists in the form that the most common model requires it to.

That may mean that the Large Hadron Collider will not be able to spot it.

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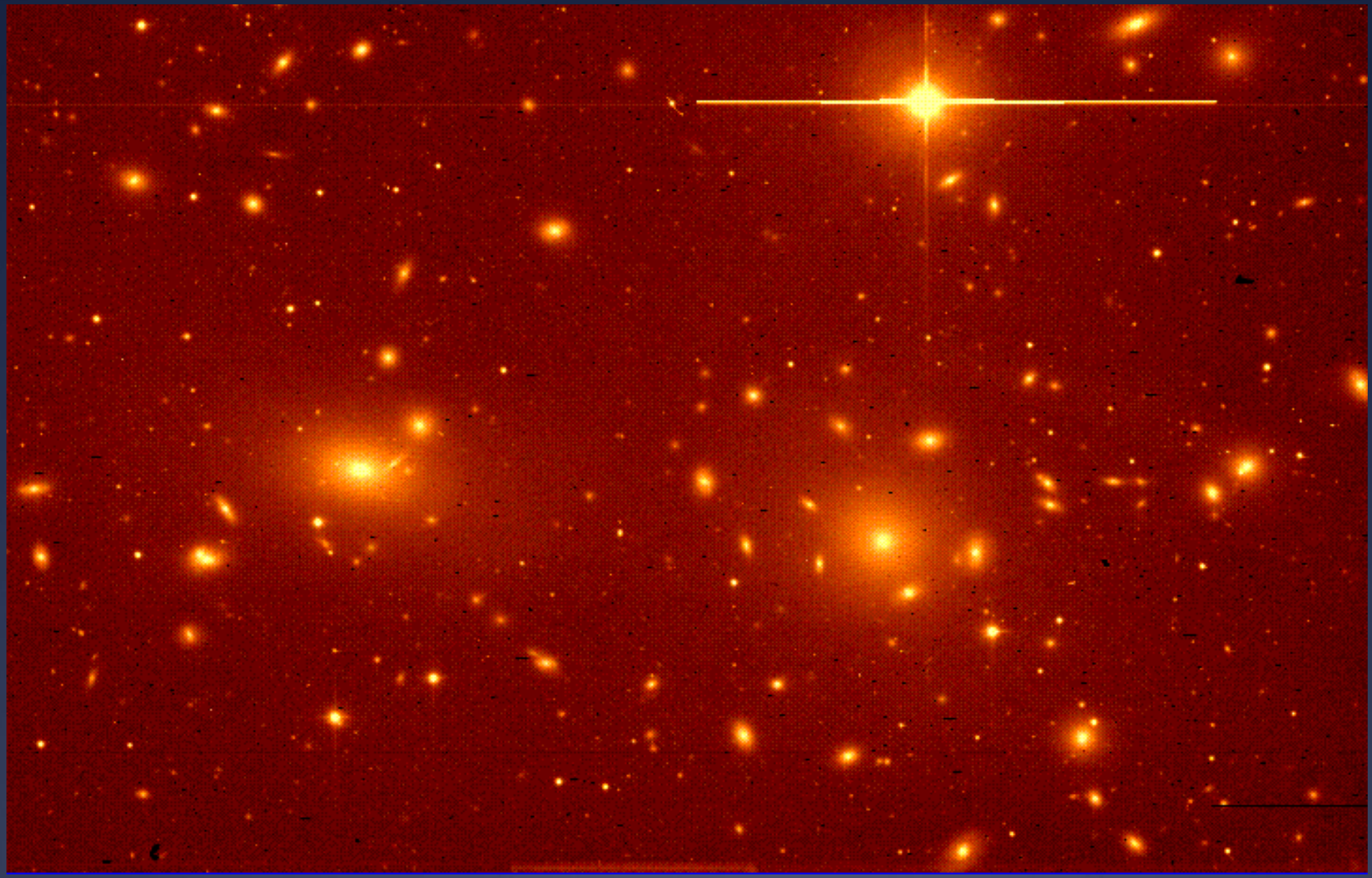
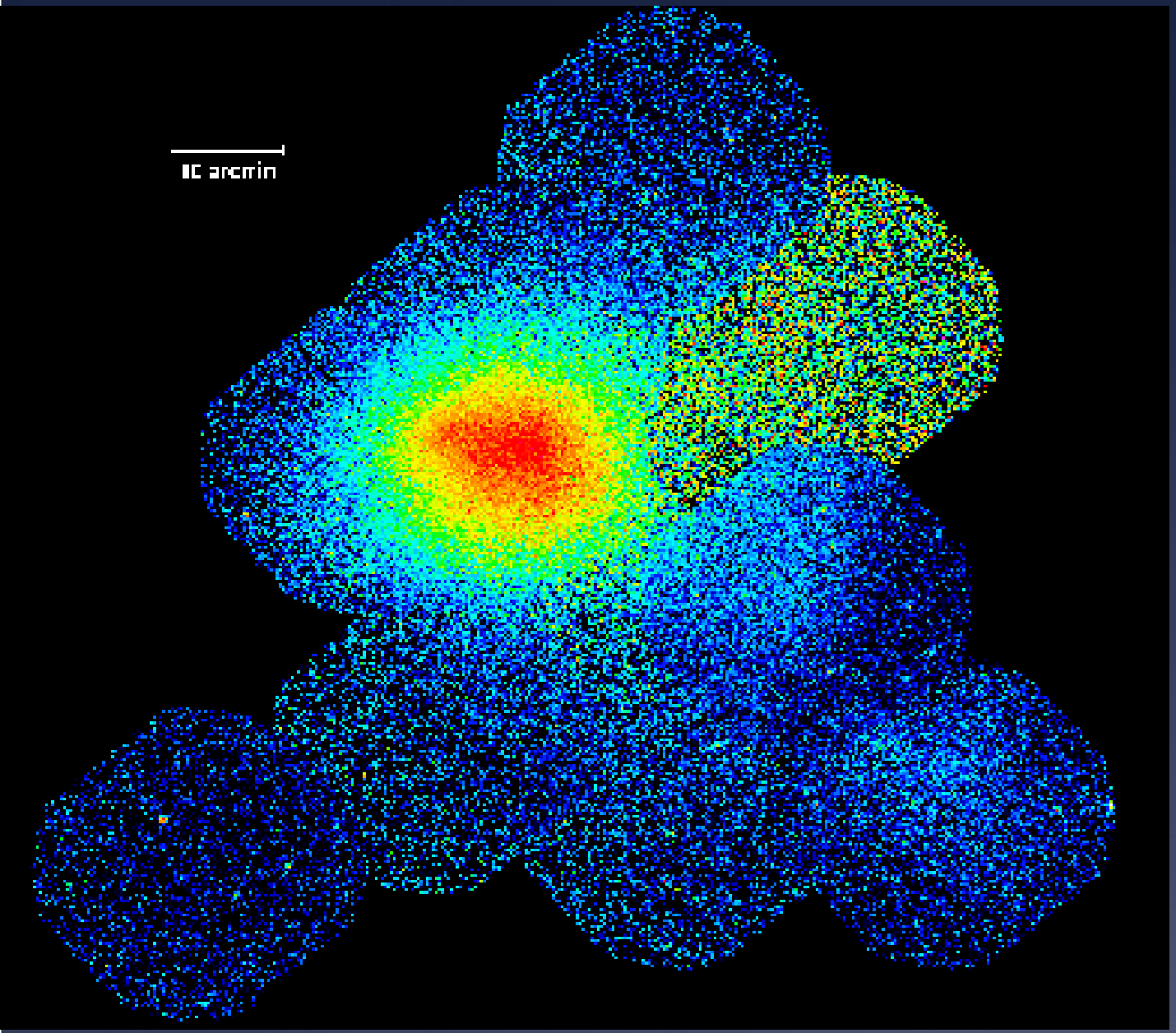
'Filaments' hold dark matter test

# Coma cluster dark matter



# Coma galaxy cluster gas



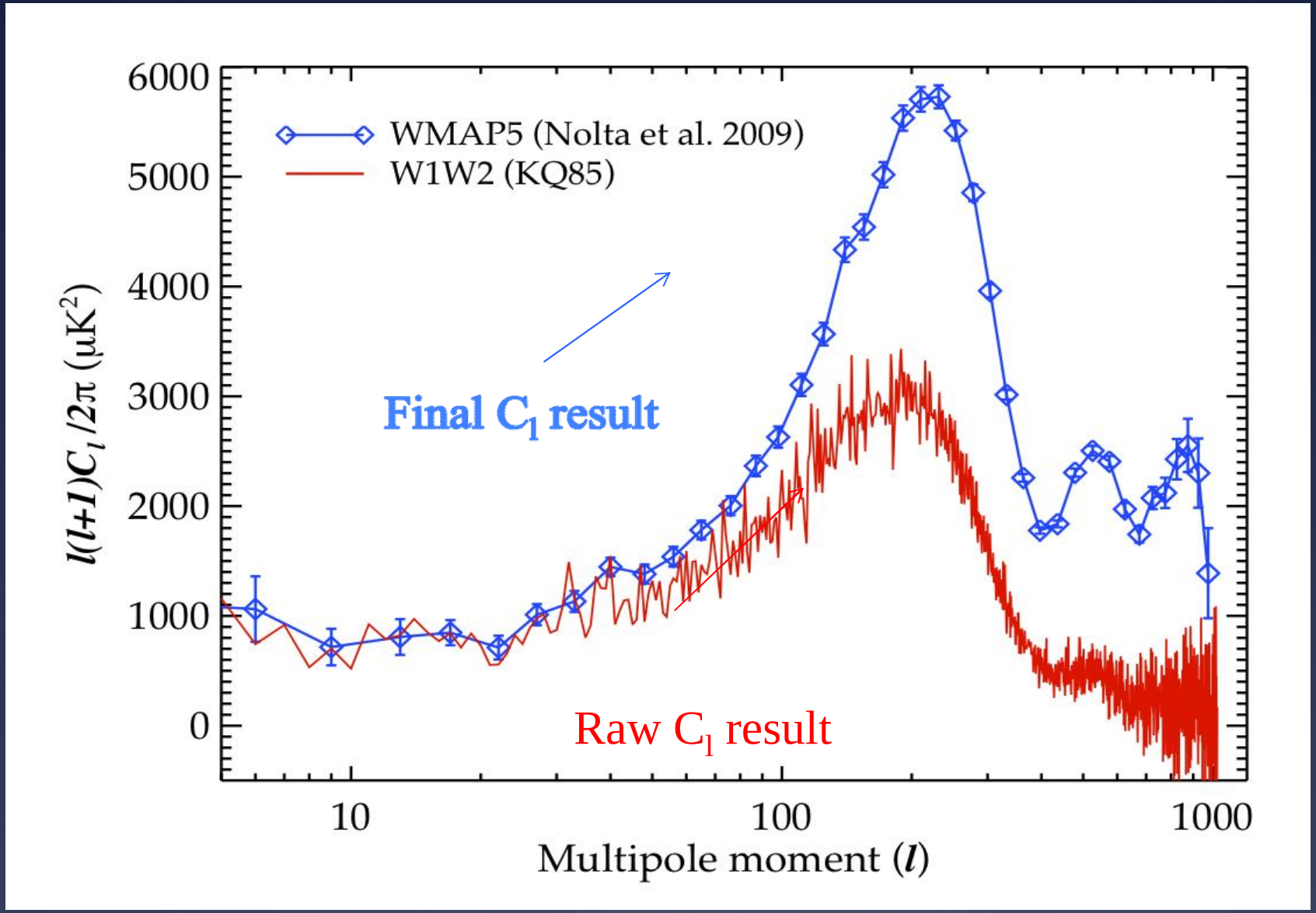

- Coma contains hot X-ray gas (~20%)
- X-ray map of Coma from XMM-Newton (Briel et al 2001)
- If M/L=5 then less plausible to invoke cosmological density of exotic particles than if M/L=60-600!

# 3 Advantages of low $H_0$

Shanks (1985) - if $H_o<30 kms^{-1}Mpc^{-1}$ then:

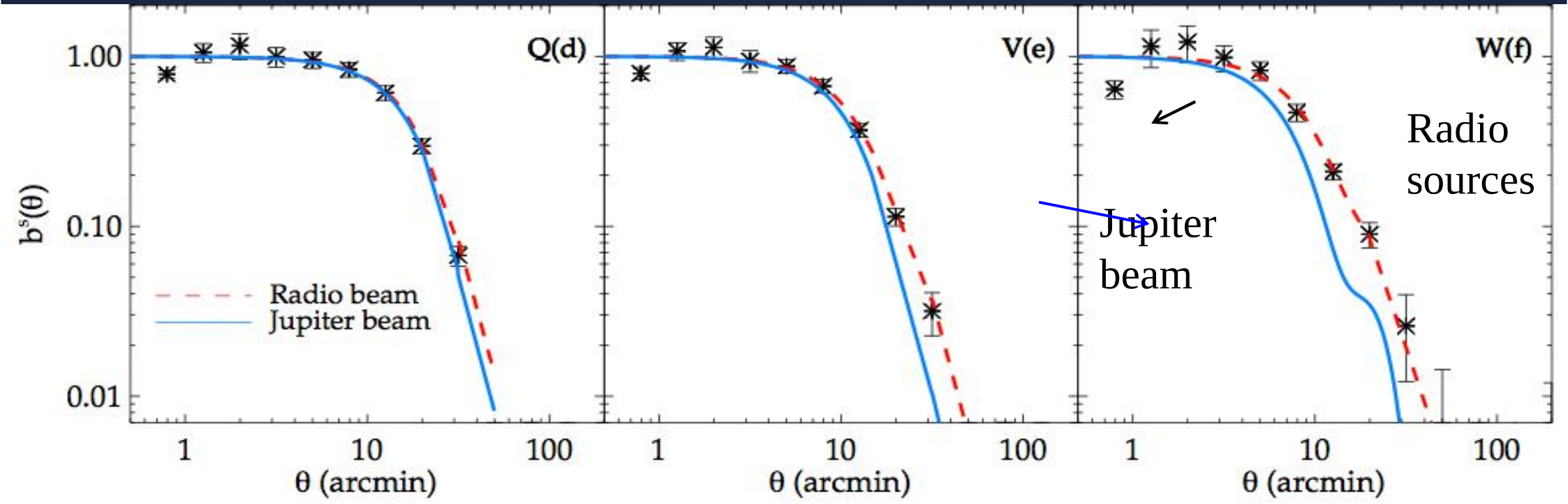
- X-ray gas becomes Dark Matter in Coma
- Inflationary $\Omega_{baryon}=1$ model in better agreement with nucleosynthesis
  - Light element abundances $\rightarrow \Omega_{baryon}h^2<0.06$
  - $\Rightarrow \Omega_{baryon} \approx 1$ starts to be allowed if $h<0.3$
- Inflation+EdS => $\Omega_M=1$ => Globular Cluster Ages of 13-16Gyr require $H_o<40 kms^{-1}Mpc^{-1}$
- But the first acoustic peak is at l=330, not l=220!

# Sensitivity of WMAP $C_l$ to beam

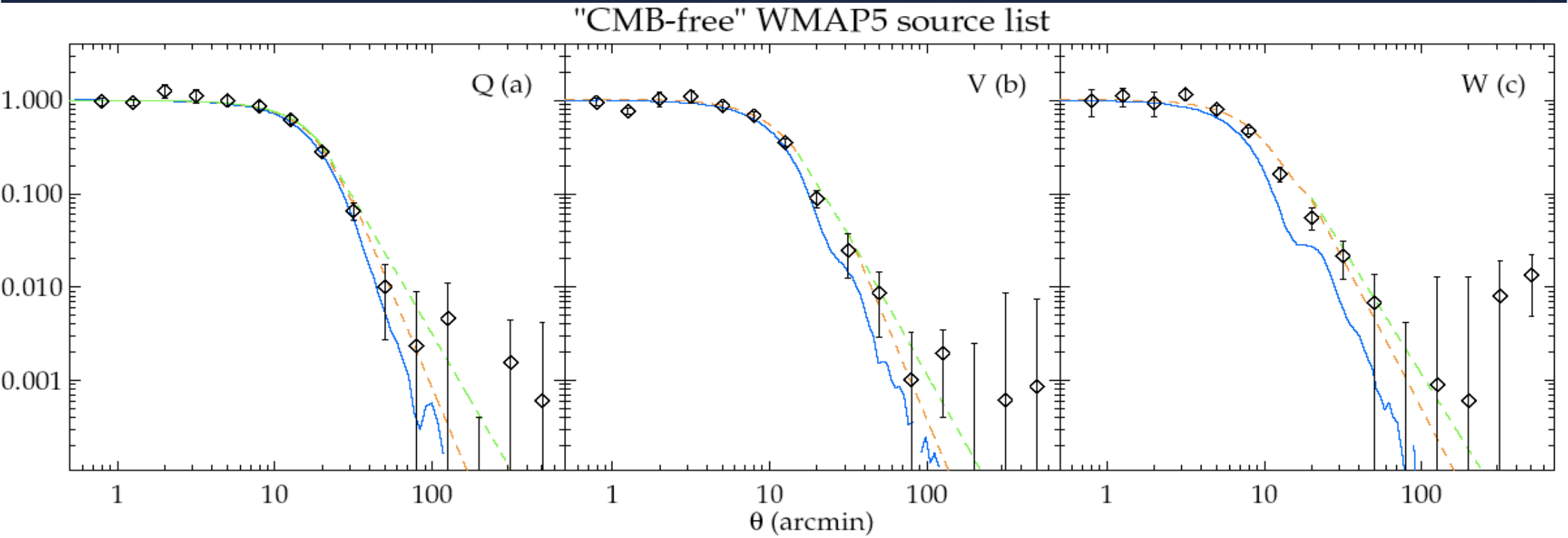



Sawangwit & Shanks, arXiv:0912.0524

# WMAP7 Radio Source Profiles

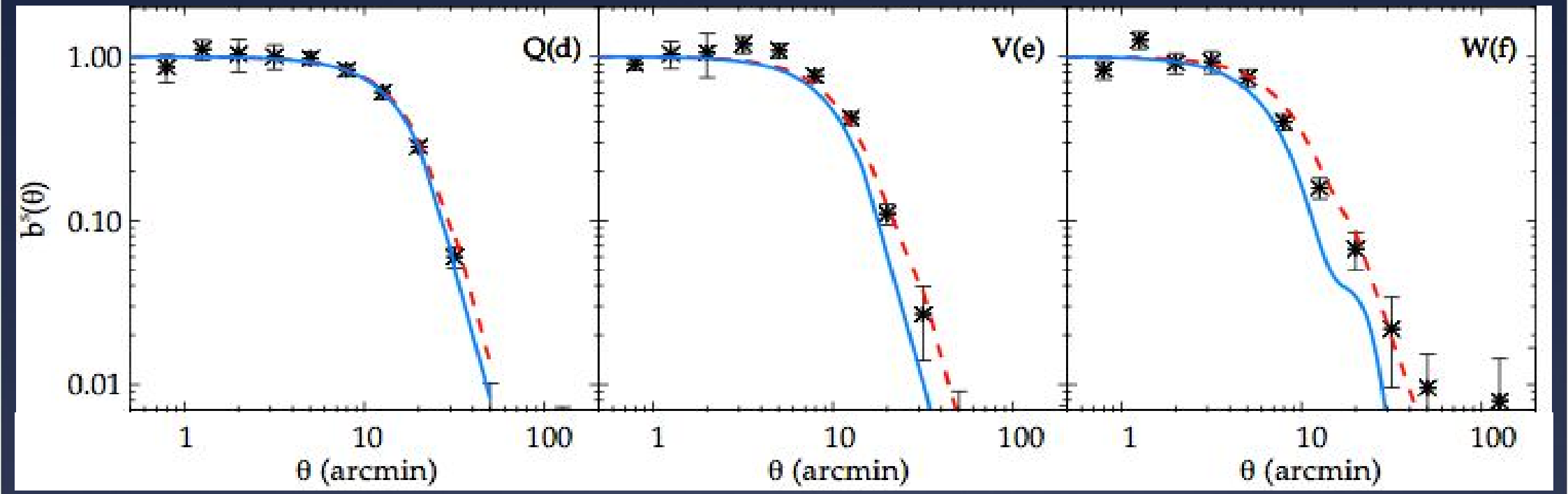


# New: “CMB-free” point sources

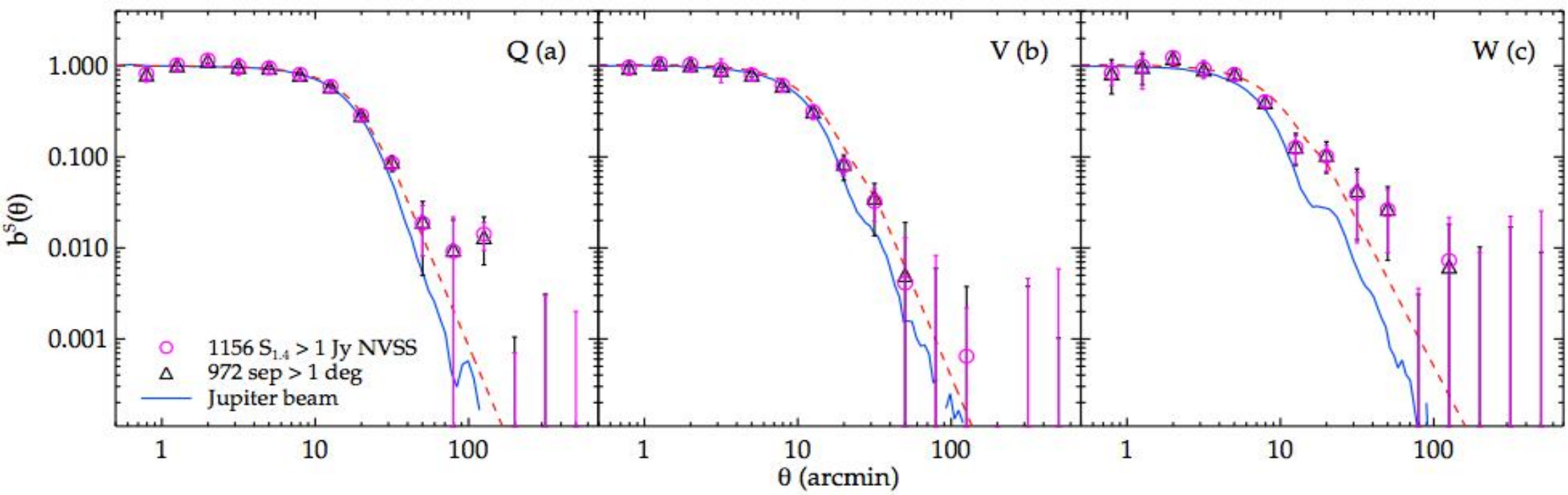



CMB-free WMAP5 source detection, Chen & Wright 2009

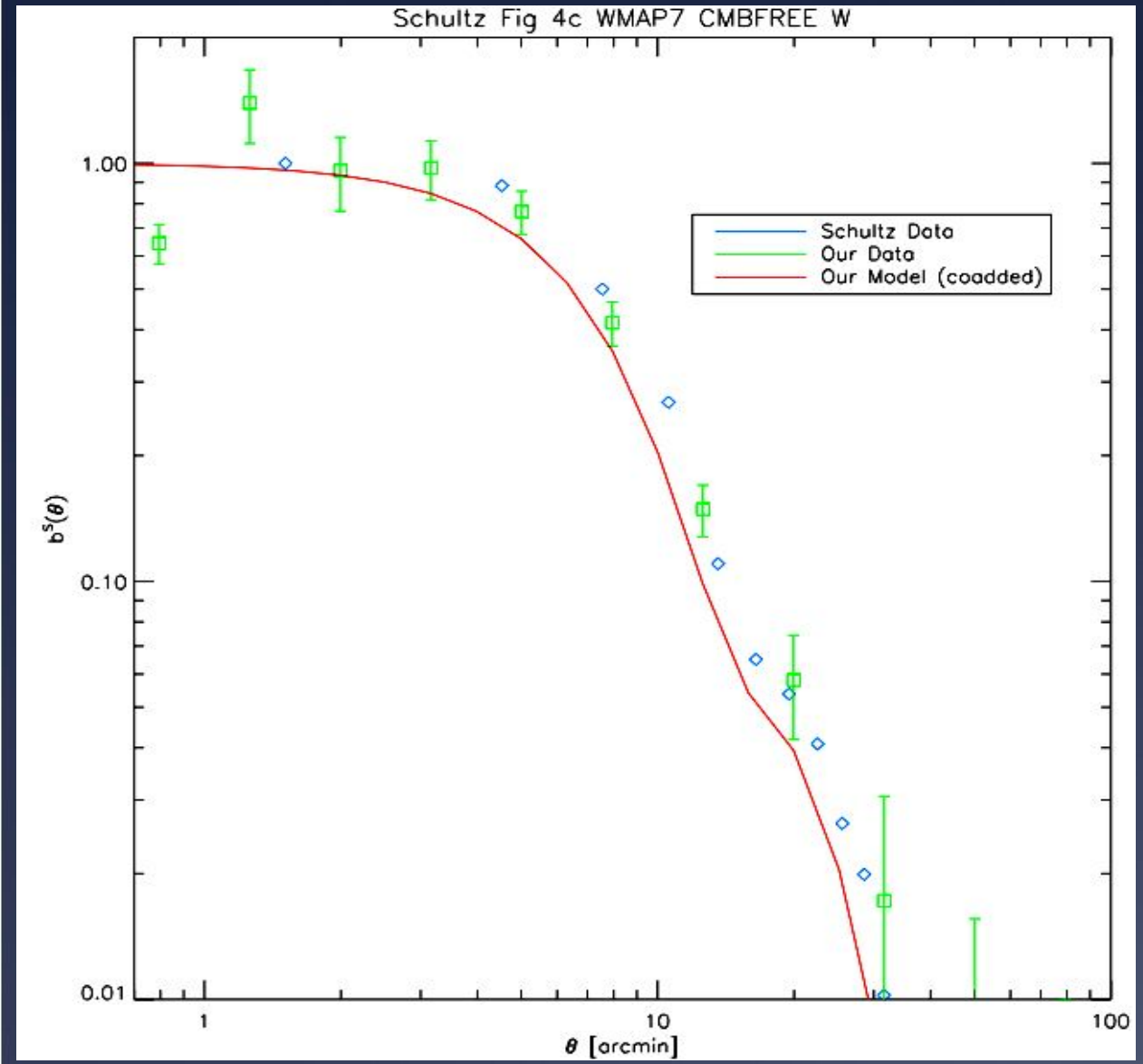
# New: Planck radio sources



# New: NVSS 1.4GHz point sources

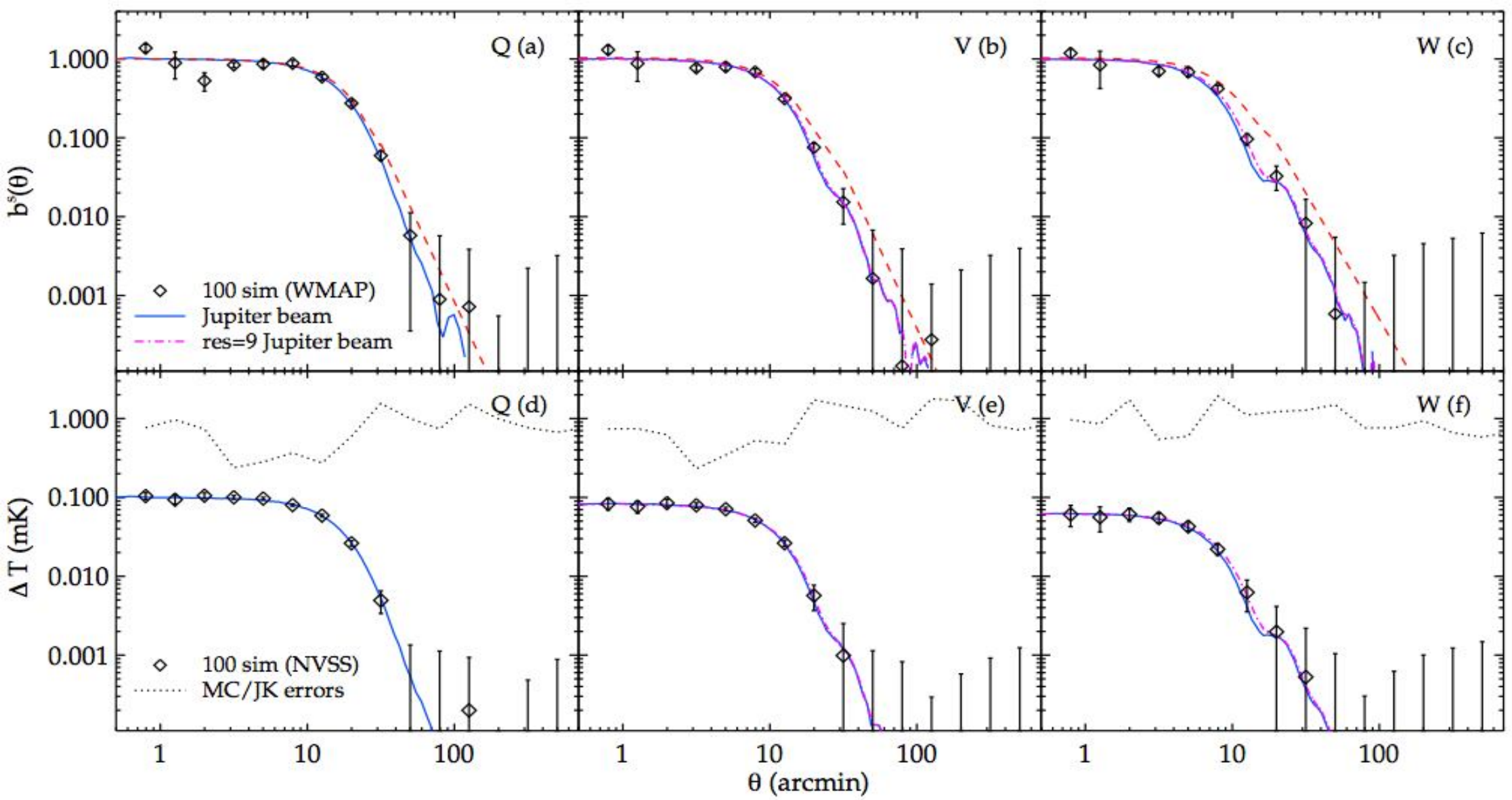


# Schultz + Huffenberger (2011)

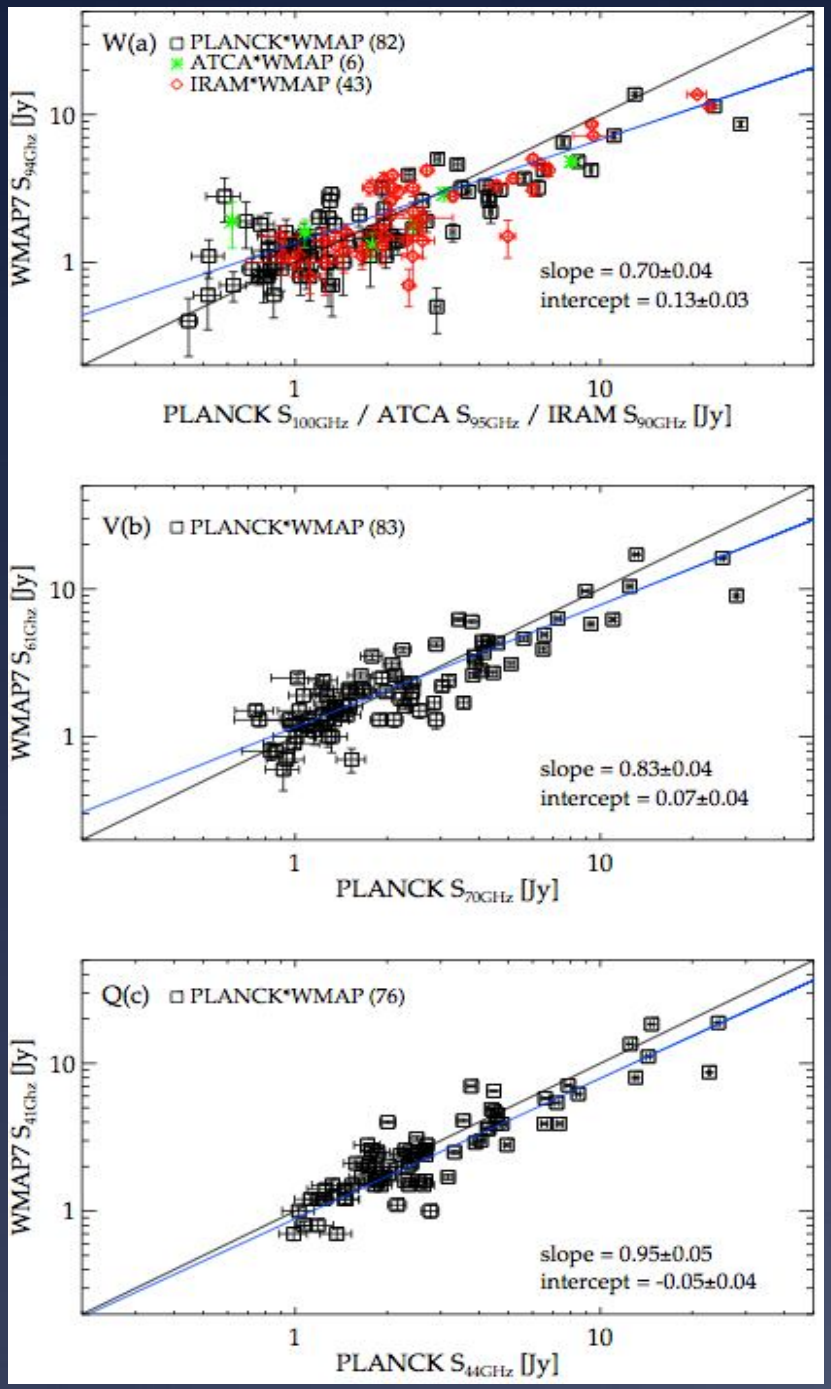


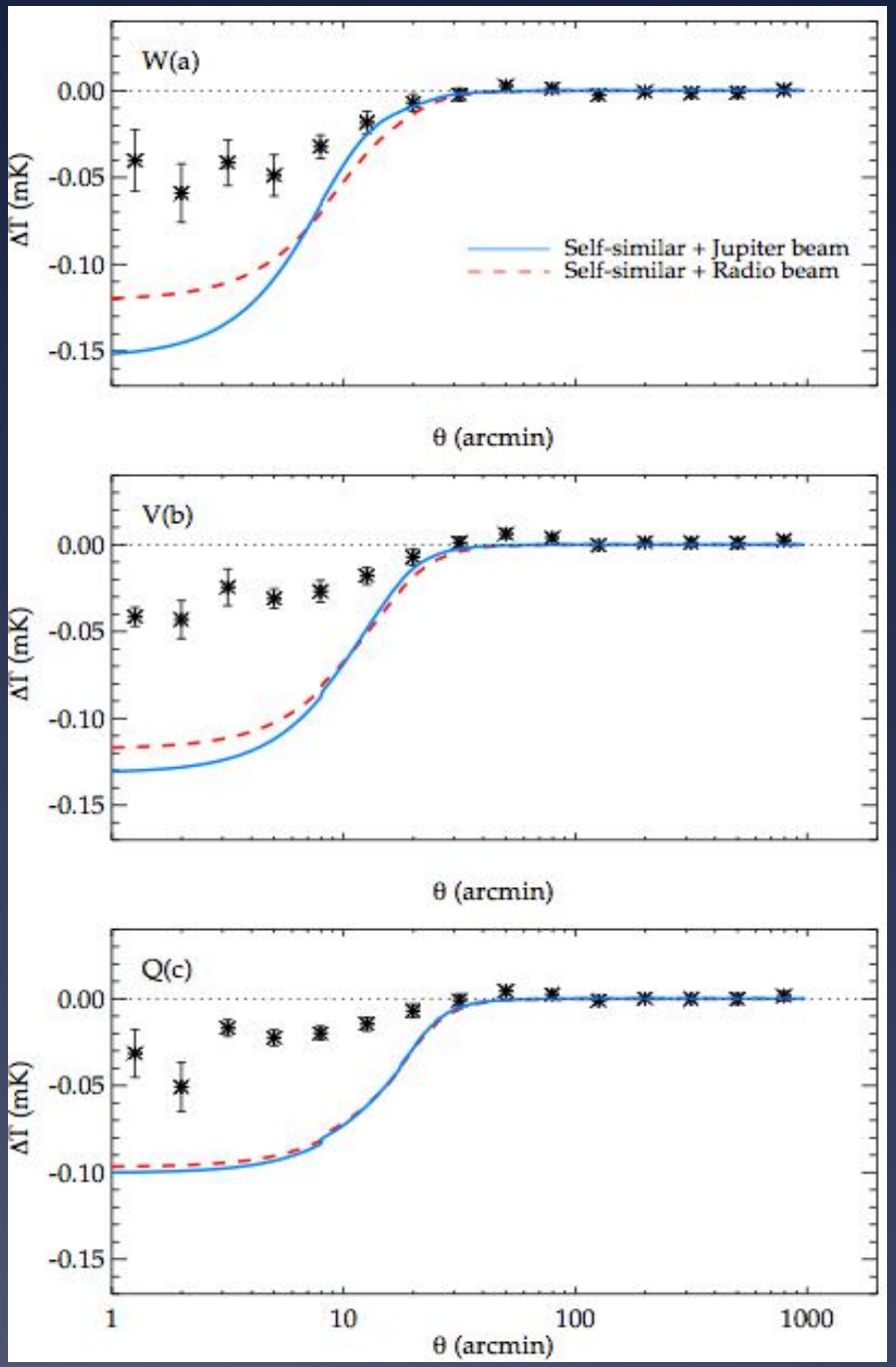

- S+H claim our results caused by Eddington bias
- But not possible since we pre-select on GB6 and PMN 5GHz point sources...
- ... and positions!
- S+H results confirm ours – they need to invoke a 4' error smoothing to explain broad profile

# Simulations: test source detection

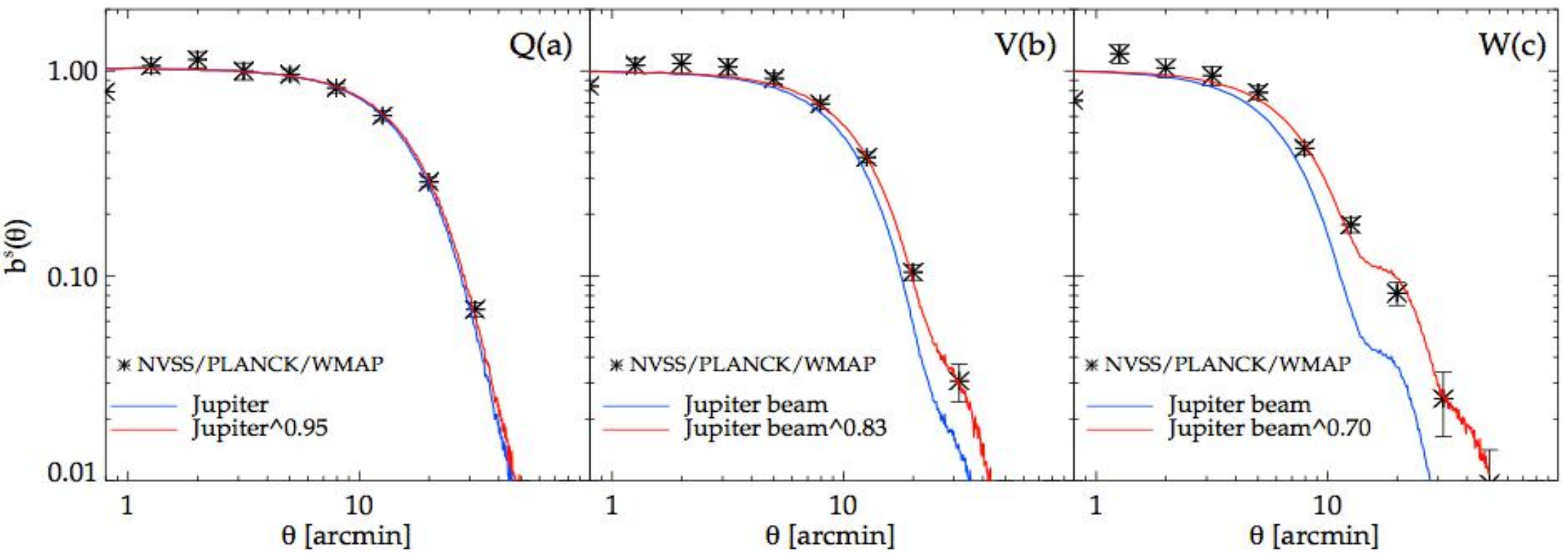


# WMAP vs Planck Flux and SZ



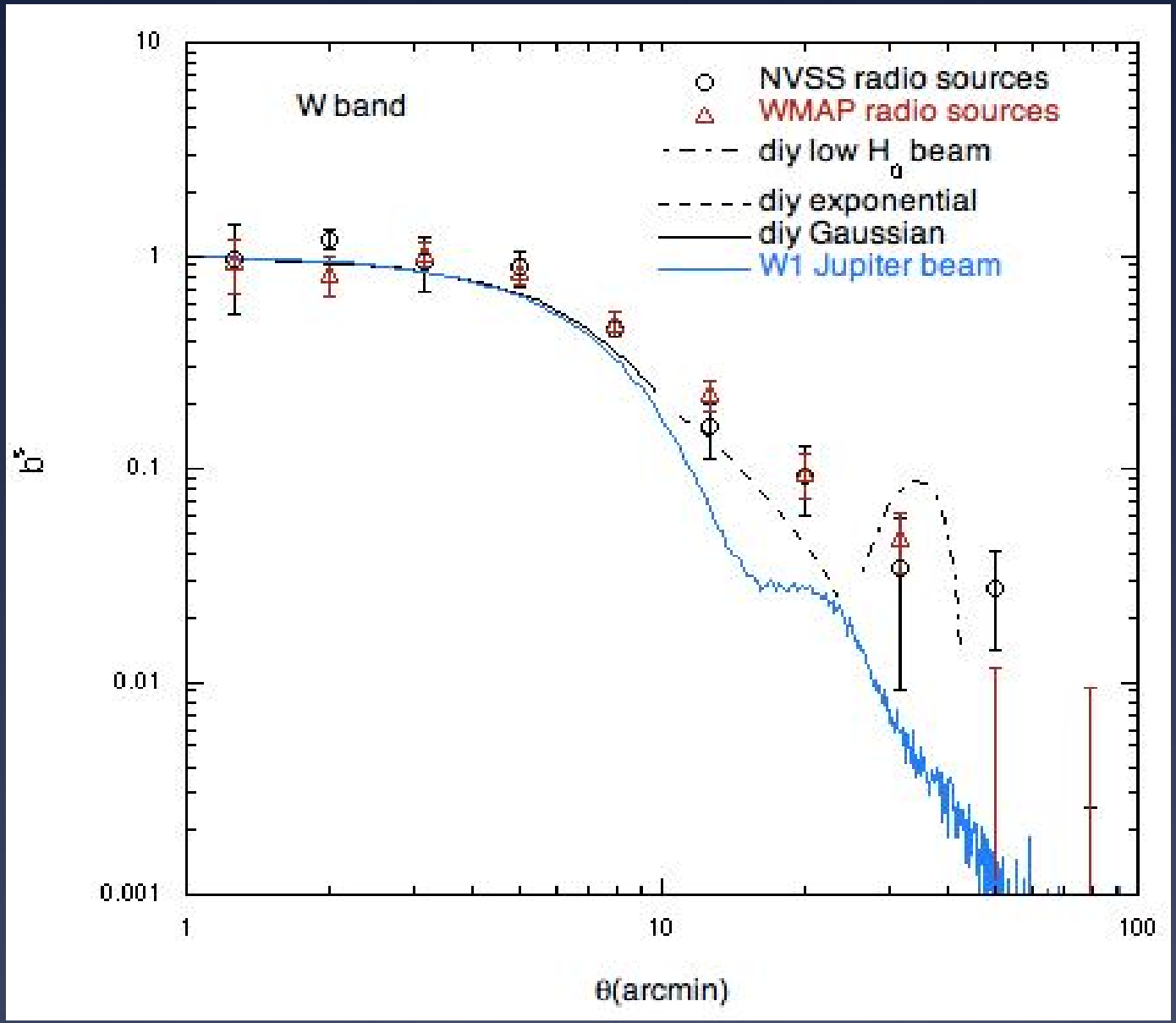



# WMAP Average Radio Profiles

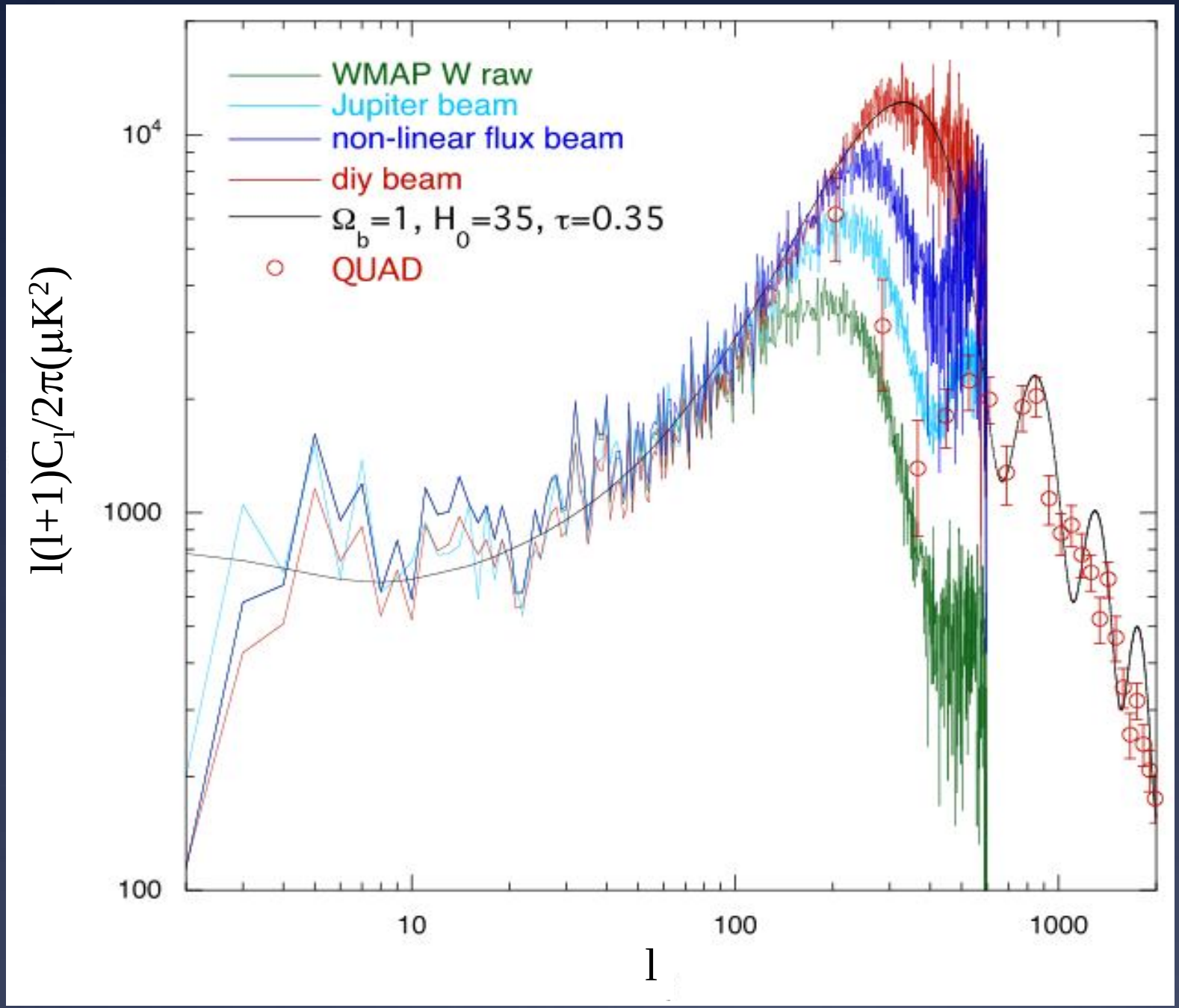



Does non-linearity in WMAP-Planck fluxes explain wide beam profiles?

# A diy beam that works!

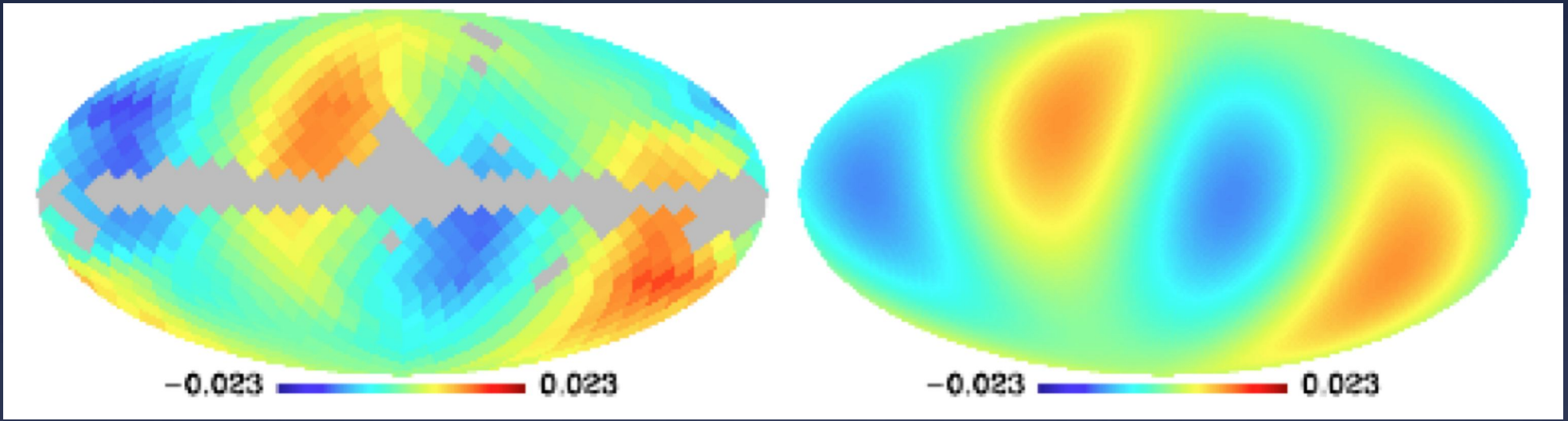


# WMAP peak moved to l~260?



# 25.6ms and "Axis of Evil"

Liu & Li 2010

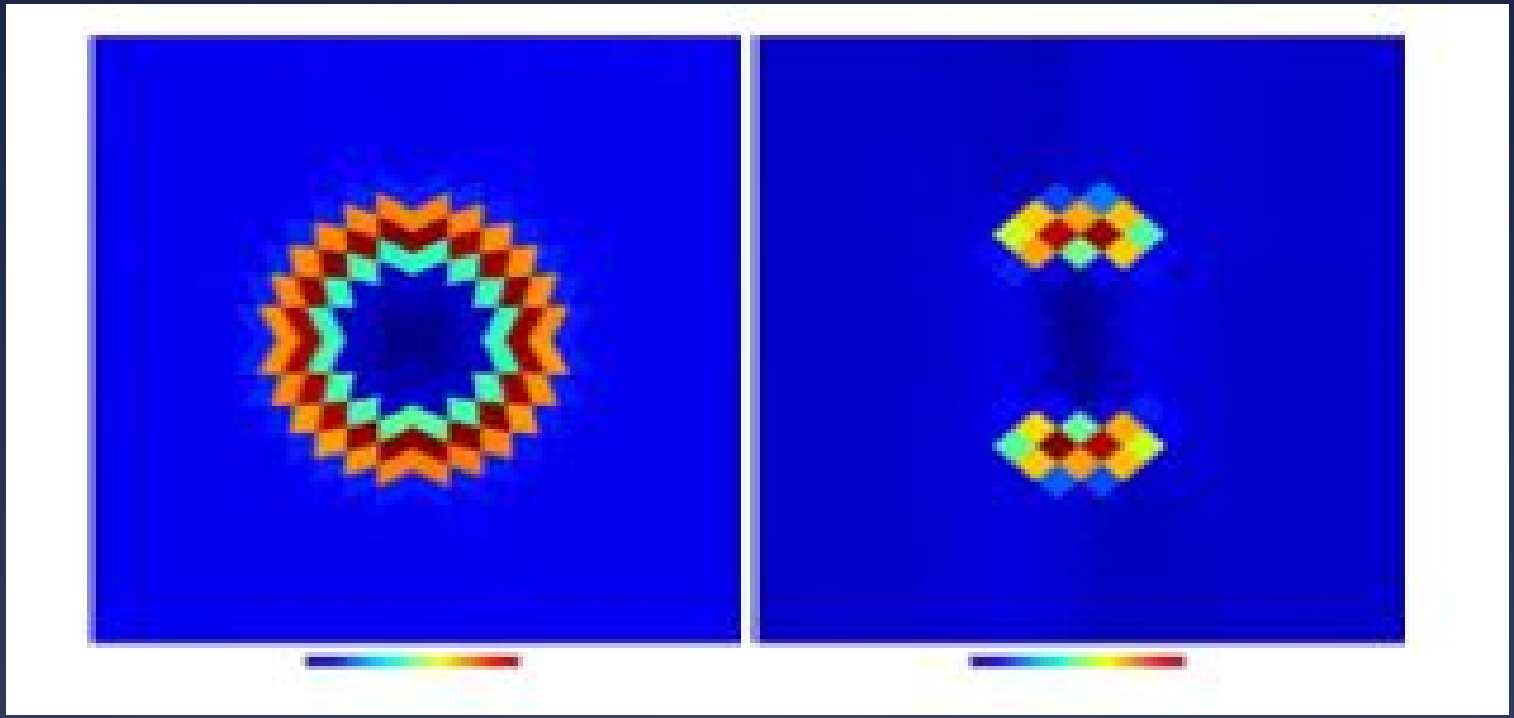



Model - Dipole+25.6ms timing offset

Official WMAP large-scale map

25.6ms - only ~4arcmin on sky – but resulting dipole residuals ☐ large-scale effect

# WMAP beam with 25.6ms offset!

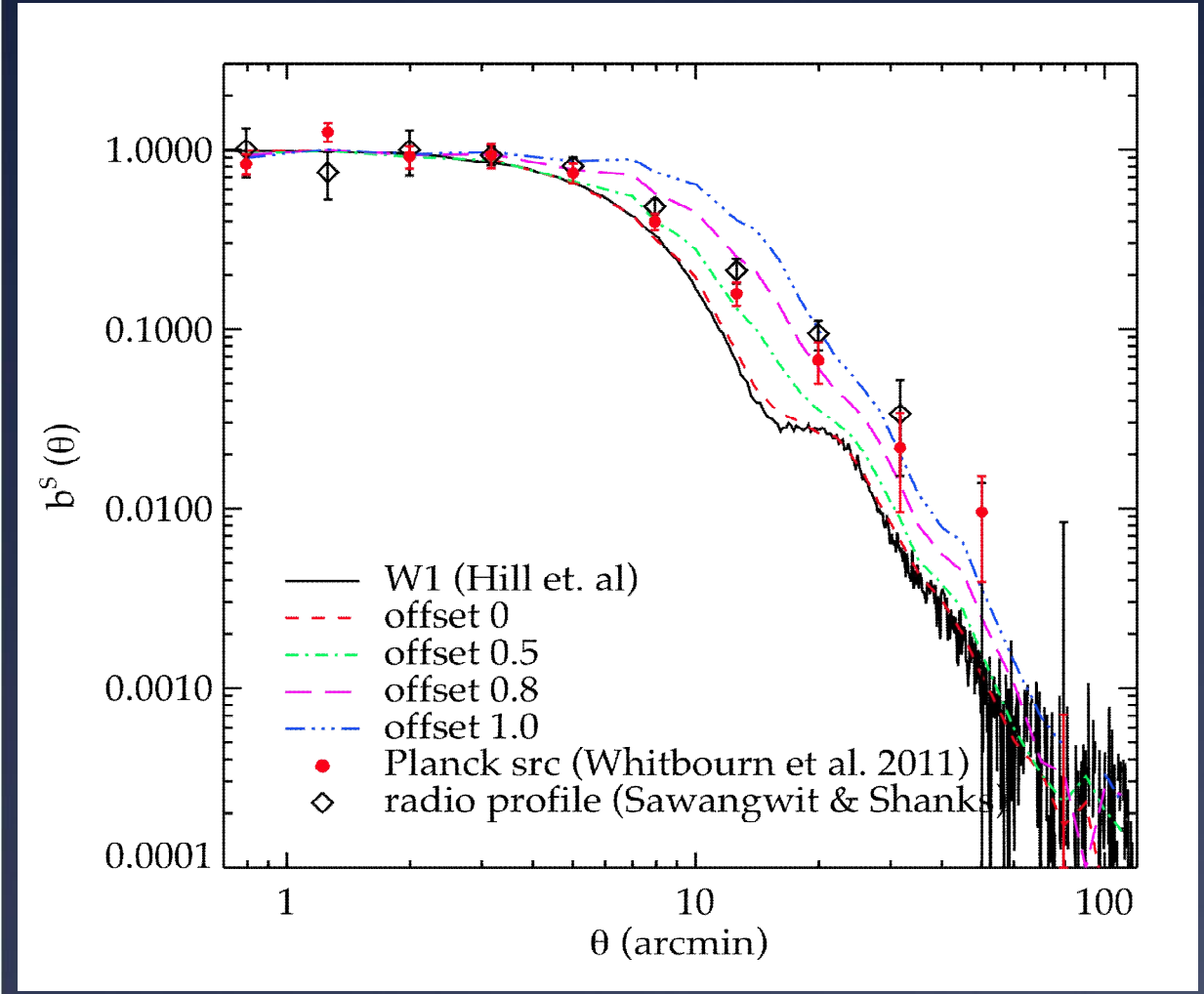


Ecliptic Pole

Ecliptic Equator

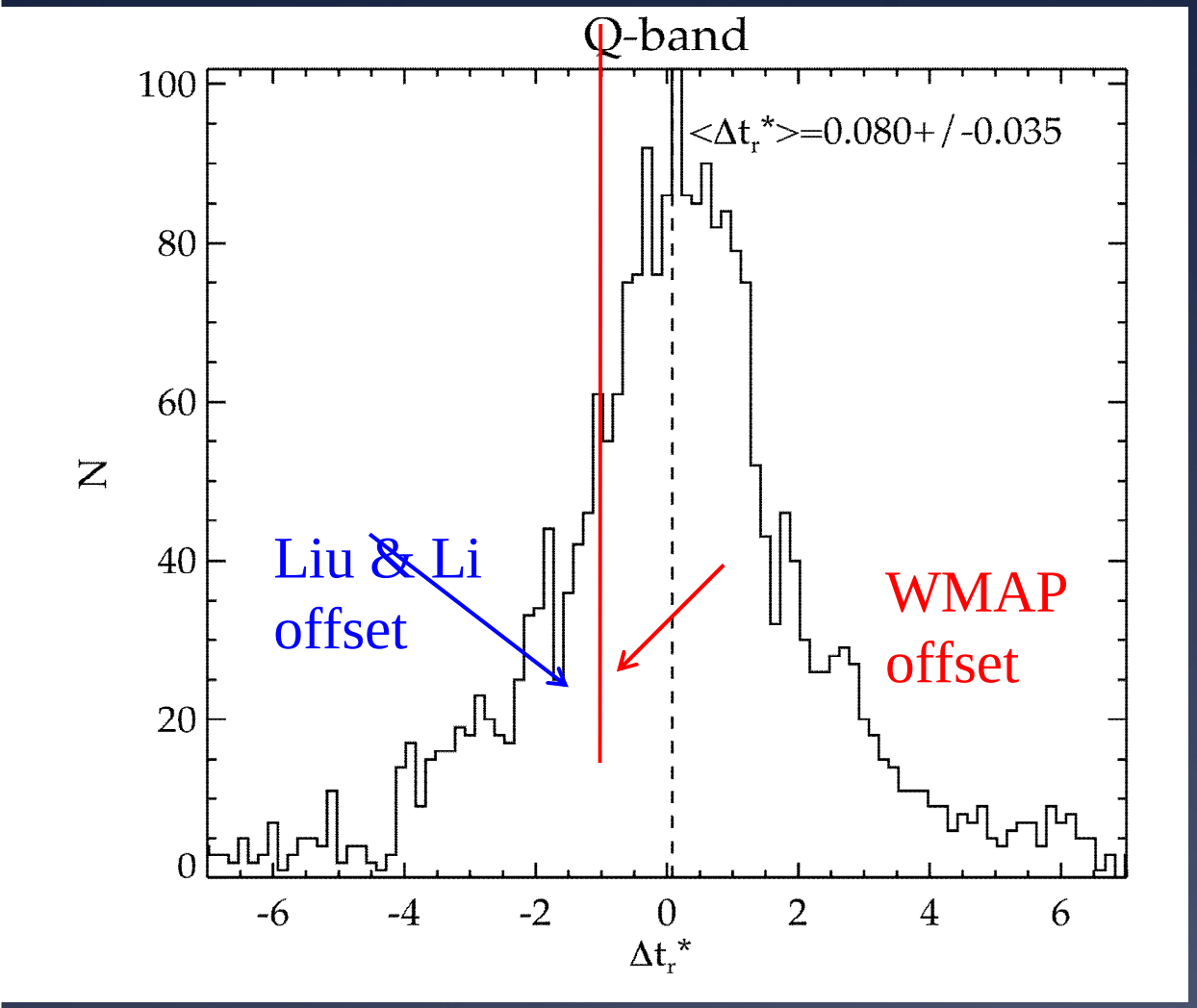
Could 25.6ms offset also explain our broad radio source profiles?

# Test WMAP timing offset




- Liu & Li 2010 check WMAP timing offset using dipole
- Dipole prefers a half-bin offset at 8 sigma
- Sawangwit et al 2012 have confirmed this result
- Almost big enough (green) to explain radio source profile!

# Test WMAP timing offset




- Liu & Li 2010 check WMAP timing offset using dipole
- Dipole prefers a half-bin offset at 8 sigma
- Sawangwit et al 2012 have confirmed this result

# Conclusions

- ΛCDM gains strong support from recent observational results - WMAP, SNIa, P(k)
- But no neutralino at LHC + very finely-tuned Λ + MW satellites problem!
- WMAP v Planck anomalies in radio fluxes and SZ
- WMAP 25.6ms timing offset ☐ "Axis of Evil" + wide beam? Or non-linearity?
- CMB beam profile uncertainty may give escape route to simpler $\Omega_{Baryon}$ =1, low $H_0$ model
- Planck – check for l~260 first peak + beam width at 1 degree + low quadrupole