Session IX. Possible Future Measurements and Models

B

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Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

NRAO

Session VIII. Possible future measurements and models

ARCADE2 non-CMB monopole T_b = 54 mK at 3.3 GHz

ARCADE2 plus old "all sky" maps are consistent with $T_b \propto \nu^{-2.6}$,

a typical synchrotron spectrum (our Galaxy, extragalactic sources, SNRs, …)

JVLA monopole from counts of discrete extragalactic sources stronger than ~ 1 μJy/beam (in an 8" beam) at 3.02 GHz is only T_b ~ 13 mK (versus 68 mK ARCADE2)

No *observational* disagreement is possible because the JVLA monopole is only a lower limit to the actual monopole. Tension arises from *modeling* the temperature difference as being primarily extragalactic, in which case a bright and smooth "new population" of sources seems to be required.

Revisit T_b at frequencies << 3.3 GHz?

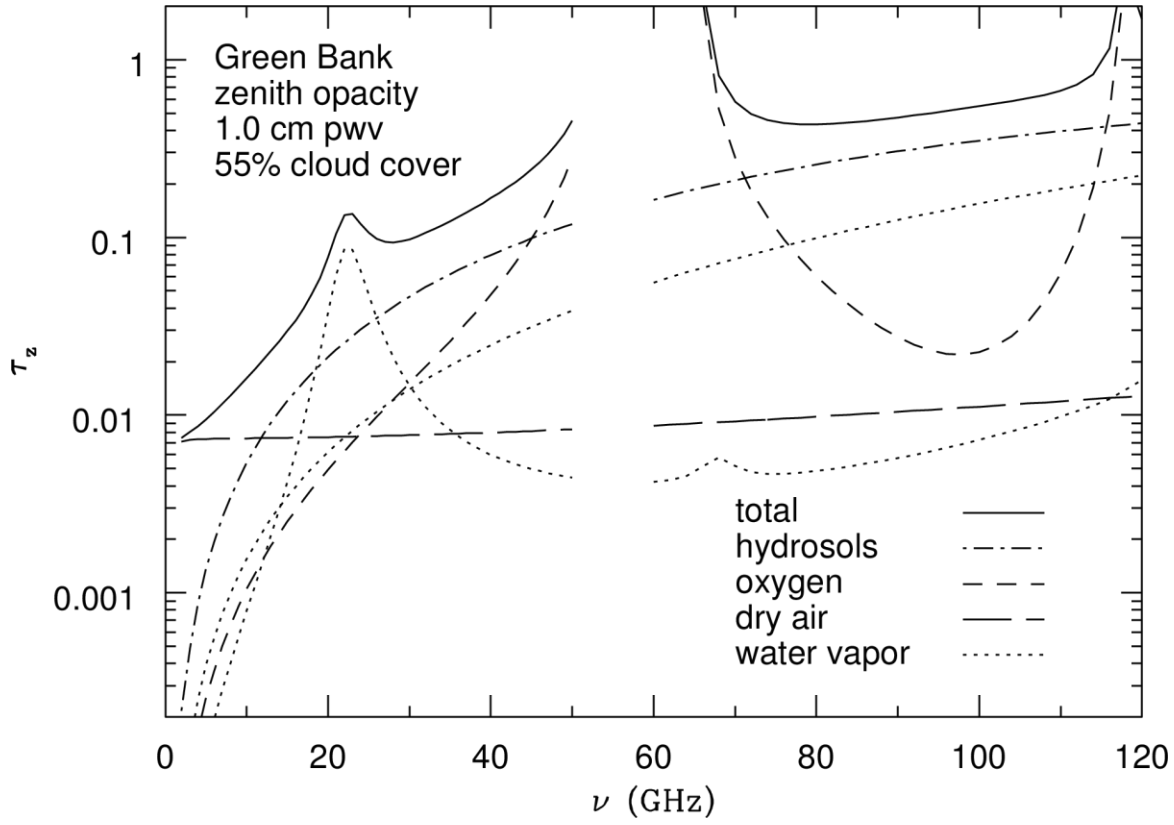
v(GHz)	T_b(K)	"Sources" $\propto \nu^{-2.7}$
3.3	0.054	
3.02	0.068	0.013
1.4	0.50	0.10
0.408	12.6	2.9
0.3	28	6.6
0.12	300	79

Compare with CMB = 2.7 K , ambient = 300 K, $T_{sys}/ (BT)^{1/2} < 0.1$

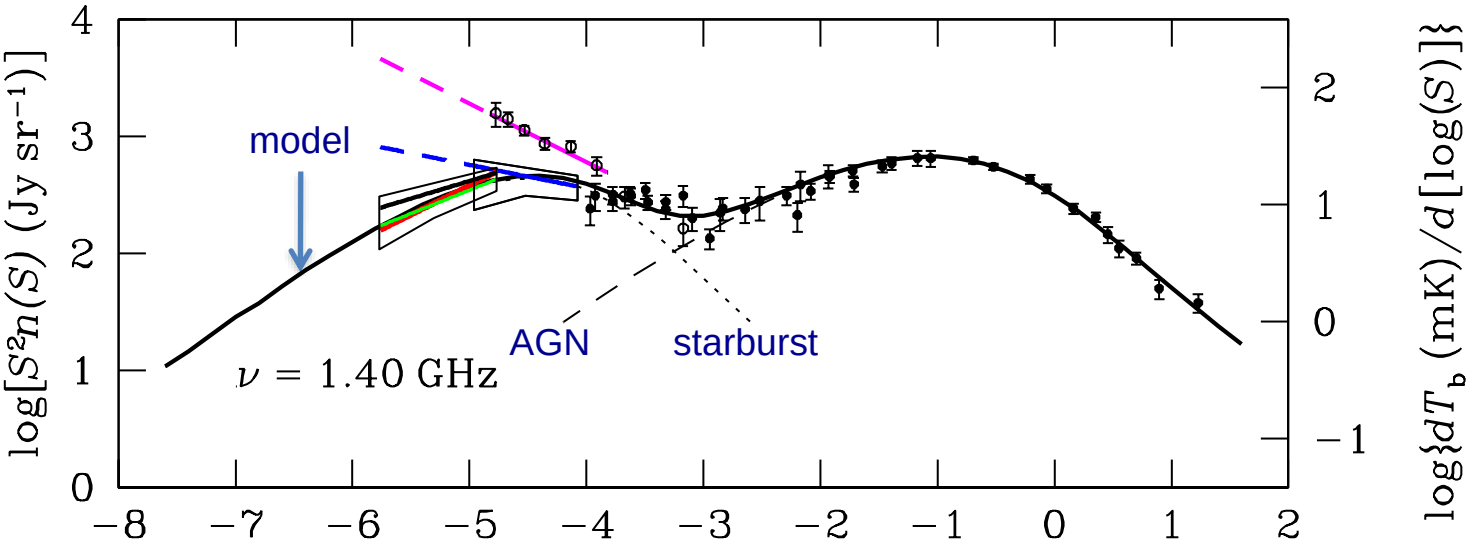
GBT

GBT prime focus boom and feed

GBT atmosphere and spillover



Source counts and sky brightness



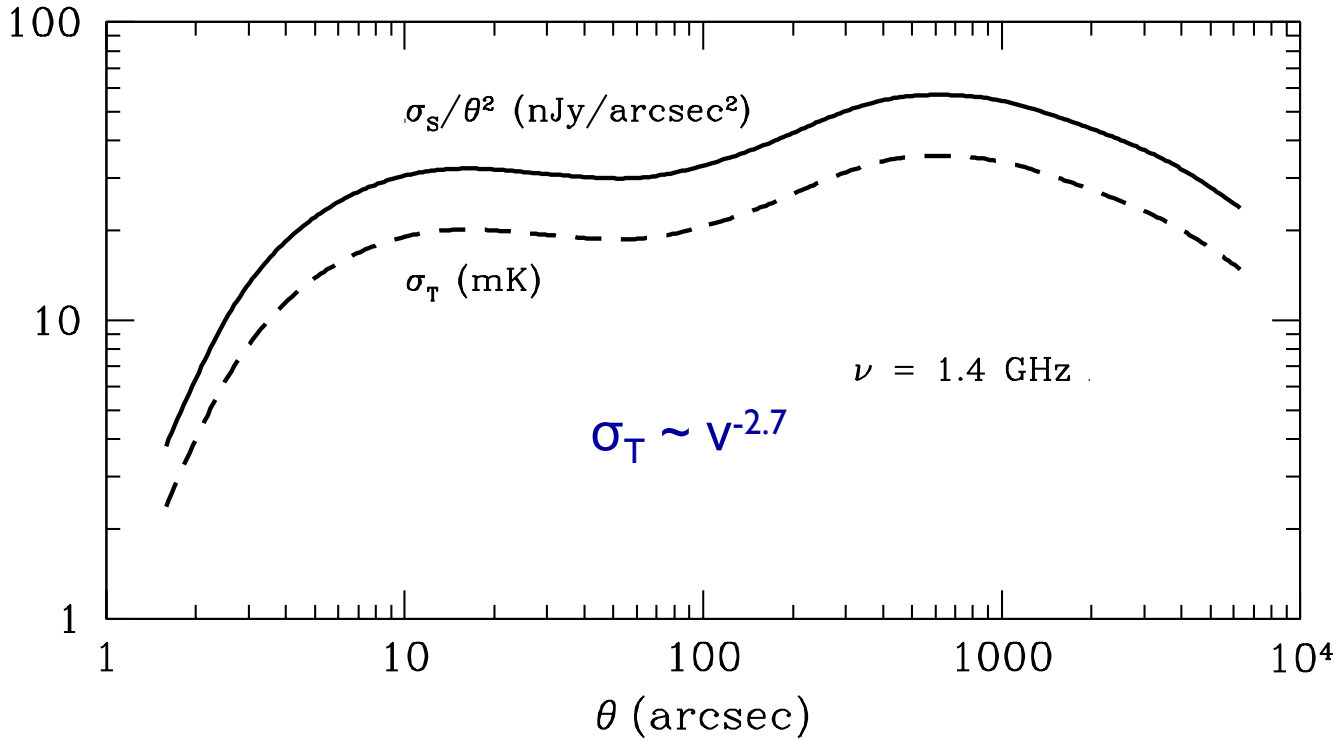
$$S = \frac{2k_{\rm B}T_{\rm b}\Omega}{\lambda^2}$$

$$dT_{\rm b} = \frac{\lambda^2}{2k_{\rm B}} S^2 n(S) d\ln(S)$$

$$Sn(S)dS = \frac{2k_{\rm B}dT_{\rm b}}{\lambda^2}$$

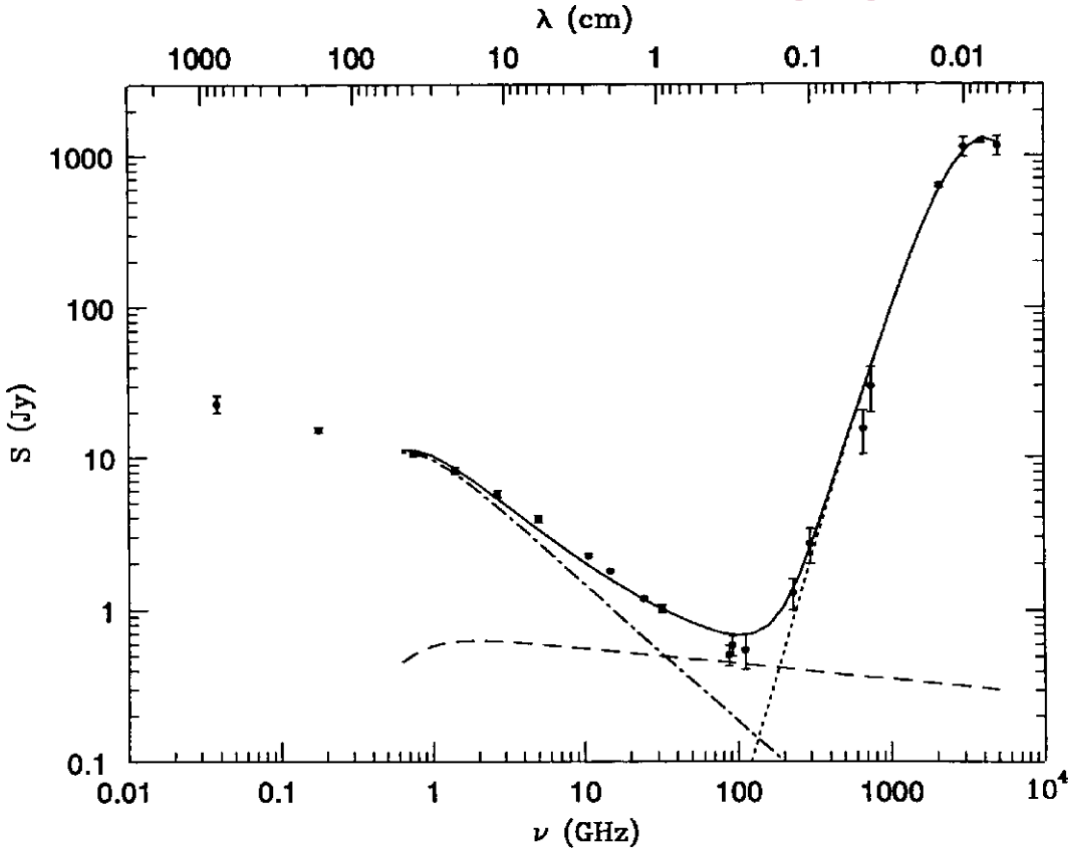
$$\left[\frac{dT_{\rm b}}{d\log(S)}\right] = \left[\frac{\ln(10)c^2}{2k_{\rm B}\nu^2}\right] S^2 n(S)$$

Observed confusion from non-overlapping sources



σ_T ~30 mK on GBT, could be reduced to ~ 3 mK by NVSS point-source subtraction to infer large sources making 500 mK background unless more than about $(500/3)^2 > 10^4$ sources overlap

T_b limits on star-forming galaxies



$T_b < 10^5$ K at 1.4 GHz

IC scattering off CMB at high z

$$\frac{P_{\rm IC}}{P_{\rm syn}} = \frac{U_{\rm rad}}{U_B}.$$

$U_{CMB} \propto (1+z)^4$

$U_B = B^2 / (8\ pi)$

$U_{CMB} = U_B$ when $B = 3(1+z)^2$ μG

e.g., 3000 μG for a Pop III SNR at z = 30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