

VLA observations of Microwave Emission from Flares

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VLA Observations of Microwave Emission from Flares

PLAN OF THE TALK

1) Introduction to the Instrument

2) Some Cautionary Notes

3) Conclusions

4) Illustrative Examples

a) High-frequency observations (15 and 22.5 GHz)

i) Marsh and Hurford 1980, *Ap. J.*, 240, L111

ii) Hoyng et al. 1983, *Ap. J.*, 268, 865

b) Low-frequency observations (1.4 and 5 GHz)

i) Velusamy et al. 1987, *Astrophys. J.*, 319, 984

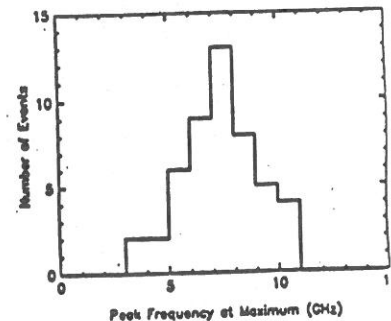
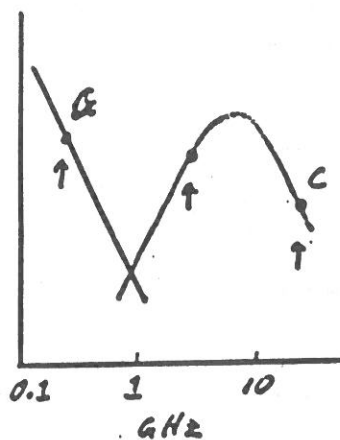
ii) Kundu, Velusamy, and White 1987, *Ap. J.*, 321, 593

iii) Bastian et al. video

c) Multi-frequency observations

i) Dulk, Bastian, and Kraus 1986, *Ap. J.*, 300, 438

ii) Kundu, Velusamy, and White 1987, *Ap. J.*, 321, 593



Castelli and Guidice (1975)

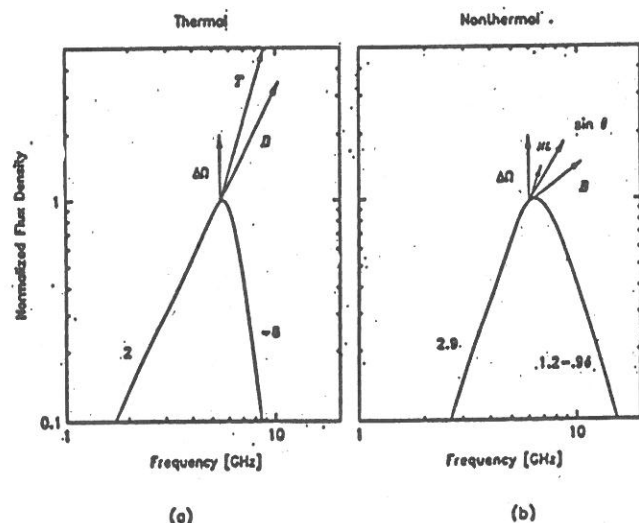


TABLE I

Maximum and Minimum Angular Scales
("snapshot imaging")

	A	B	C	D
92 cm	3.3'/6"	10.7'/19"	33'/1'	1°/3.3'
✓ 20 cm	50"/1.2"	2.7'/3.9"	8.1'/13"	15'/43"
✓ 6 cm	15"/0.37"	48"/1.2"	2.5'/4.3"	4.7'/14.3"
3.6 cm	9"/0.22"	29"/0.72"	1.5'/2.4"	2.8'/7.8"
✓ 2 cm	5"/0.12"	16"/0.4"	49"/1.3"	1.5'/4.3"
✓ 1.3 cm	3"/0.08"	10"/0.26"	32"/0.86"	1'/2.8"

Cautionary Notes

- Limited amount of observing time
- typically, ~4% / year
- Limited time resolution (typically, 10 s)
- Bias toward small events
- $dN/dS \propto S^{-\alpha}$
- Saturation problems
- Mismatch between event and array configuration;
- high-frequency mapping in A, B configurations suspect

CONCLUSIONS

Marsh and Hurford (1980)

- 1) High-frequency observations (15, 22.5 GHz; $\tau < 1$)
 - a) Sources usually display simple compact component (few arcsec)
 - b) Sources associated with magnetic NL
 - c) Sense of circular polarization often changes across NL
- 2) Low-frequency observations (1.4, 5 GHz; $\tau > 1$)
 - a) Sources often spatially complex
 - b) No clear association with magnetic footpoints or neutral line
 - c) Circular polarization can range from 0 to 100%
 - d) Time variation of degree and sense of polarization attributed to
 - i) Changes in position of the source and/or
 - ii) Changes in coronal magnetic field strength
- 3) Multifrequency observations
 - a) Reveals complex spatial relationships possible
 - b) Powerful diagnostic potential
- 4) The future

Goal:

To fully exploit the diagnostic potential of microwave emission.

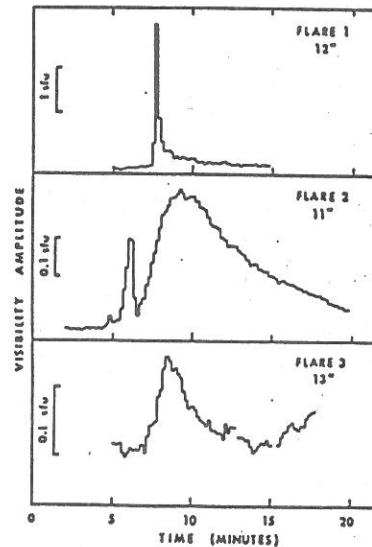
Requirements:

 - a) Sufficiently complete spatial, temporal, spectral resolution
 - b) Sufficient numbers of events to perform statistical analyses
 - c) Sufficient supporting observations (e.g., HXR/SXR, UV, H α)

TABLE I
SUMMARY OF BURST PARAMETERS

Flare Number	Date	UT	Frequency (GHz)	Peak Flux Density (Jy) ^a
1. ...	Sept 7	1907	15.05	4.9
2.	Sept 8	1319	15.05	3.0
3.	Sept 9	1608	22.5	0.4

^a 1 sfu = 10⁴ Jy.

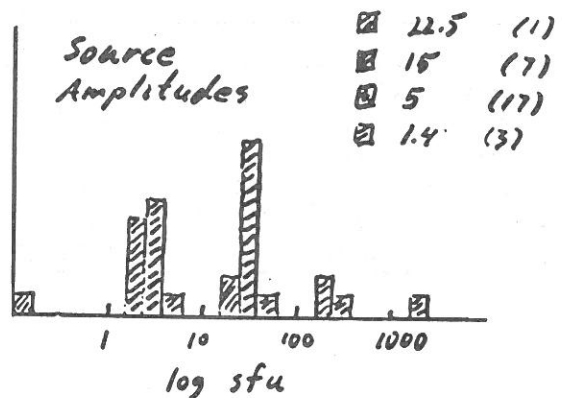
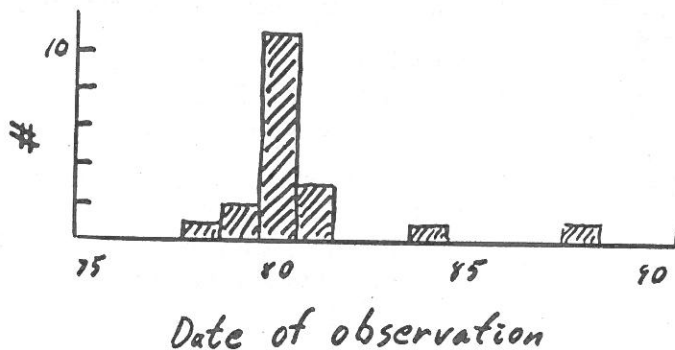
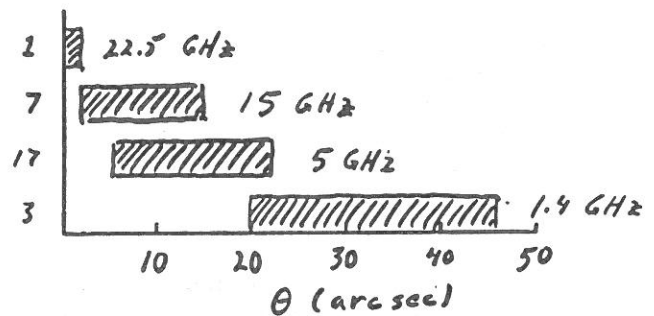
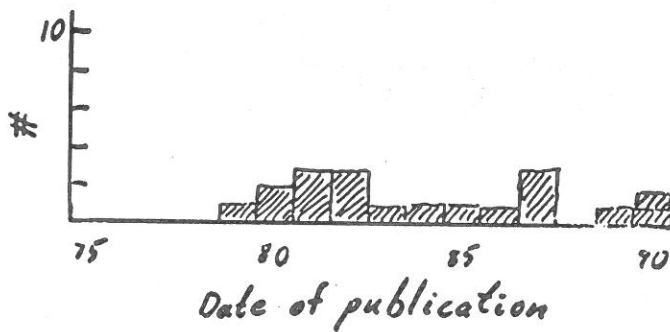


7 Sep. '79

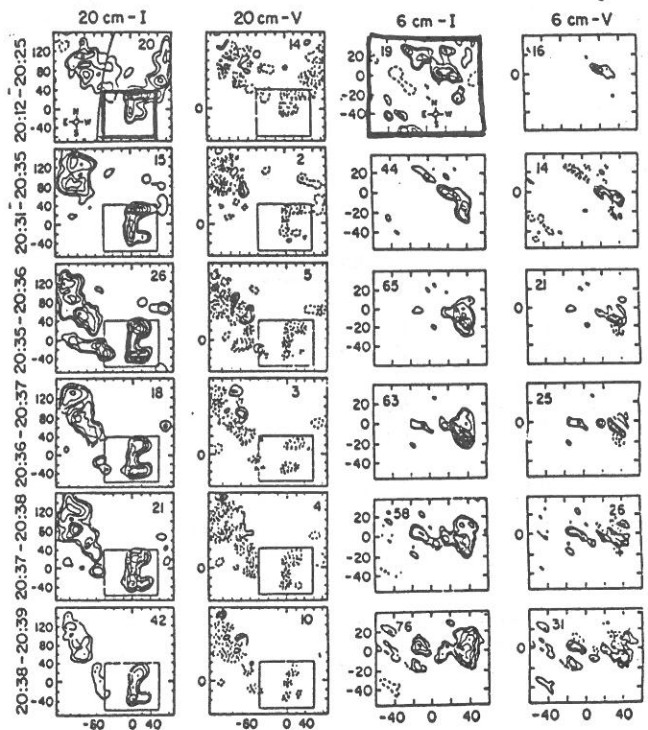
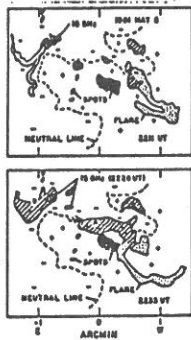
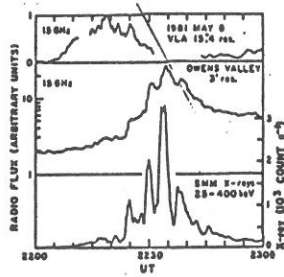
8 Sep. '79

9 Sep. '79

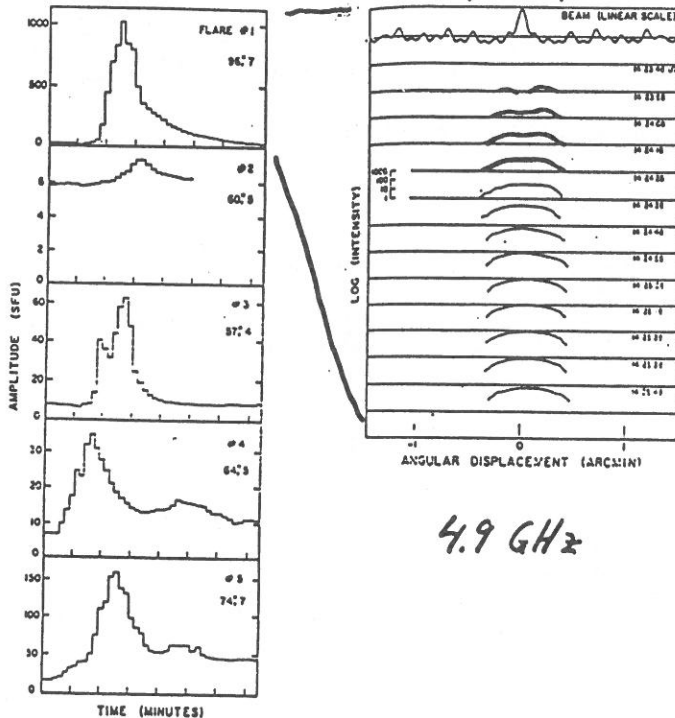
Source Sizes



Dulk, Bastian, and Hurford (1984) Velusamy et al. (1987)

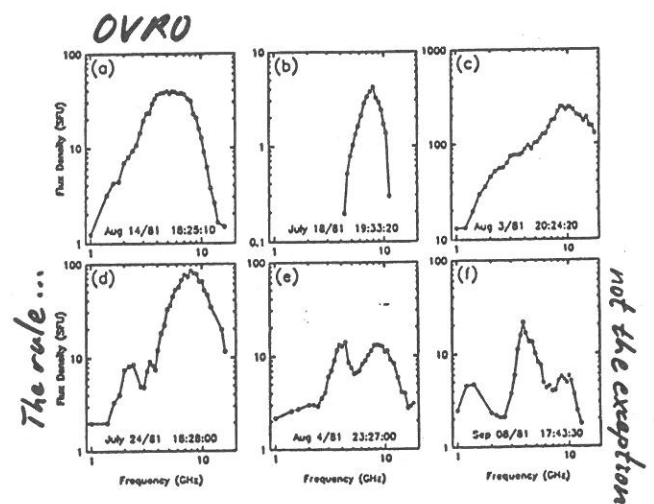


Marsh et al. (1980)



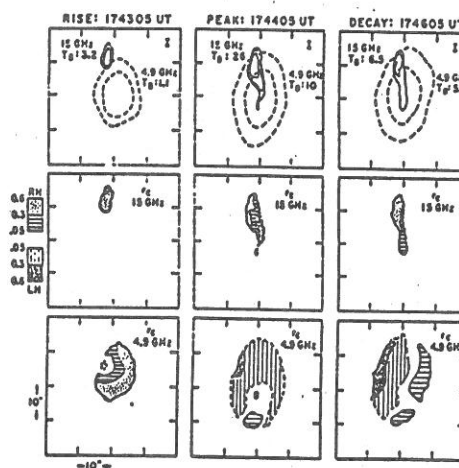
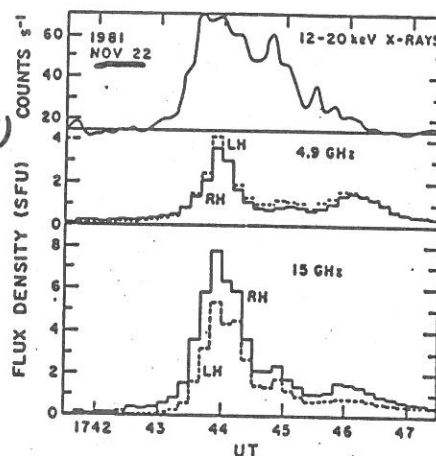
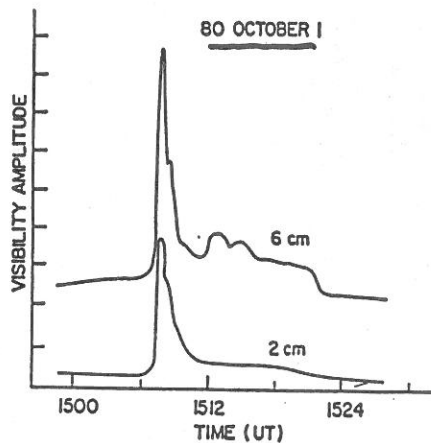
15 May 1980

Stähli, Gary, and Hurford (1989)

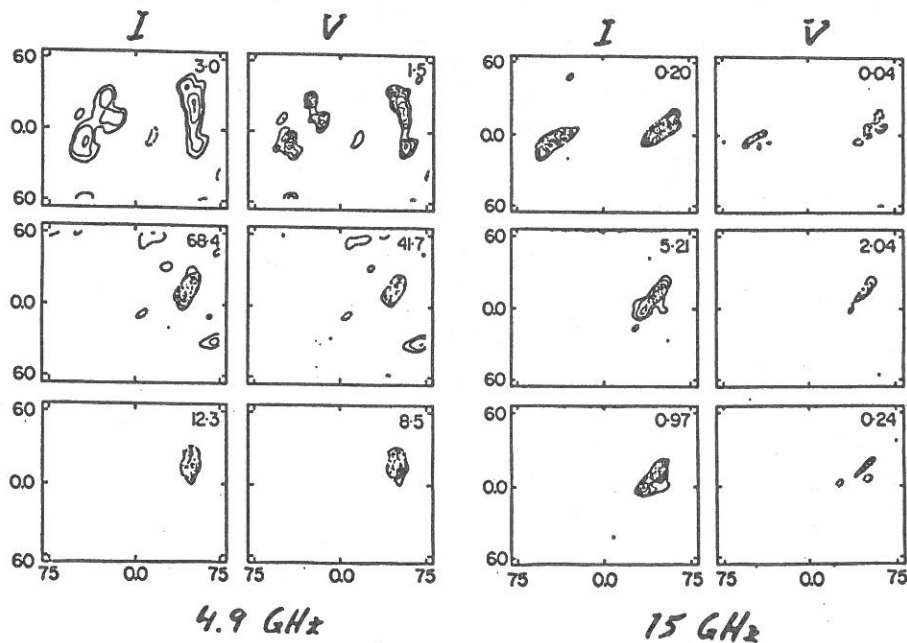


Kundu, Velusamy, and White (1987)

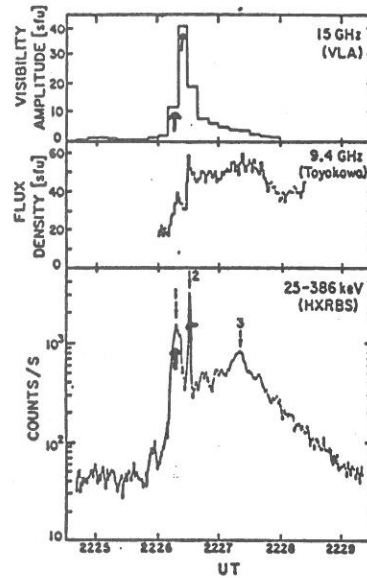
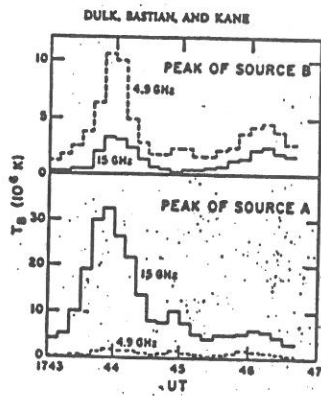
Dulk,
Bastian,
Kane (1986)



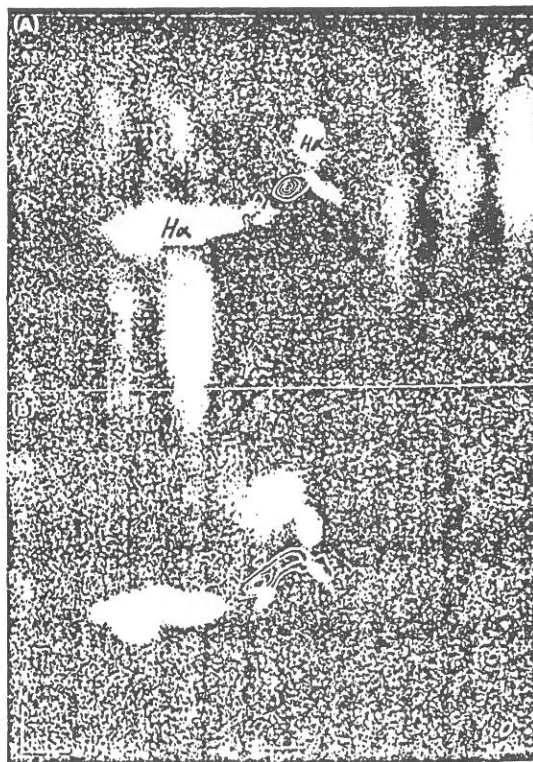
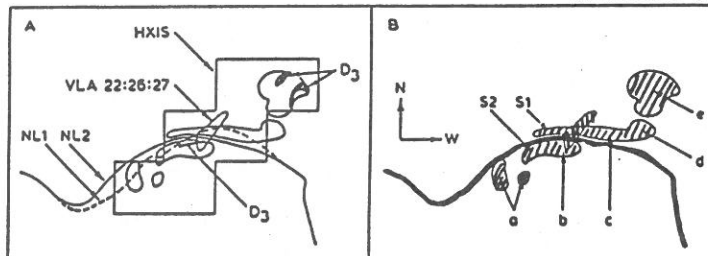
Kundu, Velusamy, and White (1987)
1 Oct. 1980



Dulk, Bastian, Kane (1986) Hoyng et al. (1985)



5 Nov. '80



MH80

Fig. 1.—(a) Photograph and VLA maps at 15.0 GHz for flare 1. (a) 17:13:12 UT (peak of the impulsive phase). $T_{\text{max}} = 2.3 \times 10^4$ K. (b) 17:18:15 UT (peak of the gradual phase). $T_{\text{max}} = 2.3 \times 10^4$ K.