1.0 ARC SECOND STRUCTURE ON THE SUN
AT 3.71 CM WAVELENGTH

(Research Note)

ROBERT W. HOBBS and STUART D. JORDAN
Laboratory for Solar Physics and Astrophysics

WILLIAM J. WEBSTER, JR.
Laboratory for Meteorology and Earth Sciences

and

STEPHEN P. MARAN and HOWARD M. CAULK
Laboratory for Solar Physics and Astrophysics, NASA-Goddard Space Flight Center,
Greenbelt, Md. 20771, U.S.A.

(Received 8 November, 1973; in revised form 19 March, 1974)

We recently reported the existence of small scale (2.8") structure in solar active
regions at 3.71 and 11.1 cm (Hobbs et al., 1973). We have now confirmed the existence
of even smaller scale structures in active regions with sizes less than 1" (700 km)
at 3.71 cm wavelength. On 8 August 1973 we observed McMath-Hulbert active region
12474 at 3.71 and 11.1 cm using the 3-element interferometer at the National Radio
Astronomy Observatory* in the 2.7-1.8-0.9 km configuration with an auxiliary 45-ft
(13.7 m) antenna at 33 km spacing. The 45-ft antenna is coupled to the system by
means of a microwave link; the receiver at the middle 85-ft antenna was not used.
In other respects, the observations were taken in the manner described in our earlier
paper.

To demonstrate the existence of correlated flux at the maximum baseline corre-
spending to 0.25" (8 x 10^5 \lambda), we have chosen two periods of time when the fringe
phase drift was nearly that expected for a simple source moving at the difference
between the sidereal rate at which we tracked and the solar rate. The fringe phases
for these two periods are plotted in Figures 1a and 1b. The constant drift rate of
the observed fringes implies that for these time periods there is a significant correlated
flux corresponding to a fringe spacing of 0.25". To determine the characteristic size
of the small diameter elements we assumed that they are gaussian in shape. The
visibility function must then also be gaussian. The half-width of the distribution
defined by points at the three interferometer spacings is about 250000 wavelengths,
corresponding to a source size of about 0.6" (420 km).

* Operated by Associated Universities, Inc., under contract with the National Science Foundation.
Fig. 1. Fringe phase as function of time during two periods for which phase drift was nearly that expected for simple source moving at the difference between the solar and sidereal rates. The dashed lines represent data for the remote antenna and the fixed, north-east 85-ft (26 m) antenna; the solid line represents data for the remote antenna and the south-west 85-ft antenna.

Reference