X-615-67-165

NASA TM X- 55745

LUNAR OCCULTATION OF 3C 132

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APRIL 1967

NASA
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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ABSTRACT

The diameter and position of radio source 3C 132 has been determined by means of a lunar occultation. A probable optical identification with a red galaxy has been confirmed.

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A lunar occultation of the radio source 3C 132 was observed on 27 June 1965. The observation was made at the National Aeronautics and Space Administration's Data Acquisition Facility located at latitude 35^{o} 12' 0".05 N., longitude 05^{h} 31^{m} $29^{s}.294$ W. In addition to position and diameter measurements of the source, the occultation has provided confirmation of a previous identification of the optical counterpart.

The observation was made by tracking the center of the moon with an 85-foot parabolic antenna for the duration of the occultation. The receiver was a switched-type system using gain modulation. The receiving frequency was 403 MHz with an intermediate frequency of 30 MHz, bandwidth of 5 MHz and RC integration time of 3 seconds. Digitized records of the disappearance and reappearance of the source are presented in figures 1a. and 1b., respectfully.

The data has been restored as previously discussed (Brown 1966) and a Gaussian curve fitted to the resulting brightness distribution. Analysis of the fit provides the best values for the position of the intensity peak and the source diameter along the scan. The diameter and corresponding position angles are given in Table 1. The accuracy of the disappearance suffers from a slight asymmetry in the profile. This asymmetry is apparently caused by a decrease in the signal to noise ratio during the occultation.

Table 1.

DIAMETER AND POSITION ANGLE MEASUREMENTS

Phase	Time of Occurrence (U.T.)	Position Angle	Diameter	Restoring Beam Width Used
Disappearance	$17^h18^n49^s.0 \pm 7^s.4$			7".1
		137°	7".1±4".1	4".1
Reappearance	$17^h57^n06^s.4 \pm 3^s.9$			6".0
		19°.5	6".0±2".5	3".5

The position of the source has been computed from the universal times (corrected for RC integration time) corresponding to the peak intensities of the restored brightness distributions (figures 2a. and 2b.). There are two possible positions for the source corresponding to these times.

Position 1: R.A. (1965.5) = $04^h\ 54^m\ 58^s.55 \pm 0^s.13$
Dec. (1965.5) = $+22°\ 18'\ 04".3 \pm 1".9$

Position 2: R.A. (1965.5) = $04^h\ 54^m\ 35^s.2 \pm 0^s.13$
Dec. (1965.5) = $+22°\ 46'\ 02".6 \pm 1".9$

In calculating these positions, it has been assumed that the difference in Universal and Ephemeris Time is 35.0 seconds.

The ambiguity in position can be resolved by considering the position given in various catalogues listed in Table 2.

Table 2.

SOURCE COORDINATES

	RA (1950.0)	DEC. (1950.0)	Reference
Position 1	$04^h54^m02^s.79 \pm 0^s.13$	$+22^\circ16'38''.0 \pm 1''.9$	
3C	$04^h52^m57^s + 2^s$	$+22^\circ50' \pm 6'$	Edge et al. 1959
B	$04^h53^m42^s.7 \pm 3^s.0$	$+22^\circ43'48'' \pm 3'$	Bennett 1962
R		$+22^\circ44'42'' \pm 9''$	Read 1963
W	$04^h53^m42^s.1 \pm 0^s.5$	$+22^\circ44'42'' \pm 7''$	Wyndham 1966
Position 2	$04^h53^m39^s.26 \pm 0^s.13$	$+22^\circ44'35''.8 \pm 1''.9$	

Because position 2 lies nearest the quoted positions in the catalogues and position 1 is considerably removed, the source is assumed to be at position 2.

The radio position of the source was located on the National Geographic Society - Palomar Observatory Sky Survey plates from comparison with a number of eight-magnitude stars in the area. The optical positions were obtained from the Smithsonian Astrophysical Observatory Star Catalogue. The radio position was found within the error limits of the plate measurements to coincide closely with the position of a faint red galaxy previously identified as the optical counterpart of the source (Wyndham 1966).

The galaxy appears to be extremely red in color and it is apparently a member of a cluster of galaxies. Figure 3 is a 10X enlargement of the source area on the red and blue survey plates showing the distinct red image of the galaxy as opposed to the extremely faint blue image. The contrast is highlighted by the closeness of a stellar image.

The identification of 3C 132 with this red galaxy appears to be confimed by the occultation. However, the radio source appears to be located slightly east of the galaxy. The probable accuracy of the occultation suggests that this difference is real.

References

Brown, L. W., 1966, Nature, 210, 1102.

Bennett, A. S., 1962, Mem. R. A. S., 68, 163.

Edge, D. O., Shakeshaft, J. R., McAdam, W. B., Baldwin, J. E., and Archer, S., 1959, Mem. R . A. S., 68, 37.

Read, R. B., 1963, Ap. J., 138, 1.

Wyndham, J. D., 1966, Ap. J., 144, 459.

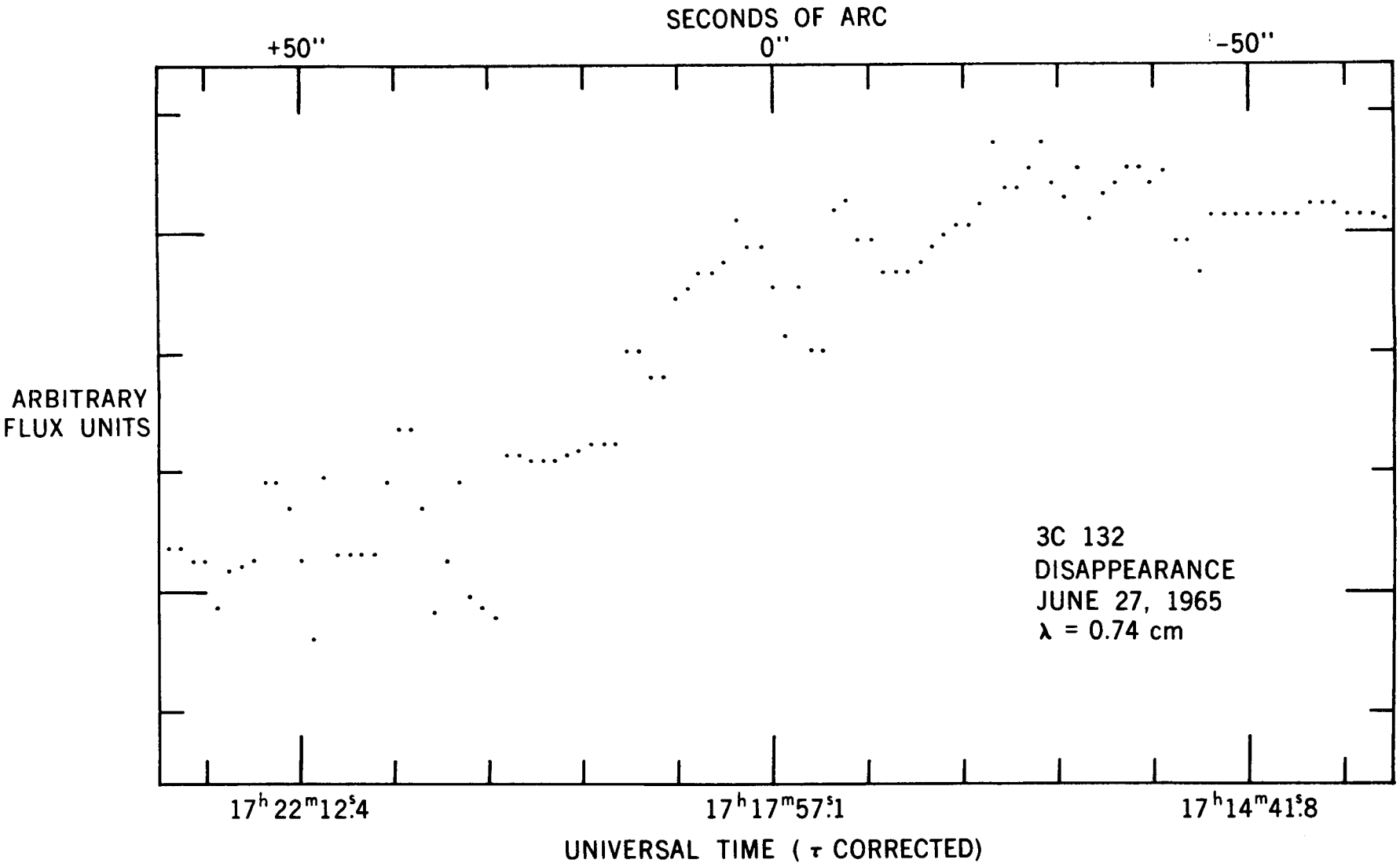


FIGURE 1a. DIGITIZED DATA: DISAPPEARANCE

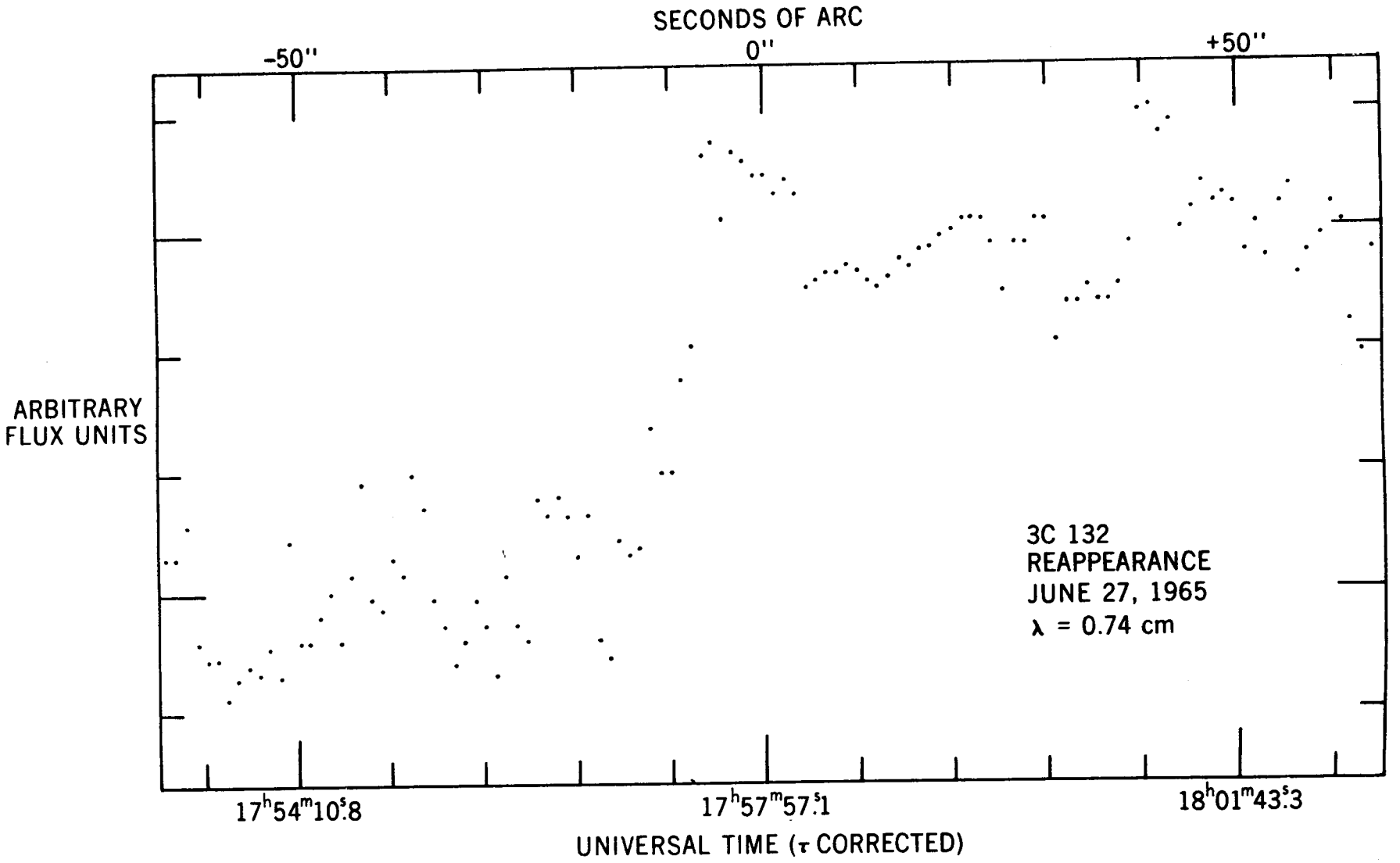


FIGURE 1b. DIGITIZED DATA: REAPPEARANCE

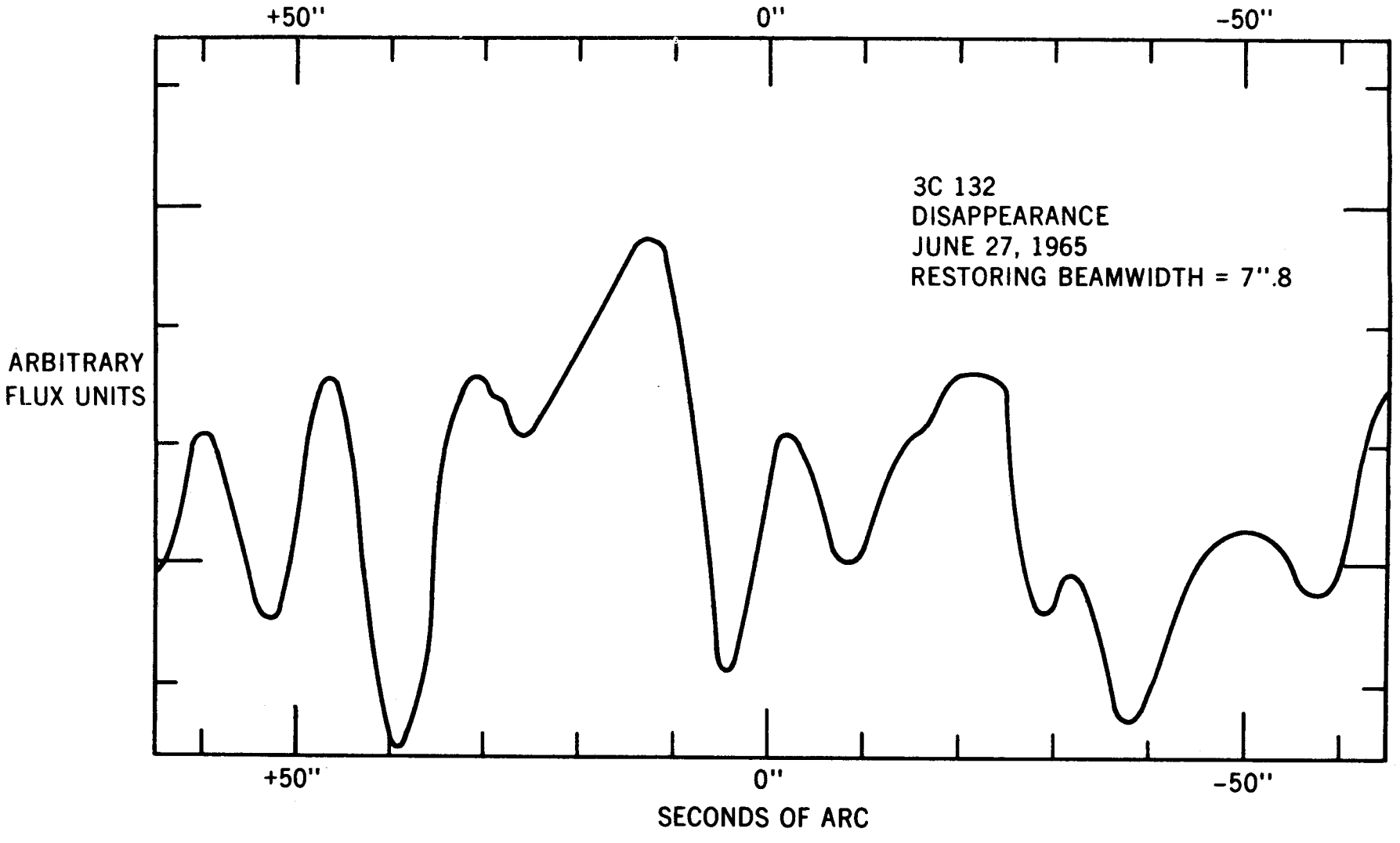


FIGURE 2a. RESTORED DATA: DISAPPEARANCE RESTORED WITH BEAMWIDTH OF 7".8

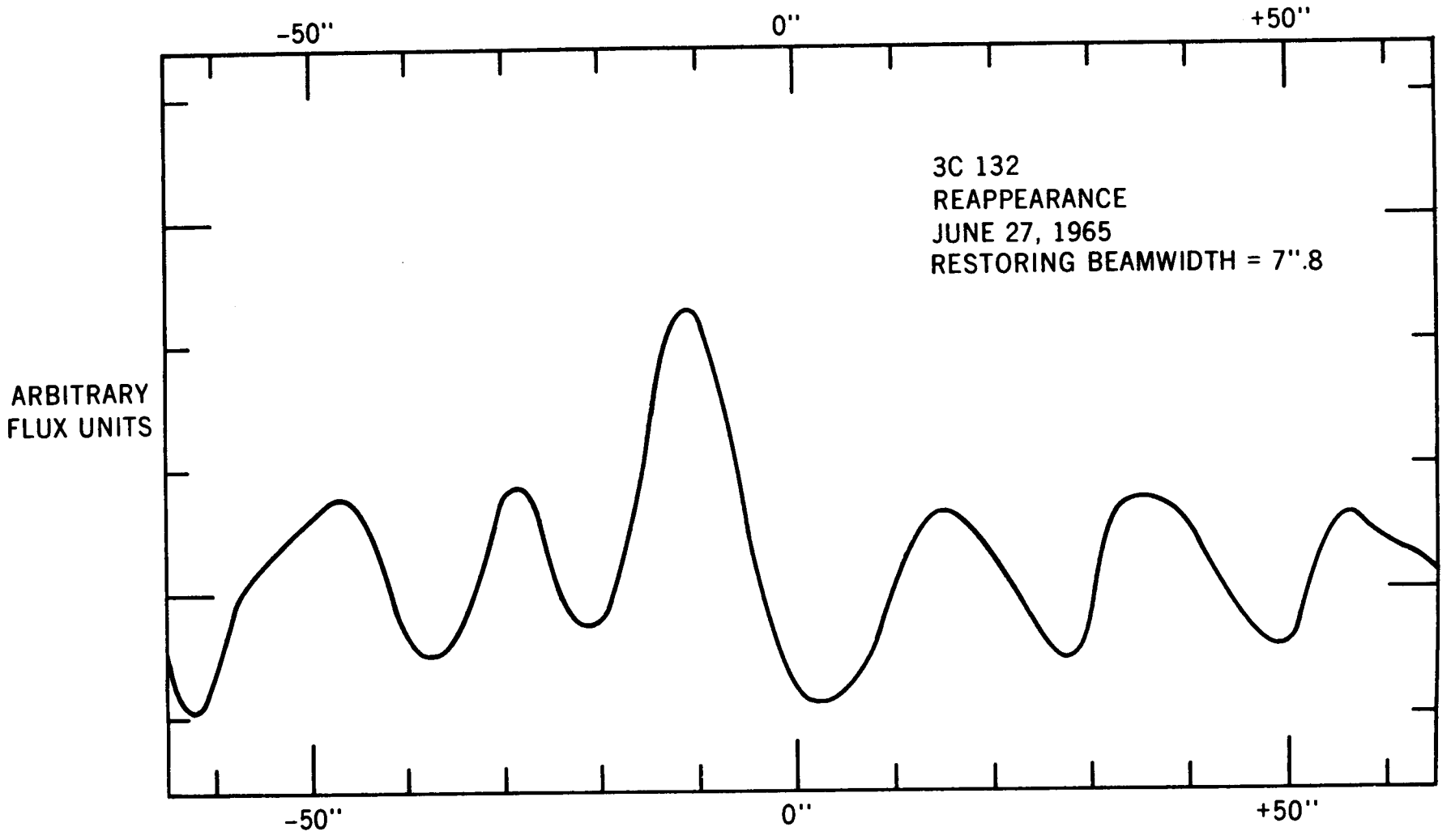
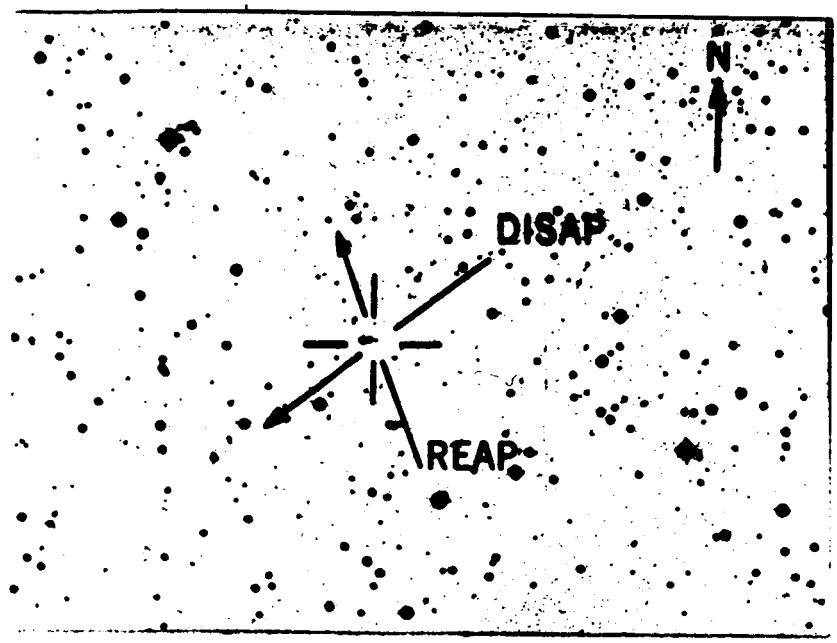


FIGURE 2b. RESTORED DATA: REAPPEARANCE RESTORED WITH BEAMWIDTH OF 7".8



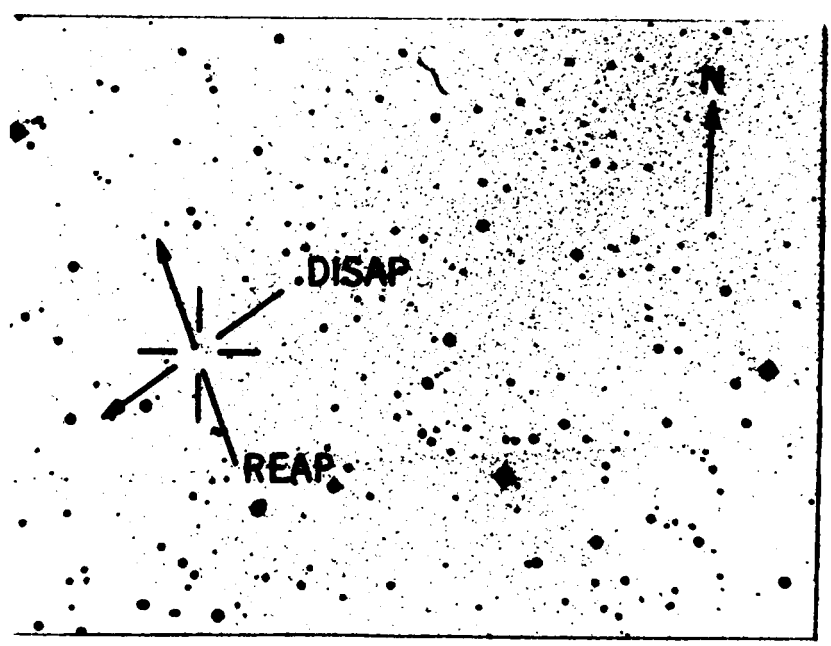


FIGURE 3. 10X ENLARGEMENT OF NATIONAL GEOGRAPHIC SOCIETY-PALOMAR OBSERVATORY SKY SURVEY PLATES. TOP: RED PLATE. BOTTOM: BLUE PLATE.