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ILLINOIS OCCULTATION SUMMARY I. 1977-1978

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ABSTRACT

We present results from the first two years of a program undertaken to record lunar occultations at the University of Illinois Prairie Observatory. The 64 events summarized include 30 observations of stars brighter than 7th magnitude, 40 reappearances, 4 angular diameter measurements, 8 observations of binary stars, and 6 observations which may indicate multiplicity.

I. INTRODUCTION

This paper presents results from the first two years of a program which we have undertaken to record lunar occultations at the University of Illinois Prairie Observatory. We have specialized in obtaining observations of events involving bright stars or objects of special interest, and reappearance timings. Consequently, 30 of the 64 events summarized here involve stars brighter than 7th magnitude, and 40 are reappearances. Results from the September 1978 Hyades passage are included. Four angular diameter measurements, eight ob ervations of binary stars, and six observations which may indicate multiplicity are reported. We also describe the instrumentation which we use to record occultations and the procedures for observation and data analysis which we have adopted.

II INSTRUMENTATION

Our observations are obtained at the Prairie Observatory 1-m reflector using a single-channel Cassegrain photometer which houses a RCA C31034A photomultiplier tube. We normally use either a Strömgren b or y filter for spectral definition, although we occasionally use a spectral filter (here designated "FI") centered at 8575A with a FWHM of 300A for late-type stars to take advantage of the better starlight-to-background ratio available from such stars at longer wavelengths. In addition, a few observations in 1977 were made using a filter (here designated "NB") centered near 6900A with a FWHM of 450A. This filter has a rather peculiar passband (illustrated in Radick and Tetley, 1979), and we discontinued its use once this characteristic had been discovered. If necessary, count rates are limited by using neutral attenuation in conjunction with the spectral filter.

Data are recorded on magnetic tape using a computer-controlled photoelectric data acquisition system, partial descriptions of which have been published elsewhere (Nelson, 1975; Radick,1979). A block diagram of the principal components of the system as it currently exists is presented as Figure 1. This system is also used for conventional photoelectric observations. Since occultations are frequently observed as interruptions to other programs, the controlling software has been carefully written to facilitate rapid changeover between observing modes. No hardware changes at all are required, unless the observer elects to mount a fresh tape.

The heart of the system is a Texas Instruments model 960A minicomputer. For occultation observations, a data queue is maintained in the memory of the computer. Photometric data enter the queue at 1 msec intervals as interrupt-driven accumulator dumps and are simultaneously output to magnetic tape at approximately the same rate. The utilization of a queue as the data-storage structure permits repeated reuse of memory space and allows the system to operate at millisecond time resolution for as long as five minutes despite the fact that the queue itself occupies only a few kilobytes of memory. The observatory's UT clock provides the computer's time-of-day reference. System timing is controlled by a crystal oscillator which also drives the UT clock.

The UT clock may be set (as of January 1978) by means of a trigger circuit which detects the 1KHz WWV timing pulses. Since WWV reception at Prairie Observatory is often less than ideal, we routinely check the clock set by feeding the WWV audio into an oscilloscope which is triggered by a seconds pulse from the UT clock. By examining the WWV signal, it is easy to decide which of the five timing pulses was "caught" by the trigger circuit when it set the clock and from this infer whether or not the clock is running slow and, if so, by how many milliseconds.

III. REAPPEARANCE OBSERVATIONS

Although the technical difficulties of observing occultation reappearances are now being addressed by various observers (e.g. Africano and Montemayor, 1977), the great majority of timings being reported are still for disappearances. Accordingly, we have decided to emphasize reappearance timings in our program, and have developed a standard procedure for observing reappearances. We achieve telescope pointing by tracking a nearby guide star and then off-setting to the position of the target star shortly before its emersion. The digital drive of the 1-m telescope makes this a simple and reliable procedure, at least if the two stars are at about the same altitude and not too far apart ($\lesssim 1^0$) in the sky. Guide stars are selected in one of two ways: (1) If the upcoming reappearance is one of a series of such events listed in the predictions provided by the U. S. Naval Observatory, we choose a nearby star which has already reappeared (or not yet disappeared) as the guide star, current coordinates for both the guide star and the target star being immediately available from the prediction listing. (2) If no such guide star is available, we select one beforehand from the SAO sky charts and difference the catalog coordinates of the guide star and the target star to obtain the offset. If the target star is not an SAO star, it is still generally possible to bootstrap an offset through some other SAO star which is occulted during the evening. In this way we avoid expending telescope time measuring offsets prior to a reappearance observation, but still find that we can routinely "hit" a 16" aperture. Irregularities in the telescope drive plus the unexceptional seeing (3-4") typically experienced at Prairie Observatory generally preclude use of a smaller diaphragm even for disappearance observations. Consequently, this has become the preferred aperture for all our occultation observations.

IV. DATA ANALYSIS

We process our data in two stages. In the first stage the telescope tapes are copied onto an archive tape. The observational traces are then scanned with the aid of an interactive graphics program which plots a selected segment of the trace, or the corresponding integral plot (as introduced by P. Bartholdi and described in Dunham et al., 1973), or both (one above the other). Five hundred points are plotted, each representing one, two, four, eight, or sixteen data points. Thus, the time interval plotted ranges from 0.5 to 8.0 seconds. In practice, we examine several plots of both types, noting any features characteristic of multiple stars. Finally, we extract data sets, centered on the events and corrected for coincidence losses, for input into the model-fitting program of the second stage. This first stage of the analysis is usually completed soon after the observations are obtained.

The second stage is the detailed fitting of the observational traces. This is comparatively time-intensive computationally, and we have found it convenient to accumulate fifteen or twenty data sets from stage one, waiting for a time when computer demand is comparatively light, and then process them together. The fitting programs have been described elsewhere (Nelson, 1975; Radick, 1979) and those descriptions will not be repeated here. We have found that the fitting procedure is somewhat more forgiving with respect to poor initial estimates for the model parameters if the lunar shadow velocity is included among the fitted parameters, even for faint-star events where the fitted value of the shadow velocity cannot have much significance. Accordingly, we generally fit each observational trace twice, first with the shadow velocity free, and then with it fixed at the predicted value, using the best-fit parameter values determined by the first fit as the initial estimates for the second. We generally find that the best-fit values obtained from these two fits agree within their formal errors. Some events require additional analysis. For those involving binary stars, we determine values for the vector separation and the magnitude difference. For stars which we expect to show resolvable disks we attempt to determine best-fit angular diameters for both the uniformly-illuminated disk and the fully limb-darkened (cos θ) disk.

V. RESULTS

Table I summarizes our occultation observations for the years 1977 and 1978. Column 1 contains a four-digit run number. The first two digits of each run number simply specify the year of the observation, while the last two order the events chronologically. The run numbers are not necessarily sequential; gaps in the sequence generally refer to observations which failed for one reason or another. The Durchmusterung and SAO numbers of the occulted stars are listed in columns 2 and 3, and the visual magnitudes and spectral types of the stars, drawn either from the Naval Observatory predictions or the Bright Star Catalog (Hoffleit, 1964), appear in columns 4 and 5. The passbands of the observations are indicated in column 6. The type of event (D = disappearance, R = reappearance), the UT date, the observed UTC of the occultation and its formal standard error (in seconds) are listed in columns 7 through 10. A correction of 4.8 msec has been applied to the timings to compensate for the mean propagation delay of the WWV signal. Column 11 contains the starlight-to-background ratio for each observation. We have found that this ratio represents a fairly reliable detectability criterion, as follows: any event for which this ratio equals or exceeds 0.02 should be detected, an event for which this ratio falls in the range 0.01 to 0.02 may be detected, and one for which the ratio is less than 0.01 will probably not be detected with any certitude. This ratio may also be used to estimate how bright a companion might be and still remain undetected by the observation assuming, of course, that the geometry is favorable. We quantify this estimate in columns 12 and 13, where we have adopted the Δm_o and Δm_* notation introduced by Eitter and Beavers (1974). We define Δm_o, the minimum magnitude difference detectable against the lunar background, as

$$\Delta m_o = 2.5 \log \frac{(S/B) - 0.02}{0.02}$$

where S/B is the starlight-to-background ratio for the observation and 0.02 is our (conservative) detectability threshold estimate for this ratio. Since scintillation generally increases the noise level when the star is visible, we define Δm_*, the minimum magnitude difference detectable against the star plus the lunar background, as

$$\Delta m_* = 2.5 \log \frac{f(S/B) - 0.02}{0.02}$$

where f is an estimate for the ratio of the lunar background noise level to the noise level when the star is also visible. For those events for which S/B or $f(S/B) \leq 0.04$, we have tabulated a nominal value of zero for Δm_o or Δm_*. We emphasize that our estimates for Δm_o and Δm_* are conservative, and also point out that the 0.1 magnitude precision of the tabulated values probably overstates their relative accuracy. Listed in columns 14 and 15 are the position angle and contact angle for each observation, as conventionally defined. If an observation is of sufficient quality to provide a meaningful value for the local limb slope, that value and its error appear in columns 16 and 17. The slope is calculated using the relation

$$\cos(\theta-\phi) = \frac{v_{obs}}{v_{pred}} \cdot \cos(\theta),$$

where v_{obs} and v_{pred} are the observed and predicted lunar shadow velocities, respectively, θ is the contact angle, and ϕ is the local limb slope. The algebraic sign assigned to the slope is such that the sum of the slope and position angle defines the direction of resolution ("aspect") of the observation. This sign may or may not agree with the one specified by the convention adopted by the University of Texas group: if not, this fact is indicated by an asterisk in column 16. If $\frac{v_{obs}}{v_{pred}} \cos(\theta)$ is greater than unity, the value tabulated for the slope is the contact angle (adjusted to be less than 180°), and is enclosed in parentheses. Asterisks indicating notes appear in column 18. In addition, an "a" in column 18 indicates observations which resulted in angular diameter measurements, details of which appear in Table II. Likewise, a "b" indicates an event involving a binary or multiple star, in which case the entries of Table I refer either to the primary, if one can be distinguished, or the first event to occur, if one cannot. Additional details for these binary star observations are presented as Table III.

Table II contains additional information for those observations which involved resolved stars. The run number, Durchmusterung number, SAO number, and Bright Star Catalog number for each star appear in columns 1 through 4. The best-fit value for the angular diameter and its formal standard error, assuming a uniformly-illuminated disk, are listed in columns 5 and 6. Angular diameters corresponding to other limb darkening laws are readily scaled from these values. Notes are flagged in column 7.

Two of the angular diameters reported in Table II are less than two milliarcsec. We realize that resolving diameters smaller than two milliarcsec by means of occultation measurement is difficult, and we admit that, in the case of Run 7841 (SAO 93950), the resolution may, indeed, be spurious, since the standard error of the measurement is comparable to the measurement itself. In the other case (Run 7840 = SAO 93955), we are confident that the resolution is real. The fitting program has successfully demonstrated its ability to distinguish a resolved source from a point source when presented with a high-quality trace (Run 7708 = SAO 162512, illustrated as Figure 2), but it has consistently refused to "change its mind" about Run 7840 despite being offered a variety of inducements.

Finally, Table III contains additional information for those observations which clearly indicated binary or multiple stars. The run number, Durchmusterung number, SAO number, and a binary star identification number (if available) are listed in columns 1 through 4. The passband of the observation is tabulated in column 5. The best-fit value for the observed magnitude difference and its formal standard error are listed in columns 6 and 7. The vector separation and its error (in arcseconds) appear in columns 8 and 9, while the aspect of the observation (which is the position angle corrected for the local limb slope) and its error are listed in columns 10 and 11. Notes are flagged in column 12.

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TABLE 1

Run No.	DM No.	SAO No.	Visual Mag	Sp	Filt.	Phen	Date	UTC Observed	ΔT	S/B	Δm_0	Δm_e	PA	CA	Slope	ΔS	Notes
7701	+17 0703	093849	7.5	G5	NB	D	02 Jan 77	07 55 54.7	0.2	0.04	0.0	0.0	33.4	66.9			*
7704	+17 0719	093923	4.30	A2IV	NB	D	26 Feb 77	03 12 06.4	0.2	0.06	0.4	0.7	59.4	23.0			*
7706	-12 4019	158492	8.7	M5	FI	R	30 Mar 77	07 1[illegible] [illegible]3.4	0.2	0.27	2.7	2.6	259.9	-177.5	(2.5)	1.6	
7708	-18 5322	162512	3.34	F0IV	NB	D	2[illegible] Jul 77	05 13 37.1	0.2	0.45	3.4	3.0	78.5	-1.1	0.0	0.9	*
7710	-14 5812	163780	7.8	K0	FI	D	23 Sep 77	05 32 05.4	0.2	0.38	7.1	2.9	77.5	-18.2			
7711	-08 5858	146043	7.9	M5	FI	D	25 Sep 77	01 21 10.6	0.2	0.29	2.8	2.7	138.8	-70.0	3.6*	0.1	*
7712	-08 5861	146052	9.3	M5	FI	D	25 Sep 77	01 30 57.7	0.2	0.09	1.4	1.4	107.9	-39.6			
7713	-07 5765	146062	6.11	gG6	NB	D	25 Sep 77	02 21 03.5	0.2	0.21	2.4	2.1	76.7	-10.2	(-10.2*)	2.1	
7715	-18 4935	161376	5.40	F5p	y	D	18 Oct 77	01 14 31.5	0.2	1.81	4.9	4.3	76.8	3.8	(3.8)	0.5	*
7716	-15 5535	[illegible]	6.16	B9	b	D	29 Oct 77	02 48 53.3	0.2	3.52	3.5	3.3	16.1	54.2	-1.4	0.4	b
7717	-15 5629	163841	3.07	comp	y	D	20 Oct 77	02 53 36.6	0.2	2.24	5.1	4.0	21.6	48.7	5.0	0.2	a,b,*
7718	+17 0800	094173	8.5	M4e	FI	R	30 Oct 77	07 25 42.2	0.2	0.04	0.0	0.0	231.6	-149.9			*
7804	+14 1999	097843	5.87	A5V	y	D	20 Mar 78	02 01 00.749	0.011	0.03	0.0	0.0	26.5	80.1			*
7805	+14 1917	097910	8.3	C5	y	D	20 Mar 78	05 18 45.654	0.002	0.08	1.2	1.1	103.5	6.6			
7809	-19 4892	161150	8.9	B9	y	R	27 Apr 78	07 17 11.312	0.008	0.02	0.0	0.0	264.8	-171.6			
7810	-19 4894	161165	8.8	B	y	R	27 Apr 78	07 21 02.104	0.008	0.02	0.0	0.0	262.5	-169.4			
7812	-19 4901	161192	9.0	K0	FI	R	27 Apr 78	07 45 00.130	0.020	0.02	0.0	0.0	220.6	-128.2			
7813	-19 4905		8.8	Bp	FI	R	27 Apr 78	07 49 30.542	0.042	0.01	0.0	0.0	197	-103			
7814	-18 4842		8.2	B5	y	R	27 Apr 78	07 58 14.757	0.015	0.02	0.0	0.0	331	121			
7815	-19 4909	161200	8.8	B2	y	R	27 Apr 78	08 25 46.633	0.007	0.03	0.0	0.0	279.9	171.0			
7816	-18 4856		8.2	K5	FI	R	27 Apr 78	08 32 20.887	0.003	0.15	2.0	1.8	337	114	0.3	0.3	
7817	-18 4850		9.5	B5	y	R	27 Apr 78	08 42 34.186	0.016	0.01	0.0	0.0	293	157			
7818	-19 4917	161208	8.2	B3	y	R	27 Apr 78	08 50 49.137	0.006	0.03	0.0	0.0	265.9	-176.0			
7819	-19 4924		9.0	B9	b	R	27 Apr 78	08 57 32.961	0.013	0.02	0.0	0.0	231	-141			
7821	-18 4866	161229	9.2	B3	b	R	27 Apr 78	09 28 36.098	0.005	0.03	0.0	0.0	296.1	152.2			*

Table 1 cc

7822	[illegible]	161247	8.6	K0	FI	R	27 Apr 78	09 45 18.898	0.003	0.10	1.5	1.3	323.5	124.0	-2.0*	1.0	
7823	-19 4939	161245	8.7	B8	b	R	27 Apr 78	09 55 03.188	0.009	0.02	0.0	0.0	280.9	166.3			*
7824	-19 4944	161255	7.5	B2	b	R	27 Apr 78	10 14 22.762	0.002	0.07	1.0	0.8	280.1	166.2			*
7825	-18 4888	161278	6.6	B5	FI	R	27 Apr 78	10 31 21.696	0.005	0.07	1.0	1.0	319.5	126.1	2.5*	[illegible]	*
7826	+17 1177	095407	8.9	A0	y	D	11 May 78	01 55 04.370	0.004	0.30	2.9	2.7	156.1	-57.8			
7827	+17 1187	095448	8.8	Ma	FI	D	11 May 78	02 22 47.546	0.001	9.21	6.7	4.5	85.4	12.9	(12.9)	3.4	*
7828	-18 5115	161935	6.9	K0	y	R	25 May 78	07 41 53.641	0.005	0.04	0.0	0.0	279.3	166.2			b,*
7829	-11 5690	164711	6.8	K0	y	R	28 May 78	08 35 09.431	0.002	0.11	1.6	1.6	231.9	-159.6	-1.8	5.7	
7830	-10 5783	164715	8.6	K0	y	R	28 May 78	08 53 09.870	0.009	0.02	0.0	0.0	291.5	139.8			
7831	-10 5785	164717	6.50	B9	y	R	28 May 78	09 04 39.412	0.002	0.11	1.6	1.3	273.5	157.4	0.6*	2.5	b
7832	-19 4998	161453	8.9	K2	FI	D	15 Aug 78	03 01 15.830	0.015	0.02	0.0	0.0	93.2	-6.3			
7833	-19 5007	161482	8.3	B8	b	D	15 Aug 78	04 07 08.762	0.008	0.06	0.8	0.8	79.5	4.9			
7834	-18 4983	161540	5.76	gK0	FI	D	15 Aug 78	05 50 12.138	0.001	0.30	2.9	2.5	49.7	32.1	-0.1	1.8	*
7835	-16 5617	163641	7.0	A0	y	D	17 Aug 78	02 50 28.252	0.007	0.02	0.0	0.0	105.1	-27.0			
7836	-16 5634	163675	9.1	M1	FI	D	17 Aug 78	04 18 11.148	0.012	0.01	0.0	0.0	100.7	-26.0			
7837	-15 5732	163740	6.9	K0	FI	D	17 Aug 78	06 36 17.324	0.001	0.13	1.9	1.8	69.6	1.7			
7838	-15 5743	163771	5.30	B6III	y	D	17 Aug 78	07 39 30.901	0.001	0.11	1.6	1.4	63.0	8.1			b,*
7839	+15 0621	093925	6.46	dF5	y	R	22 Sep 78	05 34 21.274	0.002	0.12	1.7	1.4	240.2	-164.7	-0.7	2.6	b,*
7840	+15 0631	093955	3.85	K0III	FI	R	22 Sep 78	06 51 18.924	0.001	1.57	4.7	3.9	192.9	-117.9	3.8	0.2	a,b,*
7841	+16 0605	093950	5.10	K2III	y	R	22 Sep 78	07 12 44.923	0.001	0.48	3.4	3.2	295.8	139.0	-0.5*	1.6	a,*
7842	+15 0533	093961	6.6	F8	y	R	22 Sep 78	07 32 42.981	0.003	0.08	1.2	0.9	241.1	-166.1			b,*
7843	+15 0635	093969	8.1	Ma	FI	R	22 Sep 78	08 10 02.286	0.003	0.09	1.4	1.2	227.9	-152.6			
7844	+15 0637	093975	4.78	A7V	y	R	22 Sep 78	08 28 21.457	0.001	0.64	3.7	3.4	226.3	-150.7	4.8	1.0	*
7845	+16 0621	094004	6.5	F0	y	R	22 Sep 78	10 34 38.326	0.002	0.14	1.9	1.9	217.1	-137.5	-8.3	1.1	
7846	+16 0629	094027	0.86	K5III	FI	R	22 Sep 78	12 25 37.011	0.009	0.16	2.1	1.8	246.4	-162.0			*

7847	+17 0920	094526	4.98	F8V	y	R	23 Sep 78	09 59 55.950	0.001	0.42	3.3	3.0	224.8	-142.5	2.4	0.9	*
7848	+17 1182	095419	5.71	Am	y	R	24 Sep 78	09 22 48.523	0.002	0.17	2.2	2.0	304.5	140.9	4.6*	1.4	b,*
7849	-12 6087	164639	5.59	A2V	y	D	12 Oct 78	04 00 20.224	0.002	0.16	2.1	2.0	126.5	-59.9	10.3*	0.3	*
7850	+16 0672	094227	5.48	gK1	y	R	20 Oct 78	05 27 38.338	0.026	0.07	1.0	1.0	290.0	147.2			*
7851	+17 1004	094858	5.38	gF4	y	R	21 Oct 78	04 31 05.192	0.003	0.06	0.8	0.6	281.0	160.7			*
7853	+17 1357	096015	5.10	A2V	y	R	22 Oct 78	06 41 17.074	0.003	0.08	1.2	1.1	283.9	162.9			*
7854	-10 5860	145929	8.7	K0	y	D	06 Dec 78	02 24 07.417	0.004	0.08	1.2	1.2	85.8	-19.2			
7856	+16 0605	093950	5.10	K2III	FI	D	13 Dec 78	09 35 04.355	0.001	0.12	1.7	1.1	109.9	-22.5	-7.1*	3.2	*
7858	+17 1441	096261	8.2	K2	FI	R	16 Dec 78	04 33 35.935	0.005	0.03	0.0	0.0	245.3	-156.0			
7859	+17 1447	096288	6.9	K0	FI	R	16 Dec 78	05 43 28.222	0.007	0.02	0.0	0.0	259.3	-167.4			
7860	+18 1423	096318	7.1	B2	b	R	16 Dec 78	06 39 36.218	0.009	0.03	0.0	0.0	302.9	151.6			
7861	+18 1428	096337	9.0	K5	FI	R	16 Dec 78	07 18 18.862	0.018	0.02	0.0	0.0	303.9	152.4			
7862	+18 1431	096339	8.3	K5	FI	R	16 Dec 78	07 29 13.816	0.011	0.03	0.0	0.0	295.1	161.7			
7865	+17 1479	096407	6.00	M1	FI	R	16 Dec 78	09 58 17.903	0.001	0.34	3.0	2.7	309.7	151.6	0.5*	1.8	a

TABLE II

Run Number	DM Number	SAO Number	HR Number	Angular Diameter (milliarcsec)	Standard Error	Notes
[illegible]	-15 5629	163481	7776	3.13	0.39	*
7840	+15 0631	093955	1411	1.49	0.45	*
7841	+16 0605	093950	1407	1.63	1.07	*
7865	+17 1479	096407	2631	5.98	1.17	*

TABLE III

Run Number	DM Number	SAO Number	Binary Identification	Passband	Magnitude Difference	Standard Error	Vector Separation	Standard Error	Aspect	Standard Error	Notes
7716	-15 5626	163471	ADS 13717	b	3.05	0.27	0.2768	0.0014	14.7	0.4	*
7717	-15 5629	163481		y	1.86	0.14	0.0086	0.0003	26.6	0.2	
7831	-10 5785	164717	Fin 358	y	0.87	0.27	0.0358	0.0010	274.3	2.5	*
7838	-15 5743	163771	ADS 14099	y	0.39	0.08	0.2303	0.0032	63.0		*
7839	+15 0621	093925	Fin 342	y	0.74	0.27	0.0253	0.0011	239.5	2.6	*
7840	+15 0631	093955		FI	3.92	0.28	0.0880	0.0026	196.7	0.2	
7842	+15 0633	093961	ADS 3248	y	0.53	0.17	0.2731	0.0033	241.1		*
7848	+17 1182	095419	Kui 24	y	0.01	0.06	0.4451	0.0006	129.1	1.4	*

NOTES ON TABLE I

7701. Double-lined spectroscopic binary member of the Hyades, with $\Delta m = 0.4$ (Batten et al. 1978). The components were seperated by some 0."01 at the epoch of this observation and could perhaps have been resolved. However, there is no evidence of two stars on this trace, due perhaps to unfavorable geometry and/or a rather poor-quality record.

7704. 68 Tau = ADS 3206. A member of the Hyades. The companion, some 77" distant from the primary according to the Index Catalog of Double Stars (IDS) (Jeffers et al., 1963), did not fall within our photometer diaphragm. Observed through clouds.

7708. 44 = ρ^1 Sgr. Reported as double by some visual observers. Neither our observation nor three other photoelectric observations of this star with which we are familiar support this claim. Illustrated as Figure 2.

7711. A particularly difficult trace to interpret. Possibly a close double, with $\Delta m \simeq 1.2$ and a vector separation $\simeq$ 0."01 at PA = 139°. An attempt to fit for the angular diameter yielded a (probably spurious) value of 9.6 ± 1.3 milliarcsec for a uniform disk, much larger than the 3.0 milliarsec expected. The event occured 18 seconds before the predicted time, suggesting that limb features may have played a role in creating the anomalous features of this record.

7715. Y Sgr. Illustrated as Figure 3.

7717. 9 = β Cap. Details of this observation have been published elsewhere (Radick, 1979).

7718. V Tau.

7804. 29 Cnc. Observed through clouds.

7819. Possibly double, with $\Delta m \simeq 1.0$ and a vector separation $\simeq$ 0."05 at PA = 296°.

7823. Possibly double, with $\Delta m \simeq 1.5$ and a vector separation $\simeq$ 0."62 at PA 281°.

7824. Possibly double, with $\Delta m \simeq 1.7$ and a vector separation $\simeq$ 0."08 at PA 280°.

7825. ADS 11232. Several companions, none closer than 22" from the primary according to the IDS, fell outside our photometer diaphragm.

7827. Strong distortion, probably due to scintillation, present in this record.

7828. ADS 11776. The visual companion, some 18" distant from the primary according to the IDS, fell outside our photometer aperture. Just possibly double, with $\Delta m \simeq 1.3$ and a vector separation $\simeq$ 0."15 at PA = 99°. Observed through overcast.

7834. Essentially fringeless, but observed near horizon.

7838. 14 = τ Cap. No evidence of the faint companion to the secondary reported by Africano et al., (1975), although the quality of the record is inadequate to support a firm statement on this point. An intensity drop did occur before the disappearance of the primary, corresponding to $\Delta m \simeq = 0.9$ and a vector separation $\simeq$ 0."08 at PA 243° relative to the primary. Doubtful.

7839. 70 Tau. Binary member of Hyades.

7840. 77 = o' Tau. One of the Hyades giants, and a recently discovered binary (Griffin and Gunn, 1977; Beavers and Eitter, 1979). The companion has been seen on several occasions since it was first reported. Illustrated as Figures 4 and 5.

7841. 75 Tau. Also observed as Run 7856. No evidence of a companion, contrary to the report of Fekel et al., 1980.

7842. Binary member of Hyades.

7844. Member of Hyades. Reported as double by some visual observers. Our observation does not support this claim.

7846. 87 = α Tau (Aldebaran). Daytime reappearance observation was only partially successful, as the star fell almost outside our photometer diaphragm. Accordingly, no attempt has been made to derive an angular diameter from this record.

7847. 111 Tau. The visual companion, some 86" distant from the primary according to the IDS, fell outside our photometer diaphragm.

7848. Time tabulated is for the first star to reappear. The second star appeared at 9:22:50.244 ± 0.002. The local limb slopes derived from the two events are 3°.7 and 5°.5.

7849. 48 = λ Cap.

7850. Relatively large timing uncertainty due to unintentional 5-bit truncation of observational data, resulting in poor intensity resolution.

7851. 130 Tau.

7853. 26 Gem. Close binary. Two level changes occured after the reappearance of the primary. However, the quality of the record is not very good, and an April 1979 observation of another occultation of this star showed no features corresponding to these.

7856. 75 Tau. Also observed as Run 7841.

NOTES ON TABLE II

7717. Other measurements of the angular diameter are: 3.05 ± 0.12 (Ridgway *et al.*, 1977) and 2.8 ± 0.4 (inferred) (Africano *et al.*, 1978) for a uniformly-illuminated disk.

7840. White (1979) measured 2.3 ± 0.3 (inferred) for the uniform disk.

7841. An attempt to derive an angular diameter from Run 7856, which was of substantially poorer quality than Run 7841, showed the Run 7856 trace to be indistinguishable from one produced by a point source.

7865. Morbey *et al.*, (1978) measured 6.5 ± 0.5 for the uniform disk, but indicate that they suspect their trace is distorted.

NOTES ON TABLE III

7716. The separation and position angle listed in the IDS are 0."8 and 89°.

7831. The separation and position angle listed in the IDS are 0."1 and 129°.

7838. The separation and position angle (0."30, 112°.9) specified by the orbital elements of Heintz (1978) are consistent with this observation. The elements of Baize (1953) place the secondary west of the primary at the epoch of this observation, contrary to what we observed.

7839. The separation and position angle (0."130, 321°0) specified by the orbital elements of Finsen (1978) are consistent with this observation, as is the September 1978 occultation observation of Beavers and Eitter (1979). However, occultation observations obtained in March 1979 (Africano and Radick, 1980; Fekel et al., 1980) clearly indicate that the secondary is east of the primary, not west. The most likely explanation is that the analyses of the September 1978 observations were prejudiced by noise distorting two nearly coincident events.

7842. The separation and position angle (0."28, 82°.6) specified by the orbital elements of van den Bos (1956) are in good agreement with this observation.

7848. The separation and position angle listed in the IDS are 0."5 and 139°

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FIGURE CAPTIONS

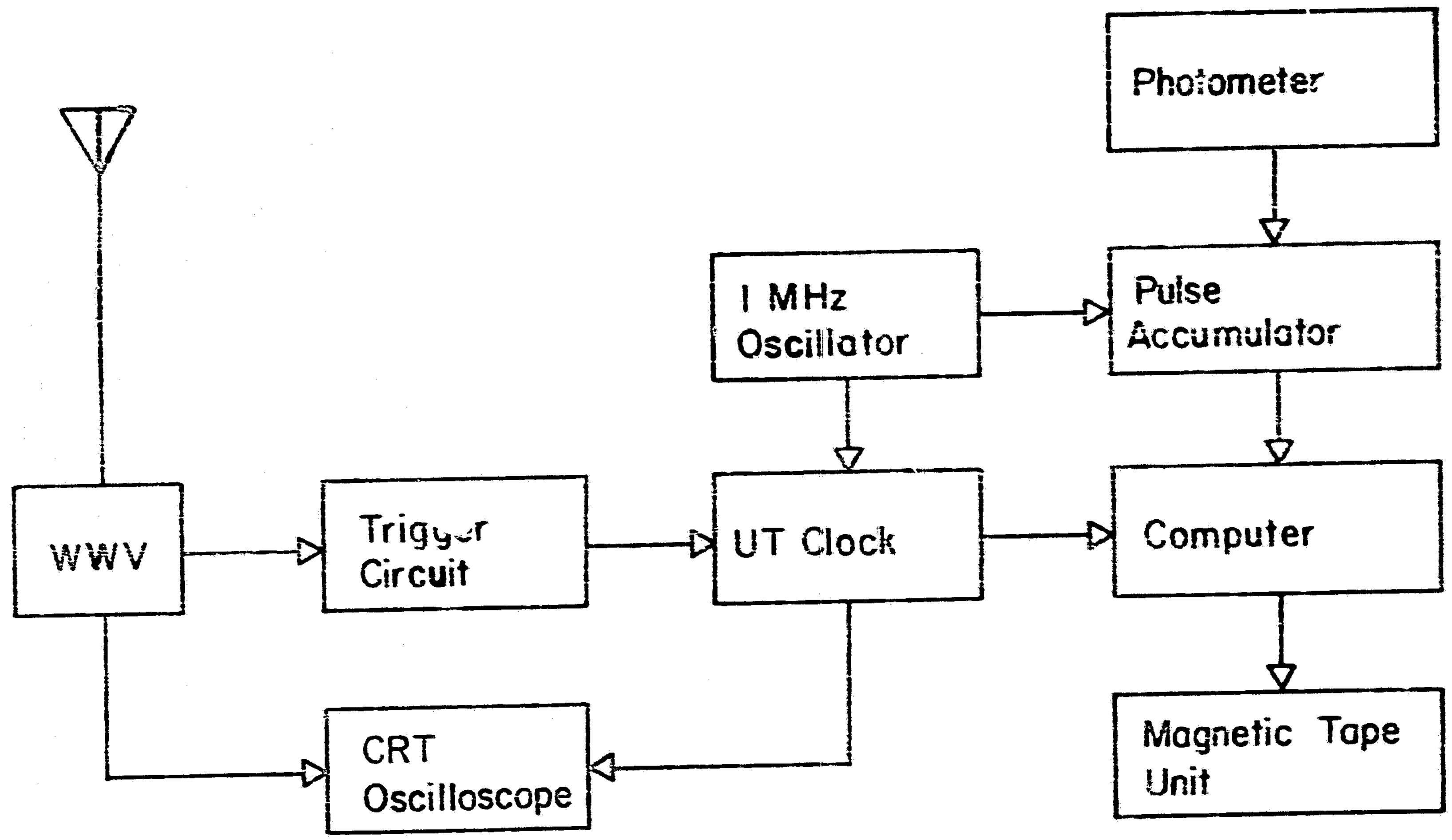
Figure 1 Block diagram of data acquisition system.

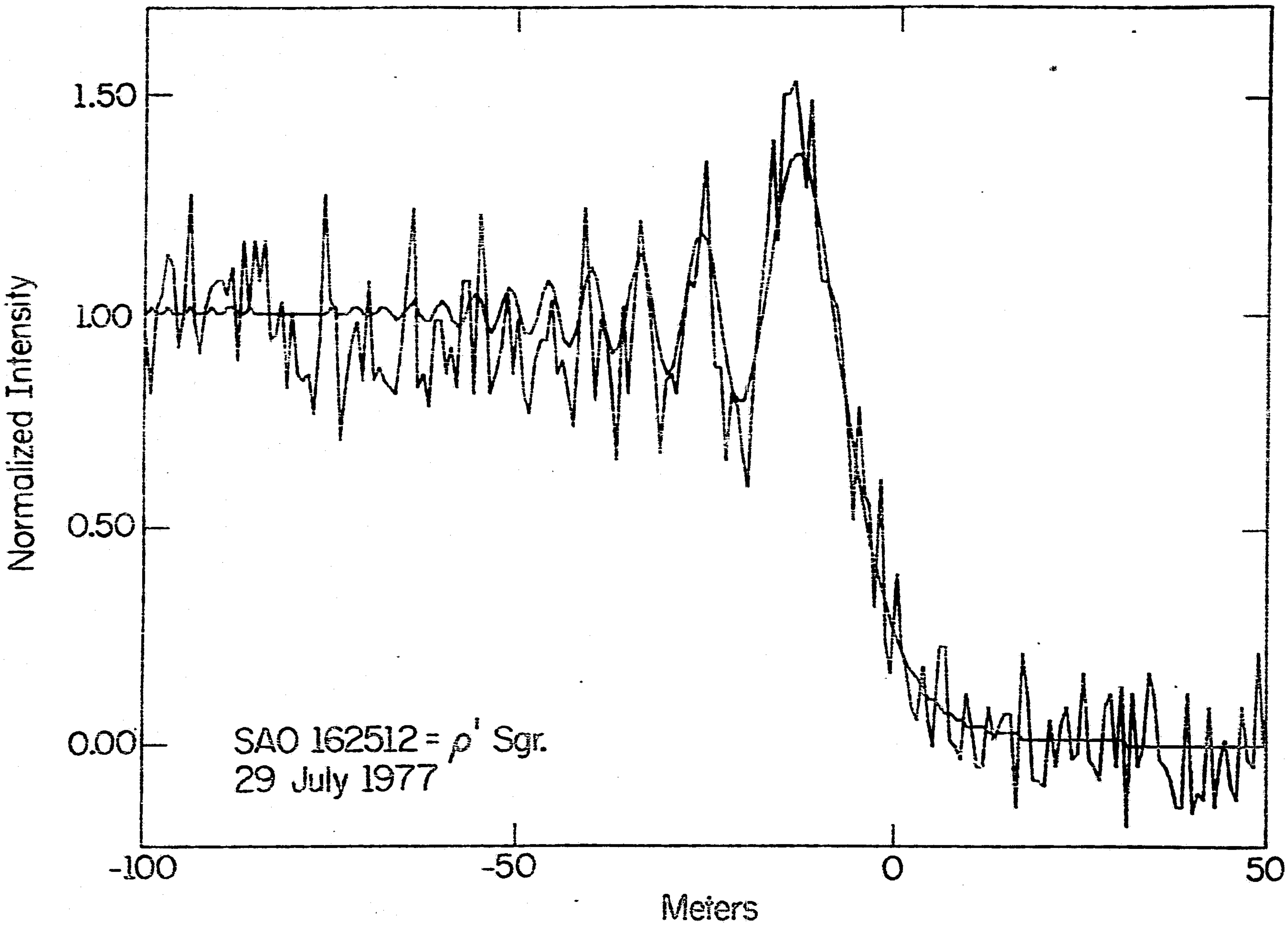
Figure 2 SAO 162512 occultation.

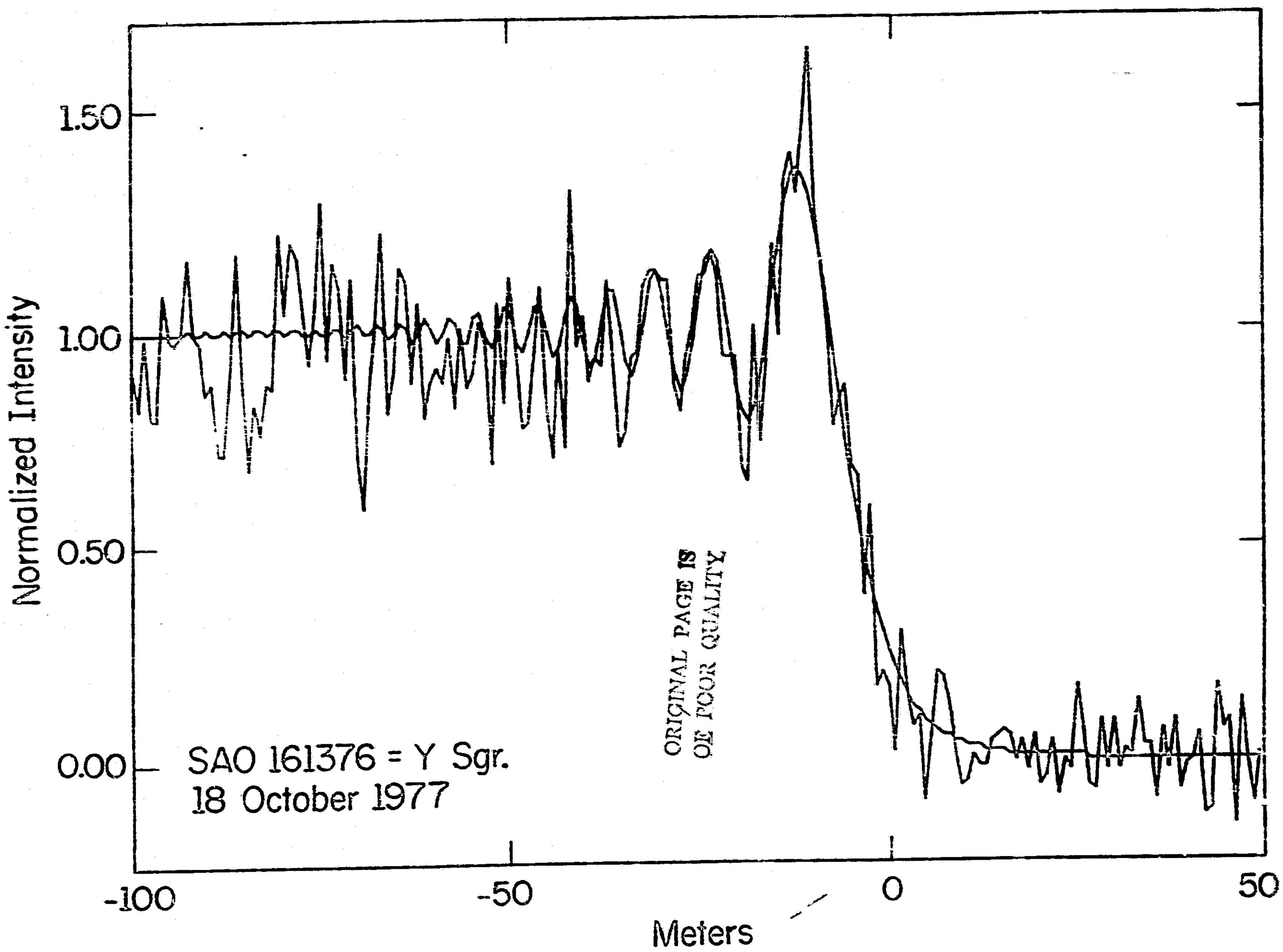
Figure 3 SAO 161376 occultation.

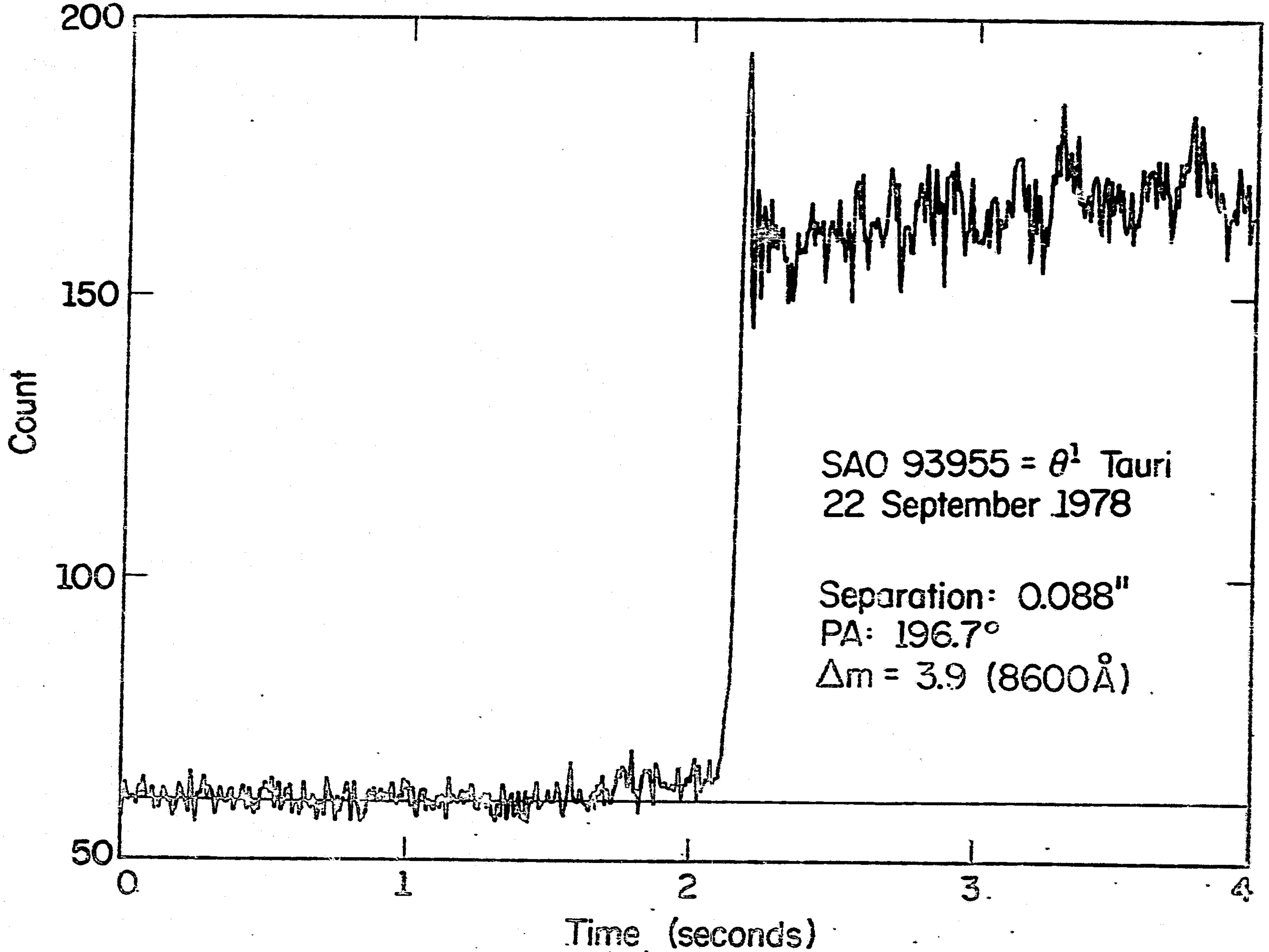
Figure 4 SAO 93955 occultation. The secondary reappeared about 0.4 second before the primary.

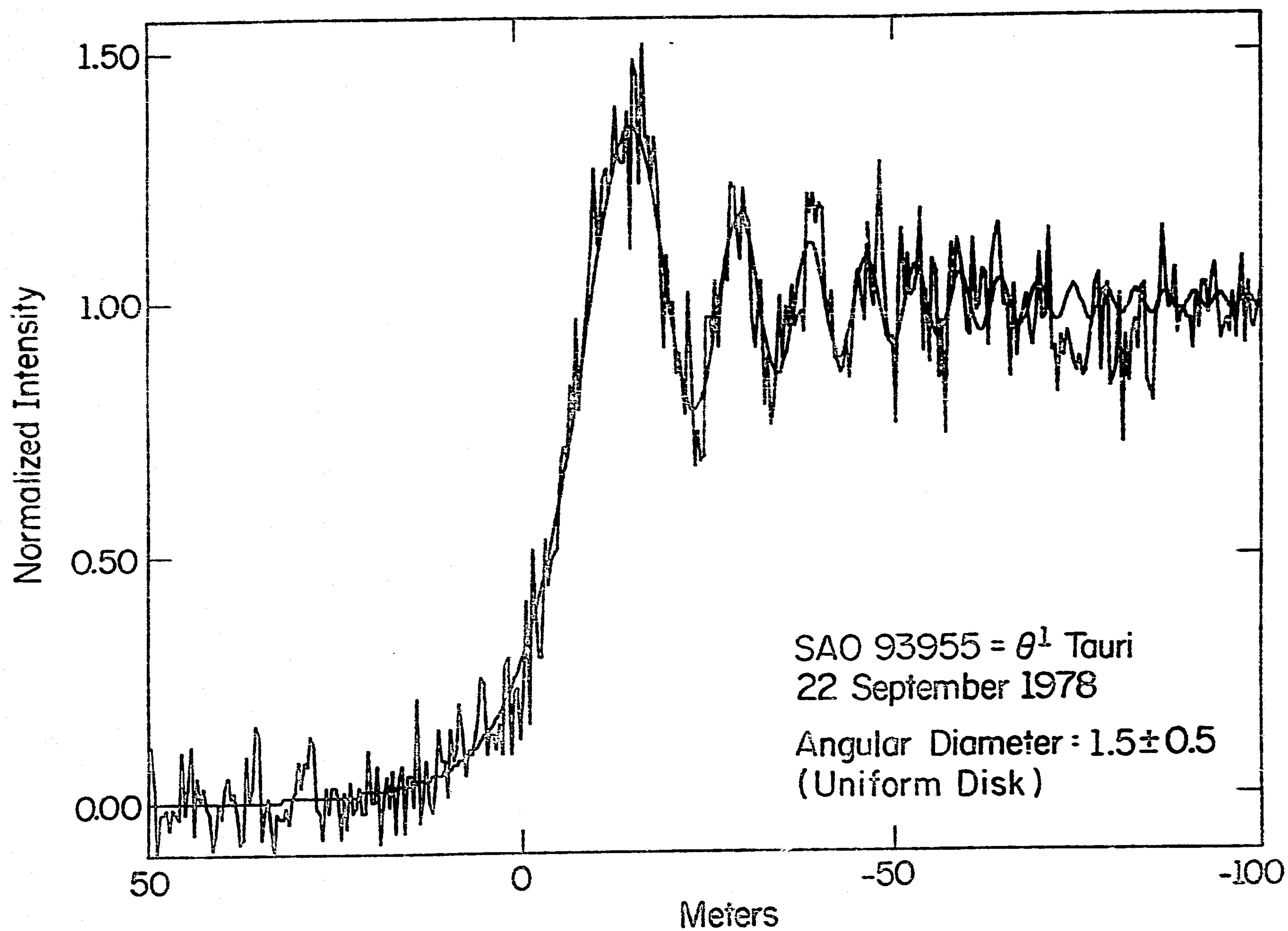
Figure 5 SAO 93955 occultation, primary only.


Photometer
Pulse Accumulator
I MHz Oscillator
WWV
Trigger Circuit
UT Clock
Computer
CRT Oscilloscope
Magnetic Tape Unit


Normalized Intensity
1.50
1.00
0.50
0.00
-100
-50
0
50
Meters
SAO 162512 = ρ' Sgr.
29 July 1977


Normalized Intensity
1.50
1.00
0.50
0.00
-100
-50
0
50
Meters
SAO 161376 = Y Sgr.
18 October 1977


200
150
100
50
Count
0
1
2
3
4
Time (seconds)
SAO 93955 = θ¹ Tauri
22 September 1978
Separation: 0.088"
PA: 196.7°
Δm = 3.9 (8600Å)


1.50
1.00
0.50
0.00
Normalized Intensity
50
0
-50
-100
Meters
SAO 93955 = θ1 Tauri
22 September 1978
Angular Diameter : 1.5±0.5
(Uniform Disk)

Mountain Winds — Revisited

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