PREDICTIONS OF STELLAR OCCULTATIONS BY SATURN'S RINGS FOR THE PERIOD 1987 - 1991

by

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Submitted to the Department of
Earth, Atmospheric, and Planetary Sciences
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ABSTRACT

Geocentric circumstances are presented for 271 possible stellar occultations by Saturn's rings for the time period 1 January 1987 - 31 December 1991. This work is an extension of the search done by Killian and Dalton (1985) with the Palomar Observatory Sky Survey (POSS), and improved coordinates for 85 of those candidates as well as new predictions for gaps left uninvestigated are included.

Signal-to-noise ratios (S/N) were calculated for Hubble Space Telescope (HST) observations of stellar occultations of candidates identified in Killian and Dalton for a star of estimated V magnitude equal to 11.0. The lowest (S/N) was approximately 17 for a one second integration through a B filter on the visual image dissector tube with an S20 photocathode. The highest (S/N) was approximately 434 achieved with a one second integration through a "clear" filter on the photomultiplier tube. Hence, stars several magnitudes fainter than included in Killian and Dalton could still be useful for occultation observations. The author estimates that this effort extends the original search by at least one magnitude overall, although there are cases where some stars from Killian and Dalton are fainter than detected in the present work.

The current search was done by using a Perkin Elmer PDS microdensitometer to scan photographic plates taken with the Lowell Observatory 18-inch astrograph. A total of 17 fields ranging in right ascension from approximately 17 hours to 21 hours were investigated for possible appulses. 183 stars have a closest approach to the planet of 11 arcseconds or less and are the most probable events. Stars with larger values are marginal events and should be investigated further before planning to observe.

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To John, Mary, Regina, and John P.

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I. INTRODUCTION

Occultation studies have resulted in a wealth of new knowledge about the solar system, a most spectacular example being the discovery of the Uranian rings (Elliot, *et al.*, Nature, 1977 and Elliot, *et al.*, Sky and Telescope, 1977). From occultation data we can determine the temperature of an atmosphere by measuring the amount of refraction of light that occurs before the star disappears behind the limb of the planet. Precise timing of an event from two or more sites allows us to accurately measure the size and shape of the occulting body. Finally, occultations provide high spatial resolution, typically on the order of a few kilometers at the distance of Saturn, compared with a few hundred kilometers resolution achieved with direct imaging techniques from the Earth. Occultation studies, therefore, are ideally suited to investigating the structure and composition of planetary rings whose intricate details are too distant for us to resolve other than with spacecraft.

The Saturnian rings, by far the most elaborate, still remain one of the enigmas of our solar system. When and how did they form? Voyager I and Voyager II were the first to successfully record Saturn ring occultations photoelectrically, something which had previously proven too difficult to do because the planet and its rings are so brilliant they quickly flood light-sensitive instruments. In the Voyager experiments, thousands of features were revealed in each of the classical A, B, and C rings (Smith, *et al.*, 1981 and 1982). Nevertheless, each flyby provided only a snapshot of the rings. Some aspects of rings, like precession of ringlets and spiral density waves, are dynamic, varying phenomena that need to be monitored more closely to understand their history and evolution. It therefore is desirable to follow up these Voyager encounters with Earth-based occultation observations to achieve a longer time baseline of data from which to construct an accurate model for describing the rings. Occultation data provide the highest spatial resolution possible from Earth. Diffraction effects limit the resolution to approximately 3 kilometers compared to the approximate 5,000 kilometer resolution achieved with conventional ground-based imaging techniques.

What can we expect to learn from Saturn ring occultation data?[1] We can establish the orbits of ringlets. We can pinpoint ring edges and gaps. We can determine the propagation velocities of spiral density waves and bending waves which are excited by resonances with the Saturnian satellites. We can measure the size of the ring particles and thereby deduce the relative importance of both gravitational and non-gravitational forces. Finally, we can search for other time variable features as yet undetected.

With the advent of the Hubble Space Telescope (HST) as a major astronomical research facility, we can expect to achieve a much higher signal-to-noise ratio for observing Saturn ring occultations than previously attainable from the ground. HST extends our capabilities to the point where we can routinely observe Saturn ring occultations. This is true for several reasons: The small focal plane apertures (0.4 to 1.0 arcseconds) on the HST High Speed Photometer enable us to reject much of the extraneous background light from the rings and planet. There is the absence of scintillation noise from the atmosphere which has strong components at frequencies corresponding to occultation timescales. Finally, a much greater span of wavelengths can be covered, including the far ultraviolet, thereby enabling the observation of occultations of stars of early spectral type (Hall, 1982). But before we can observe an occultation, predictions for when the events will occur are necessary. This prediction process is the subject of my thesis.

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1. A good source of information on this topic is Planetary Rings (Greenberg and Brahic, 1984).

II. RESEARCH OBJECTIVE

The easiest procedure for making predictions of stellar occultations by a body with a known orbit is a computerized comparison of a star catalog with the corresponding planet ephemeris. However, stars fainter than those listed in popular catalogs (such as the SAO, AGK3, and Perth 70) can still be valuable occultation candidates, so it becomes necessary to search photographic plates for fainter occultation stars. This is especially important for observations with the Hubble Space Telescope (HST) because its small focal-plane aperture gives us the ability to observe such faint stars more easily.

The desire to extend the predictions beyond the catalog stars prompted the author and a colleague to search for faint occultation candidates using Palomar Observatory Sky Survey (POSS) prints with the Lowell Observatory PDS microdensitometer measuring engine. This effort produced a list of 136 possible occultation candidates for Saturn from 1985 through 1991 (Killian and Dalton, 1985).[2] A reprint of Paper I is included as Appendix D.

In the current research, signal-to-noise ratios for each star in Paper I were calculated for HST observations using a High Speed Photometer Simulator written by Richard White of the Space Telescope Science Institute (Appendix C). All occultation candidates were well within the range of being measurable events. The signal-to-noise ratios were calculated with the following formula:

$$\left(\frac{S}{N}\right) = \frac{n_*}{\sqrt{n_* + n_b}}$$

2. Hereafter referred to as "Paper I."

where n_* is the number of photons detected from the star, and n_b is the number of photons detected from the background. The quantity (S/N) for a star of estimated V magnitude equal to 11.0 ranged from approximately 17 for a one second integration through a B filter on the visual image dissector with a S20 photocathode, to approximately 434 achieved with a one second integration through a "clear" filter on the photomultiplier tube. This means that stars several magnitudes fainter than those in the original search could yield valuable information about Saturn's rings if their occultations could be predicted and observed with the HST.

The previous search was also limited in two other ways. First, there were gaps in the search of those regions of the sky too densely crowded with stars and dust to permit distinguishing any individual candidates, specifically the regions from right ascension 18h 3m - 18h 34m and 19h 57m - 20h 30m. Second, since sheet film reproductions of the POSS prints were used instead of the original plates, there was some degradation in the quality of the images, especially apparent near the edges.

The research objective here was a threefold improvement in the work of Paper I: (1) to search the Saturn occultation fields to a fainter magnitude limit, (2) to do more accurate astrometry on the previously identified occultation candidates already published, and (3) to fill in the gaps left in the original search. With these goals, the observing plan was to take photographic plates of the relevant regions of the sky where Saturn will pass in the upcoming years and then scan these plates with the Lowell Observatory PDS microdensitometer to find more candidates for observation.

III. OBSERVING PROCEDURE

Plate Taking Process:

Most of Saturn's motion is in Right Ascension, traversing the portion of the sky from16 hours, 55 minutes to 20 hours, 39 minutes right ascension from 1 January 1987 through 31 December 1991. Saturn changes very little in declination, staying within the range of -19 degrees to -23 degrees.

The Lowell Observatory 18" astrograph, which was used to photograph the sky, is an f/8 system that yields a plate scale of approximately 57 arcseconds per millimeter (Hoag, 1985). With 8" x 10" photographic plates, this scale produces a field approximately 3 degrees by 4 degrees in area. With the plate holder orientated so that the 4 degrees would accomodate the motion in right ascension, the search region can be easily divided into 17 slightly overlapping fields each with an SAO star as plate center/guide star. Table A.1 lists all 17 fields, the corresponding SAO star used as plate center, the star's coordinates (for equator and equinox 1950), and the approximate range of right ascension that each field covers.

The author used an RG1 filter in combination with Kodak IIIaF plates and exposure times of 10 minutes and 30 minutes. The 30 minute exposures were necessary because the very faint occultation candidates either did not appear or barely surpassed the plate limit in the 10 minute exposures. The RG1 filter was used to limit the wavelength range exposed, so that chromatic aberration by the telescope's optics would not produce systematic offset in the position of a star.

The plates used to search for new occultation candidates had only one exposure on them. However, the plates used to refine the astrometry of the candidates could accommodate multiple exposures in order to save time and materials.[3]

Plate Reduction Process:

The plate reduction process for the search fields was that described by Bowell, *et al.*, (1979) and Millis, *et al.*, (1983): A Saturn ephemeris was generated for the specific time period it would be on a given plate by using the JPL DE-118 ephemeris stored on the Lowell Vax. The plate was mounted on the stage of a Perkin Elmer PDS microdensitometer, and the Saturn ephemeris was used to drive the PDS light beam over the plate corresponding to where Saturn would be in relation to the field of stars. Each time a star that was above the the plate limit in brightness appeared on the display screen the author would interrupt the PDS scan and manually center the star under the crosshairs. The PDS would automatically record the x-y coordinates of the stage for later converting to actual right ascension and declination coordinates.

This initial pass yielded anywhere from 6 to 104 stars for each field. Most stars that appeared in the display screen fell far outside the perimeter of feasibility of being possible occultations but were included in the interruptions to prevent inadvertantly throwing a good event away.

After all potential occultation candidates were selected from the plate, the PDS returned to each star selected (from the x-y coordinates stored as the stars were chosen) and performed a 500-micron by 500-micron raster scan of each image. This gave a density profile for each star in both the x and y directions. The PDS also scanned 50 SAO stars

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3. This was easy to do because the mounting on the plate holder had fine scales for moving the center of the exposure a few millimeters in either the horizontal or vertical direction.

identified on the plate as well. Coordinates for each image, including the catalog stars, were obtained by fitting a one dimensional gaussian curve to the density profiles of both the x and y directions. A final plate solution was performed using the SAO stars previously identified, and the coordinates of each candidate star were derived from these. The plate fitting routine would typically discard 10 - 15 of these stars because of poorly known proper motion values.[4]

Once coordinates for each occultation candidate were calculated, they were compared rigorously with the JPL DE-118 ephemeris for Saturn on the Lowell Observatory Vax. In the Lowell occultation prediction program (Appendix C) the author used a search path of 210,000 kilometers which corresponds to approximately 34 arcseconds at the distance of Saturn. Saturn's E ring diameter is 140,000 km, yielding an error margin of 70,000 km, or 14 arcseconds. This sieve drastically eliminated stars from the original list of possibile candidates, leaving between 1 and 36 stars per field.

The astrometry of the stars from Paper I was done in a similar way to the search for new occultation stars except that it was unnecessary to drive the PDS according to the Saturn ephemeris. This is because the coordinates for the stars in Paper I were used to help find stars once the original plate solutions were done. The PDS did a preliminary plate solution using 5 SAO stars chosen in a chevron pattern across the plate. Once this was completed, the PDS would accept right ascension and declination coordinates, convert them to x-y coordinates for the PDS stage, and then automatically move to the proper place. The PDS was then manually centered on the star and its new coordinates recorded. At this point the PDS did the raster scan of the occultation candidates and the SAO stars to get the density

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4. A discussion of the effect of poorly known proper motions of SAO stars on the accuracy of the coordinates of the occultation candidates can be found in the chapter on error analysis.

profiles. The profiles were then used to determine the actual right ascension and declination coordinates as described above.

To recognize the proper sequence of the exposures on multiply exposed plates once they were developed and ready for measuring, the author adopted the convention of separating the second and third exposures wider apart than the first. This eliminated any ambiguity regarding the identification of a particular exposure. It also enabled instant recognition of the emulsion side of the plate and made it easy to identify SAO stars.

To check the consistancy of the new search with that described in Paper I and to get a better estimate of the accuracy of the coordinates obtained in both efforts, the author had the PDS scan a field originally covered in Paper I to compare how many of the original candidates would appear. As expected, all originals were rechosen as Saturn ring appulses. More importantly, new candidates showed up that were never recognized in the search of the POSS prints. Stars initially identified in Paper I were listed as such and were culled from the list of new candidates. They are included with their original star ID in the list of improved coordinates for Paper I. (Tables A.2 and A.3, Appendix A).

The author attributes the discrepancy in the number of candidates that appeared in the two searches to the higher image quality achieved on original photographic plates compared with the sheet film reproductions of the POSS prints used in Paper I. The spectral response of the photographic media in both searches is very similar, so it is unlikely that it significantly contributes to this difference. Figure 1 shows the response of the combination Schott RG1 filter and a Kodak 103-F emulsion to wavelength. The 103F data was used here because it was readily available and is very similar to the IIIaF emulsion which the author used. The "F" suffix indicates a panchromatic spectral sensitization, the difference being the basic emulsion type and its properties of relative sensitivity, contrast, and granularity.

Both the IIIaF and 103-F plates were designed for long exposure to low intensity illumination. The curve marked with circles is the spectral sensitivity of the 103-F emulsion (Kodak, 1967). The steep curve, marked with crosses, is the lower cutoff of the RG1 filter (Schott, undated). The effective passband is the area underneath these two curves in the range of 5750 - 7250 angstroms, the peak sensitivity being approximately 6500 angstroms.

In Paper I, the search was done with sheet film reproductions of the red POSS prints although the blue prints were used later to measure the relative image diameters on both exposures in order to crudely estimate the stars' spectral type. It is the red emulsion, therefore, which is most relevant to compare with the RG1 and 103-F combination. Figure 2 shows the emulsion response as a function of wavelength for the red POSS prints. The spectral response curve plotted is for the combination 103a-E emulsion with a red Plexiglas 2444 filter used to take the original plates. This particular emulsion-filter combination has a peak sensitivity near 6563 angstroms (Hα emission characteristic wavelength). It was chosen because it is well suited to the detection of faint, extended nebulosities which exhibit Hα emission (Minkowski and Abell, 1963). As indicated, the different emulsion-filter combinations used in the two searches are nearly identical in terms of spectral sensitivity and response.

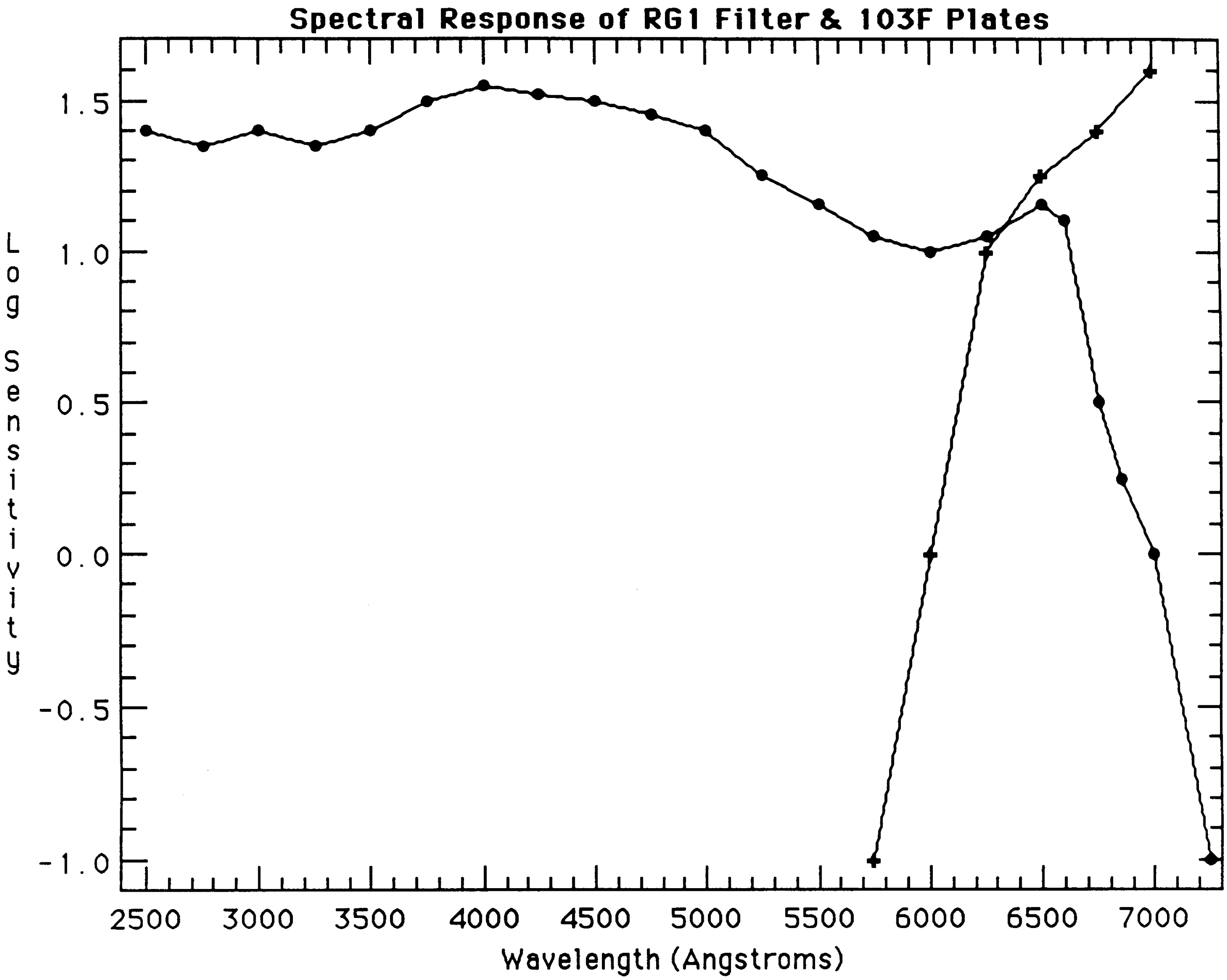

Figure 1. Spectral Response Curve for RG1 Filter (Schott, undated) and 103-F Emulsion (Kodak, 1967).

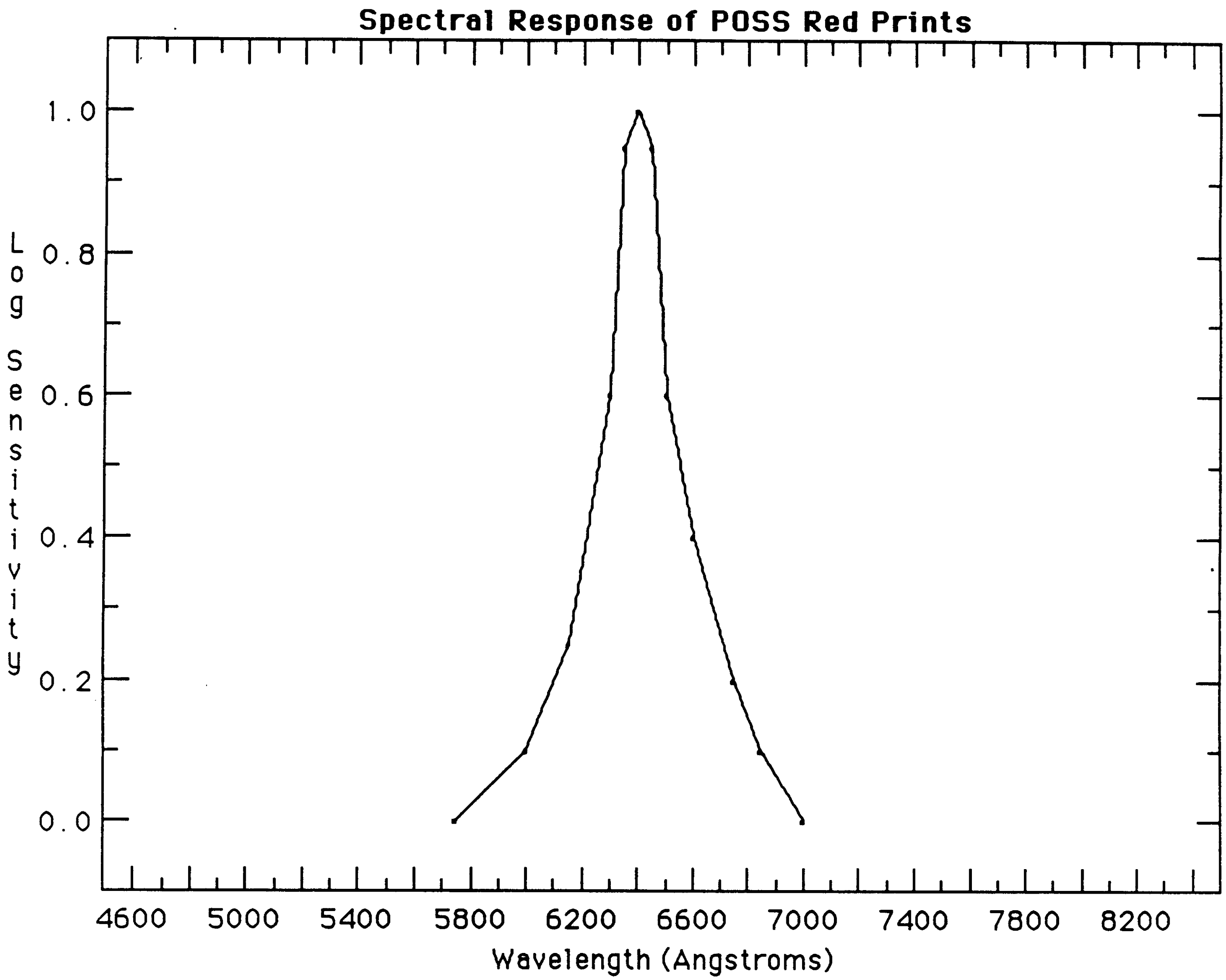

Figure 2. Spectral Response Curve of the Palomar Observatory Sky Survey (POSS) Red Plates: Kodak 103a-E Emulsion in Combination With Plexiglas 2444 Filter (Minkowski and Abell, 1963)

IV. DATA

As a result of multiple exposures of each field, most stars have more than one set of measured coordinates. Because the stars range widely in brightness and color, faint stars frequently did not appear on all plates or would be at the plate limit. This was especially true for the 10 minute exposures because they do not go as deep as the 30 minute ones, and guiding errors would tend to smear what images were there. Consequently, the actual number of measurements for each star varies.

Once all the coordinates for each star plus their respective errors were sorted (see Chapter V, Error Analysis, for discussion), weighted averages were calculated to determine a mean value for each set of coordinates and a better estimate of the true error known. (See Appendix B for averaging routine used). The result is a single set of coordinates for each star. Geocentric predictions for Saturn ring occultations were calculated with the JPL DE-125 ephemeris for Saturn (see Appendix C).

Table A.2 (Appendix A) contains all measured, unaveraged coordinates for the original Saturn stars as published in Paper I. Column one is a field and exposure identification. The number preceding the decimal point refers to the field number in the author's sequence (1-17), and the number following the decimal refers to the exposure number of the field. These are numbered sequentially. Column 2 contains the star ID numbers which correspond to the ID's given in Paper I. The third and fourth columns contain the right ascension (in hours, minutes, seconds) determined for each star from the plate fitting routines and the corresponding error in seconds of time.[5] The fifth and sixth columns contain the

5. This number should be multiplied by 15 cos δ, where δ is the declination in degrees, to get the error in arcseconds.

declinations derived for each star (in degrees, minutes, seconds) and the corresponding errors given in arcseconds. The stars are listed in numerical order by ID number, not chronologically.

Only events for the years 1987 - 1991 were included in the search which explains why they begin with number S30. The tables do not contain improved coordinates for all the stars published in the original paper because in some cases the Paper I stars were indistinguishable from the background fog. Far more stars that had not shown up on the POSS appeared on the Lowell plates than vice versa.

Finally, an "X" by the star indicates that it was not included in the final averaging. This, too, happened for a number of reasons. The primary reason here being misidentification of the star on different exposures: either there was no obvious choice in the viewing screen and the author chose different but equally likely candidates each time, or the author inadvertantly measured the position of the right star but the wrong exposure of it for the fit used. Such stars are included in this list for completeness sake but should not be taken too seriously.

Table A.3 contains the average right ascension and declination, plus errors, calculated for all the stars listed in Table A.2. The averages were figured by weighting each measurement inversely with its own variance to arrive at a mean value for the coordinates of each star and a new estimate of the mean error associated with that number. Specifically,

$$\bar{x} = \frac{\sum_{i=1}^{n} \left(\frac{x^2}{s_i^2}\right)}{\sum_{i=1}^{n} \left(\frac{1}{s_i^2}\right)}$$

where x_i = the measured data point and s^2 = the variance associated with the measurement of x_i.

Tables A.4 and A.5 are identical in format to Tables A.2 and A.3 but refer instead to the new occultation candidates. These tables contain only newly discovered candidates.

Table A.4 contains the list of all measurements of the occultation candidates before they were averaged. Column 1 contains the field ID which was arrived at using the same scheme described in Table A.2: the number before the decimal point refers to the field number (1-17), the number after the decimal refers to the exposure number. Column 2 contains the star identification. The "S" was included to help maintain an association with the original occultation candidates but not in any way to be confused with them. The number before the "S" is again a reference to the field, the number after the "S" to the number it was assigned by the original plate fitting reduction program. Each scan interruption was numbered sequentially, and the star associated with it was automatically assigned that number. Column 3 lists the right ascension (in hours, minutes, seconds) fitted for each exposure, and column 4 the error in right ascension given in seconds of time. Column 5 contains the stars' declination (in degrees, minutes, seconds), and column 6 the error in declination given in arcseconds.

Table A.5 lists the averaged values of the star coordinates given in Table A.4 that were calculated as described for Table A.3. Along with the mean values of the coordinates are included estimates of the new errors associated with the these averages.

V. ERROR ANALYSIS

The errors associated with the fitted measurements of the star coordinates were taken directly from the plate fitting programs written by Larry Wasserman for the Lowell PDS. These numbers refer to the error in the least squares fit of the gaussian to the centroid position of the density profiles and do not include systematic errors in the plate solution.

A major source of systematic error were the poorly known proper motions of SAO stars. The coordinates for the standard stars are known for epochs ranging from 1875 to 1950 and their proper motions are extrapolated to the epoch of the plate exposure (SAO, 1966). The author consistently found the root mean square deviation in the predicted positions of the standard stars to their actual positions on the plate to be up to between 20 and 25 microns in the worst cases. The author attributes this to faulty proper motion adjustments because the SAO stars with the grossest errors had comparable residuals on each of the different exposures: a program star dropped from the fit on one exposure tended to get dropped on all of them, and a star with a large residual (on the order of 20 microns) had comparable residuals on all fits.

The author is confident about the accuracy of the original plate solution using five SAO stars in a chevron pattern because even though the crosshairs were centered manually on the star, the residuals from the initial plate solution were displayed on the screen once they were calculated, and only those solutions with an error of less than (or on the order of) 10 microns were accepted. Generally, gross errors were a result of misidentifying the SAO star, an easy mistake to catch and correct.

The SAO catalog is a compilation of several catalogs, each based on independent sky surveys of varying accuracy. As a result, there are many errors inherent in the stellar coordinates of the SAO. The author tried using the Perth 70 catalog (epoch 1970) which Lowell Observatory also has on disk and which is not only more recent than the SAO, but is also intrinsically more accurate. It included the range of relevant declinations as it is primarily a southern hemisphere survey. The main disadvantage in using Perth 70 catalog is that it only contains a small number of bright stars. On the average, only 4 - 7 Perth 70 stars would appear on a plate, all of them among the brightest, compared to approximately 50 - 100 SAO stars per plate covering a much wider range of magnitudes. Typically, the occultation candidates were very faint, and long exposures were needed to reveal them. As a consequence, all of the brightest stars generally ended up overexposed and their positions known only with a high degree of uncertainty. The use of an objective grating for magnitude compensation (Klemola, 1981) was not available. This resulted in a gross deterioration in the true accuracy of the Perth 70 stars making them worse, overall, than the SAO stars for the plate solutions. Also, because of the small number of them which appeared on the plates at all, it was difficult and sometimes impossible to select the reference stars such that the entire plate was represented in the solution.

The true accuracy of the coordinates is on the order of an arcsecond in both right ascension and declination. This conclusion was drawn mostly by comparing the coordinates determined for a star on separate exposures of the same field. This is one good way to estimate the true error in the measurements although there could be other (unknown) systematic errors in the solution.

VI. RESULTS

The final results of the deeper search and astrometry effort are summarized in the last two tables in Appendix A. Table A.6 contains a summary of improved geocentric occultation predictions calculated for stars in Paper I. Column 1 contains the star identification as used in Paper I, columns 2 and 3 list the date and UT time of closest approach of the planet to the star as would be observed from the center of the earth. Columns 4 and 5 contain the right ascension and declination, epoch 1950, used to calculate the occultation predictions and were drawn directly from Table A.3. The last column refers to the impact parameter or apparent minimum distance in arcseconds of the star from the center of the planet at the time of closest approach. A value of 11 arcseconds or greater is suspect, and the star will possibly miss being an appulse with Saturn's rings. These cases are marked with an "M."

Table A.7 summarizes the geocentric occultation predictions for each of the new occultation candidates. As described for Table A.6, column 1 lists the stars' identification (as given in Tables A.4 and A.5, Appendix A), columns 2 and 3 the date and UT time of closest approach of the planet to the star, columns 4 and 5 the right ascension and declination, epoch 1950, of each star (directly from Table A.5), and column 6 is the impact parameter, or apparent minimum distance in arcseconds of the star from the center of the planet at the time of closest approach. Again, all events with impact parameters less than 11 arcseconds are definite events. Those candidates with larger values are marked with an "M." They are possible near misses and should be investigated further before planning to observe them.

VII. FUTURE WORK

The immediately necessary research to follow up this work is photometry of the occultation candidates to determine their colors and magnitudes. With this information, signal-to-noise ratios can be calculated for Hubble Space Telescope (HST) instruments to assess the feasibility and worth of observing the events.

It is not necessary, of course, to observe all 271 occultation candidates before the events occur. It is sufficient to select a representative sample from which the rest can be calibrated in terms of their integrated densities recorded from the plates already taken.

Along with the fitted coordinates of the stars from their centroid positions, the PDS also measured the integrated density of the image. This so-called "volume paramter" is not an absolute measure of a star's magnitude because it will differ for the same star on dlfferent plates depending on the length of exposure, the background density, and the image resolution. Nevertheless, it can be used as a relative indicator of magnitude among stars on the same plate. With this information about the integrated density of the occultation candidates, the author plans to select a sample of stars from each field for CCD photometry. The aim of this research will be to determine their magnitudes through different filters, calibrate them to the given volume parameters, and estimate magnitudes for the rest of the stars on the plate. Once that is complete, calculating signal-to-noise ratios for the events through different filters will reveal the most worthwhile occultations to observe.

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IX. Appendix A

Tables Of Data:

A.1 - Search Field Information: Plate Centers and Range of Right Ascension

A.2 - Measured Coordinates for Stars from Paper I

A.3 - Average Coordinates for Stars from Paper I

A.4 - Measured Coordinates for New Occultation Candidates

A.5 - Average Coordinates for New Occultation Candidates

A.6 - Improved Geocentric Predictions for Stars in Paper I

A.7 - Geocentric Occultation Predictions for New Candidates

TABLE A.1
Search Field Information

Field Number	Range of Right Ascension (h m)	SAO Number of Guide star	Plate Center RA (1950) (h m s)	Plate Center Dec (1950) (° ' ")
1	16 49 - 17 06	185906	16 57 30.7	-21 23 14
2	17 04 - 17 20	185196	17 12 07.1	-21 18 52
3	17 16 - 17 32	185402	17 23 42.8	-21 25 38
4	17 32 - 17 49	185660	17 40 25.9	-21 39 39
5	17 49 - 18 05	186083	17 57 23.0	-21 27 56
6	18 03 - 18 18	186497	18 10 46.3	-21 04 25
7	18 02 - 18 18	186474	19 09 53.6	-22 28 01
8	18 18 - 18 34	186883	18 26 40.6	-22 43 04
9	18 35 - 18 51	187185	18 43 19.7	-22 26 47
10	18 50 - 19 06	187584	18 58 36.9	-22 46 04
11	19 02 - 19 17	187816	19 09 28.8	-21 44 34
12	19 18 - 19 34	188191	19 26 45.4	-21 26 34
13	19 34 - 19 52	188551	19 43 32.8	-21 38 46
14	19 42 - 19 58	188663	19 49 44.2	-20 04 57
15	19 57 - 20 13	188937	20 04 50.2	-20 00 40
16	20 14 - 20 30	189259	20 22 04.0	-20 10 29
17	20 29 - 20 45	189533	20 36 43.5	-20 16 00

TABLE A.2

Measured Coordinates of Stars in Paper I

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
2.3	S30	17 06 49.302	0.001	-21 22 21.47	0.01
2.3	S32	17 13 12.192	0.001	-21 29 46.95	0.01
2.0	S33	17 13 15.977	0.078	-21 29 00.15	0.17X
2.2	S33	17 13 16.602	0.003	-21 29 02.62	0.01
2.1	S33	17 13 16.799	0.002	-21 29 08.16	0.02
2.1	S34	17 13 19.035	0.004	-21 29 07.15	0.03
2.2	S34	17 13 19.043	0.002	-21 29 07.05	0.02
2.0	S34	17 13 22.831	0.007	-21 28 52.31	4.74X
2.1	S36	17 12 03.504	0.001	-21 21 13.97	0.02
2.2	S36	17 12 03.505	0.001	-21 21 13.89	0.02
2.3	S37	17 12 03.537	0.002	-21 21 14.75	0.01X
2.2	S37	17 12 01.699	0.003	-21 21 01.61	0.02
2.1	S37	17 12 01.716	0.006	-21 21 01.45	0.08
2.3	S37	17 12 03.536	0.002	-21 21 14.75	0.02X
2.2	S38	17 11 53.641	0.001	-21 20 54.13	0.02
2.1	S38	17 11 53.645	0.001	-21 20 54.26	0.01
2.3	S38	17 11 53.653	0.002	-21 20 54.84	0.01
2.2	S39	17 11 29.622	0.001	-21 20 12.77	0.04
2.1	S39	17 11 29.624	0.001	-21 20 13.01	0.01
2.3	S39	17 11 29.664	0.002	-21 20 13.66	0.01
2.2	S40	17 11 29.617	0.001	-21 20 12.80	0.03
2.1	S40	17 11 29.622	0.001	-21 20 13.00	0.01
2.3	S40	17 11 31.975	0.001	-21 20 40.40	0.01X
2.2	S41	17 09 02.150	0.001	-21 17 19.86	0.06
2.1	S41	17 09 02.151	0.001	-21 17 20.27	0.05
2.3	S41	17 09 02.180	0.001	-21 17 20.97	0.01
1.5	S43	17 00 41.379	0.001	-21 09 02.00	0.01X
1.4	S43	17 00 43.412	0.003	-21 08 59.58	0.01X
1.0	S44	17 00 35.809	0.001	-21 08 41.15	0.01
1.5	S44	17 00 35.796	0.001	-21 08 41.01	0.01
1.2	S44	17 00 35.799	0.001	-21 08 40.73	0.01
1.3	S44	17 00 35.799	0.002	-21 08 40.66	0.01
1.3	S44	17 00 35.800	0.002	-21 08 40.66	0.01
1.1	S44	17 00 35.805	0.003	-21 08 40.63	0.01
1.1	S44	17 00 35.806	0.003	-21 08 40.59	0.01
1.6	S44	17 00 35.807	0.001	-21 08 41.13	0.01
1.4	S44	17 00 35.833	0.001	-21 08 39.91	0.04

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
1.10	S44	17 00 35.798	0.001	-21 08 40.99	0.01
1.8	S44	17 00 35.799	0.001	-21 08 40.86	0.01
1.7	S44	17 00 35.799	0.003	-21 08 40.85	0.01
1.9	S44	17 00 35.831	0.001	-21 08 39.97	0.04
1.0	S45	16 56 18.738	0.001	-21 04 16.99	0.01
1.3	S45	16 56 18.717	0.002	-21 04 16.80	0.02
1.2	S45	16 56 18.720	0.002	-21 04 16.90	0.01
1.5	S45	16 56 18.723	0.001	-21 04 16.84	0.01
1.6	S45	16 56 18.740	0.001	-21 04 16.92	0.01
1.4	S45	16 56 18.745	0.001	-21 04 15.81	0.02
1.1	S45	16 56 18.795	0.010	-21 04 16.64	0.04
1.8	S45	16 56 18.734	0.003	-21 04 16.84	0.01
1.10	S45	16 56 18.738	0.001	-21 04 16.83	0.01
1.9	S45	16 56 18.747	0.001	-21 04 15.74	0.03
1.7	S45	16 56 18.786	0.008	-21 04 16.52	0.01
1.5	S46	16 55 13.910	0.001	-21 03 10.78	0.01
1.6	S46	16 55 13.920	0.001	-21 03 11.03	0.02
1.4	S46	16 55 13.936	0.001	-21 03 09.80	0.02
1.2	S46	16 55 14.150	0.002	-21 03 57.44	0.01X
1.3	S46	16 55 14.155	0.002	-21 03 57.33	0.01X
1.1	S46	16 55 14.185	0.007	-21 03 57.36	0.03X
1.2	S47	16 52 13.516	0.001	-21 01 40.88	0.01
1.3	S47	16 52 13.516	0.002	-21 01 40.64	0.01
1.5	S47	16 52 13.528	0.001	-21 01 40.47	0.01
1.6	S47	16 52 13.534	0.001	-21 01 40.58	0.01
1.1	S47	16 52 13.538	0.005	-21 01 40.67	0.02
1.4	S47	16 52 13.540	0.001	-21 01 39.60	0.03
1.2	S48	16 52 38.087	0.001	-21 09 48.23	0.01
1.3	S48	16 52 38.097	0.002	-21 09 48.35	0.01
1.5	S48	16 52 38.109	0.001	-21 09 48.09	0.01
1.1	S48	16 52 38.111	0.003	-21 09 48.48	0.03
1.6	S48	16 52 38.119	0.001	-21 09 48.17	0.01
1.4	S48	16 52 38.129	0.001	-21 09 47.17	0.02
1.2	S50	16 59 01.014	0.002	-21 24 31.14	0.02X
1.5	S50	16 59 01.131	0.001	-21 25 39.06	0.02
1.6	S50	16 59 01.156	0.001	-21 25 39.58	0.03
1.4	S50	16 59 01.163	0.001	-21 25 37.90	0.04

TABLE A.2
Measured Coordinates of Stars in Paper I
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
5.0	S51	17 55 29.443	0.001	-22 19 35.89	0.01
5.7	S51	17 55 29.396	0.001	-22 19 36.41	0.01
5.8	S51	17 55 29.409	0.001	-22 19 36.39	0.01
5.4	S51	17 55 29.397	0.001	-22 19 36.39	0.02
5.5	S51	17 55 29.409	0.001	-22 19 36.37	0.01
5.1	S51	17 55 29.416	0.001	-22 19 35.71	0.01
5.6	S51	17 55 29.427	0.001	-22 19 35.12	0.02
5.3	S51	17 55 29.440	0.008	-22 19 35.56	0.02
5.0	S52	18 00 30.950	0.001	-22 19 16.47	0.01
5.4	S52	18 00 30.881	0.001	-22 19 16.55	0.02
5.5	S52	18 00 30.892	0.001	-22 19 16.68	0.01
5.1	S52	18 00 30.906	0.001	-22 19 16.45	0.02
5.6	S52	18 00 30.950	0.002	-22 19 16.15	0.01
5.3	S52	18 00 30.979	0.004	-22 19 16.02	0.06
5.7	S52	18 00 30.881	0.001	-22 19 16.57	0.02
5.8	S52	18 00 30.890	0.001	-22 19 16.67	0.01
6.0	S53	18 05 08.064	0.001	-22 18 29.15	0.01
6.1	S53	18 05 08.043	0.002	-22 18 29.70	0.03
6.4	S53	18 05 08.060	0.001	-22 18 29.15	0.01
6.3	S53	18 05 17.297	0.004	-22 21 25.60	0.05X
6.2	S53	18 05 17.403	0.004	-22 21 26.56	0.06X
6.7	S53	18 05 08.048	0.003	-22 18 29.19	0.05
6.5	S53	18 05 08.054	0.001	-22 18 29.78	0.03
6.6	S53	18 05 08.122	0.003	-22 18 28.72	0.04
6.1	S54	18 05 15.409	0.001	-22 18 35.85	0.05
6.4	S54	18 05 15.412	0.001	-22 18 36.25	0.01
6.3	S54	18 05 24.678	0.002	-22 21 31.89	0.03X
6.2	S54	18 05 24.754	0.002	-22 21 34.03	0.04
6.0	S55	18 06 58.313	0.001	-22 17 55.71	0.01
6.1	S55	18 06 58.305	0.006	-22 17 55.49	0.05
6.4	S55	18 06 58.311	0.001	-22 17 55.69	0.01
6.3	S55	18 07 07.586	0.003	-22 20 54.20	0.06X
6.2	S55	18 07 07.661	0.001	-22 20 54.98	0.02X
6.5	S55	18 06 58.300	0.004	-22 17 55.46	0.05
6.7	S55	18 06 58.317	0.002	-22 17 56.05	0.05
6.6	S55	18 06 58.334	0.002	-22 17 55.72	0.02
6.0	S57	18 05 35.634	0.001	-22 16 20.97	0.01

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
6.1	S57	18 05 35.614	0.001	-22 16 20.72	0.01
6.4	S57	18 05 35.629	0.001	-22 16 20.91	0.01
6.3	S57	18 05 44.903	0.001	-22 19 17.46	0.01X
6.2	S57	18 05 44.955	0.001	-22 19 18.92	0.01X
6.5	S57	18 05 35.623	0.001	-22 16 20.75	0.01
6.7	S57	18 05 35.639	0.001	-22 16 20.63	0.01
6.6	S57	18 05 35.653	0.001	-22 16 20.80	0.01
6.0	S58	18 05 10.582	0.001	-22 16 33.52	0.01
6.5	S58	18 05 10.572	0.001	-22 16 33.32	0.02
6.7	S58	18 05 10.591	0.001	-22 16 33.25	0.02
6.6	S58	18 05 10.606	0.001	-22 16 33.37	0.01
6.1	S58	18 05 10.561	0.001	-22 16 33.28	0.02
6.4	S58	18 05 10.578	0.002	-22 16 33.45	0.02
6.3	S58	18 05 19.847	0.001	-22 19 29.68	0.02X
6.2	S58	18 05 19.897	0.001	-22 19 31.17	0.01X
5.0	S59	17 56 06.258	0.001	-22 17 31.52	0.01
5.4	S59	17 56 06.209	0.001	-22 17 32.06	0.01
5.5	S59	17 56 06.215	0.001	-22 17 32.10	0.01
5.1	S59	17 56 06.232	0.001	-22 17 31.45	0.01
5.6	S59	17 56 06.250	0.001	-22 17 30.81	0.01
5.7	S59	17 56 06.209	0.001	-22 17 32.30	0.02
5.8	S59	17 56 06.219	0.001	-22 17 32.11	0.01
5.0	S60	17 55 33.646	0.001	-22 38 25.78	0.01
5.4	S60	17 55 33.593	0.001	-22 38 26.30	0.02
5.5	S60	17 55 33.599	0.001	-22 38 26.30	0.02
5.1	S60	17 55 33.611	0.001	-22 38 25.58	0.02
5.6	S60	17 55 33.631	0.001	-22 38 25.05	0.02
5.3	S60	17 55 33.667	0.002	-22 38 25.15	0.04
5.7	S60	17 55 33.594	0.001	-22 38 26.28	0.02
5.8	S60	17 55 33.599	0.001	-22 38 26.30	0.02
9.2	S62	18 41 07.202	0.001	-22 24 57.42	0.06
9.4	S62	18 41 07.251	0.001	-22 24 57.19	0.01
9.5	S62	18 41 07.260	0.001	-22 24 57.23	0.01
9.1	S62	18 41 07.390	0.020	-22 24 57.47	0.06
9.6	S63	18 41 14.821	0.001	-22 24 42.19	0.03
9.1	S63	18 41 14.842	0.002	-22 24 42.62	0.03
9.4	S63	18 41 14.844	0.001	-22 24 42.55	0.01

TABLE A.2
Measured Coordinates of Stars in Paper I
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
9.5	S63	18 41 14.854	0.001	-22 24 42.57	0.01
9.3	S63	18 41 14.854	0.002	-22 24 42.63	0.06
9.2	S63	18 41 14.866	0.003	-22 24 42.22	0.02
9.1	S64	18 41 14.843	0.002	-22 24 42.63	0.03
9.3	S64	18 41 14.853	0.002	-22 24 42.69	0.05
9.2	S64	18 41 14.864	0.003	-22 24 42.22	0.02
9.5	S65	18 42 28.136	0.001	-22 23 35.52	0.01
9.4	S65	18 42 28.141	0.002	-22 23 35.66	0.01
9.4	S66	18 44 07.548	0.002	-22 22 04.09	0.01
9.6	S66	18 44 07.548	0.002	-22 22 04.63	0.02
9.1	S66	18 44 07.555	0.002	-22 22 04.41	0.02
9.5	S66	18 44 07.560	0.001	-22 22 04.14	0.01
9.2	S66	18 44 07.564	0.002	-22 22 04.25	0.01
9.3	S66	18 44 07.566	0.001	-22 22 04.15	0.02
9.1	S67	18 46 40.482	0.003	-22 19 18.03	0.05
9.3	S67	18 46 40.477	0.012	-22 19 17.19	0.05
9.4	S67	18 46 40.521	0.001	-22 19 17.71	0.01
9.6	S67	18 46 40.531	0.002	-22 19 18.75	0.01
9.5	S67	18 46 40.536	0.002	-22 19 17.65	0.01
9.2	S67	18 46 40.561	0.001	-22 19 18.13	0.03
9.1	S68	18 47 04.878	0.007	-22 19 05.95	0.01
9.6	S68	18 47 04.880	0.001	-22 19 06.34	0.01
9.4	S68	18 47 04.904	0.001	-22 19 04.51	0.01
9.5	S68	18 47 04.916	0.001	-22 19 04.48	0.01
9.2	S68	18 47 04.983	0.001	-22 19 04.63	0.02
9.4	S69	18 51 18.166	0.002	-22 14 08.75	0.01
9.5	S69	18 51 18.171	0.001	-22 14 08.80	0.01
10.4	S69	18 51 18.215	0.001	-22 14 08.56	0.01
10.5	S69	18 50 18.632	0.001	-22 21 37.20	0.01X
10.0	S70	18 56 24.378	0.001	-22 07 46.19	0.01
10.0	S70	18 56 24.383	0.001	-22 07 46.16	0.01
10.6	S70	18 56 24.359	0.004	-22 07 45.71	0.01
10.4	S70	18 55 24.369	0.001	-22 07 45.58	0.01X
10.5	S70	18 55 25.363	0.002	-22 16 11.78	0.02X
10.2	S70	18 56 24.336	0.002	-22 07 46.30	0.02
10.3	S70	18 56 24.356	0.003	-22 07 45.69	0.01
10.2	S70	18 56 24.359	0.002	-22 07 45.79	0.02

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
10.1	S70	18 56 24.370	0.001	-22 07 45.62	0.02
10.3	S70	18 56 24.382	0.002	-22 07 46.00	0.02
10.1	S70	18 56 28.227	0.001	-22 07 46.50	0.01X
10.5	S71	18 56 09.164	0.002	-22 15 25.13	0.02X
10.2	S71	18 57 08.070	0.002	-22 06 50.94	0.02X
10.2	S71	18 57 08.605	0.003	-22 06 45.66	0.34
10.4	S71	18 57 08.680	0.002	-22 06 44.21	0.16
10.1	S71	18 57 08.688	0.002	-22 06 44.08	0.12
10.1	S71	18 57 12.550	0.002	-22 06 44.87	0.14
10.0	S72	18 57 41.092	0.001	-22 06 11.89	0.01
10.0	S72	18 57 41.094	0.001	-22 06 11.88	0.01
10.0	S72	18 57 41.094	0.001	-22 06 11.88	0.01
10.5	S72	18 56 42.227	0.001	-22 14 52.11	0.01X
10.2	S72	18 57 40.195	0.002	-22 06 09.80	0.02
10.2	S72	18 57 40.204	0.002	-22 06 09.31	0.02
10.3	S72	18 57 41.078	0.001	-22 06 11.18	0.02
10.4	S72	18 57 41.079	0.001	-22 06 11.59	0.02
10.1	S72	18 57 41.080	0.001	-22 06 11.60	0.02
10.3	S72	18 57 41.097	0.001	-22 06 11.70	0.02
10.1	S72	18 57 44.950	0.001	-22 06 12.07	0.01X
10.6	S72	18 57 41.088	0.005	-22 06 11.37	0.02
10.0	S74	18 57 16.053	0.001	-22 06 52.45	0.01
10.0	S74	18 57 16.049	0.001	-22 06 52.47	0.01
10.6	S74	18 57 15.985	0.004	-22 06 52.61	0.02
10.5	S74	18 56 17.124	0.001	-22 15 27.82	0.01X
10.2	S74	18 57 16.010	0.001	-22 06 52.66	0.01
10.2	S74	18 57 16.031	0.001	-22 06 52.12	0.01
10.4	S74	18 57 16.036	0.001	-22 06 51.89	0.02
10.1	S74	18 57 16.043	0.001	-22 06 51.91	0.02
10.3	S74	18 57 16.054	0.002	-22 06 52.28	0.03
10.0	S75	18 56 40.690	0.001	-22 07 59.89	0.01
10.5	S75	18 55 41.680	0.002	-22 16 28.68	0.02X
10.3	S75	18 56 40.649	0.003	-22 07 58.92	0.01
10.2	S75	18 56 40.656	0.002	-22 08 00.12	0.02
10.2	S75	18 56 40.677	0.002	-22 07 59.60	0.02
10.4	S75	18 56 40.682	0.001	-22 07 59.39	0.01
10.1	S75	18 56 40.684	0.001	-22 07 59.41	0.02

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
10.3	S75	18 56 40.689	0.001	-22 07 59.65	0.01
10.1	S75	18 56 44.543	0.001	-22 08 00.20	0.02X
10.6	S75	18 56 40.666	0.005	-22 07 59.01	0.01
10.5	S76	18 54 24.536	0.002	-22 18 08.28	0.02X
10.4	S76	18 55 22.058	0.001	-22 09 35.59	0.01
10.2	S76	18 55 23.670	0.002	-22 09 54.26	0.02
10.2	S76	18 55 23.696	0.002	-22 09 53.76	0.02
10.1	S76	18 55 23.701	0.001	-22 09 53.60	0.01
10.1	S76	18 55 27.546	0.001	-22 09 54.80	0.01
10.3	S76	18 55 23.712	0.001	-22 09 54.09	0.01
10.0	S77	18 53 13.844	0.001	-22 13 12.60	0.01
10.5	S77	18 52 14.407	0.004	-22 21 02.47	0.01X
10.3	S77	18 53 13.845	0.002	-22 13 12.40	0.01
10.2	S77	18 53 13.818	0.003	-22 13 13.00	0.01
10.2	S77	18 53 13.849	0.003	-22 13 12.38	0.01
10.3	S77	18 53 13.860	0.003	-22 13 11.85	0.02
10.4	S77	18 53 13.871	0.003	-22 13 12.14	0.02
10.1	S77	18 53 13.881	0.003	-22 13 12.29	0.01
10.1	S77	18 53 17.700	0.003	-22 13 14.11	0.02X
10.6	S77	18 53 13.861	0.004	-22 13 12.17	0.01
10.5	S78	18 50 36.681	0.002	-22 22 56.56	0.01X
10.4	S78	18 51 36.336	0.001	-22 15 24.67	0.02
9.7	S79	18 50 24.791	0.001	-22 16 59.33	0.02
9.7	S80	18 50 17.003	0.001	-22 17 26.75	0.02
9.7	S81	18 50 05.172	0.002	-22 17 14.56	0.01
9.4	S82	18 48 42.056	0.001	-22 19 40.04	0.01
9.5	S82	18 48 42.064	0.001	-22 19 40.07	0.01
9.0	S83	18 43 19.803	0.001	-22 26 46.62	0.01
9.6	S83	18 43 19.790	0.006	-22 26 46.85	0.09
9.5	S83	18 43 19.814	0.005	-22 26 46.93	0.08
9.4	S83	18 43 19.822	0.006	-22 26 47.01	0.08
9.8	S83	18 43 19.820	0.007	-22 26 46.87	0.14
9.7	S83	18 43 19.826	0.007	-22 26 47.00	0.15
9.3	S84	18 41 40.509	0.003	-22 28 57.66	0.04
9.4	S84	18 41 40.522	0.001	-22 28 57.34	0.01
9.6	S84	18 41 40.524	0.001	-22 28 57.69	0.01
9.1	S84	18 41 40.525	0.001	-22 28 57.36	0.06

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
9.5	S84	18 41 40.538	0.001	-22 28 57.41	0.01
9.2	S84	18 41 40.551	0.006	-22 28 57.58	0.03
8.2	S87	18 29 35.540	0.002	-22 47 47.79	0.02
8.3	S87	18 29 35.547	0.002	-22 47 47.82	0.02
8.1	S87	18 29 35.552	0.004	-22 47 47.70	0.01
8.4	S87	18 29 40.129	0.002	-22 48 32.65	0.01X
8.3	S88	18 29 58.506	0.002	-22 48 26.44	0.01
8.1	S88	18 29 58.512	0.004	-22 48 26.11	0.01
8.2	S88	18 29 58.517	0.002	-22 48 26.10	0.02
8.4	S88	18 29 58.524	0.001	-22 48 25.73	0.01
8.4	S89	18 34 24.102	0.003	-22 47 41.29	0.01
9.1	S90	18 35 51.240	0.002	-22 47 10.81	0.05
9.2	S90	18 35 51.259	0.004	-22 47 11.34	0.03
9.0	S91	18 37 07.712	0.001	-22 46 28.09	0.01
9.6	S91	18 37 07.706	0.002	-22 46 28.12	0.02
9.1	S91	18 37 07.725	0.001	-22 46 28.46	0.01
9.3	S91	18 37 07.726	0.001	-22 46 28.44	0.02
9.2	S91	18 37 07.728	0.002	-22 46 28.29	0.01
9.4	S91	18 37 07.732	0.001	-22 46 28.74	0.01
9.5	S91	18 37 07.735	0.001	-22 46 28.74	0.01
9.7	S91	18 37 07.740	0.001	-22 46 28.82	0.01
9.8	S91	18 37 07.742	0.001	-22 46 28.80	0.01
9.4	S92	18 37 35.411	0.002	-22 46 07.94	0.02
9.5	S92	18 37 35.433	0.001	-22 46 08.05	0.01
9.4	S93	18 38 05.819	0.001	-22 45 57.97	0.02
9.5	S93	18 38 05.822	0.001	-22 45 58.02	0.01
9.0	S95	18 39 53.943	0.001	-22 44 56.61	0.01
9.6	S95	18 39 53.940	0.001	-22 44 56.68	0.01
9.3	S95	18 39 53.949	0.001	-22 44 56.83	0.01
9.4	S95	18 39 53.953	0.001	-22 44 56.77	0.01
9.1	S95	18 39 53.953	0.001	-22 44 56.78	0.01
9.2	S95	18 39 53.954	0.003	-22 44 56.59	0.01
9.5	S95	18 39 53.955	0.001	-22 44 56.78	0.01
9.7	S95	18 39 53.956	0.001	-22 44 56.83	0.01
9.8	S95	18 39 53.958	0.001	-22 44 56.79	0.01
9.0	S96	18 41 08.611	0.001	-22 43 57.94	0.01
9.8	S96	18 41 08.583	0.001	-22 43 58.39	0.01

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
9.7	S96	18 41 08.585	0.001	-22 43 58.44	0.01
9.2	S96	18 41 08.560	0.003	-22 43 58.34	0.01
9.3	S96	18 41 08.580	0.001	-22 43 58.39	0.03
9.5	S96	18 41 08.583	0.001	-22 43 58.37	0.01
9.4	S96	18 41 08.584	0.001	-22 43 58.35	0.01
9.1	S96	18 41 08.599	0.001	-22 43 58.58	0.02
9.6	S96	18 41 08.603	0.002	-22 43 57.97	0.02
9.4	S98	18 46 11.100	0.002	-22 39 56.46	0.01
9.5	S98	18 46 11.116	0.001	-22 39 56.57	0.01
9.4	S99	18 46 19.545	0.001	-22 39 41.87	0.01
9.5	S99	18 46 19.561	0.001	-22 39 41.91	0.01
12.0	S100	19 30 04.707	0.001	-21 35 01.53	0.01
12.1	S100	19 30 04.610	0.009	-21 35 01.17	0.07
12.4	S100	19 30 04.657	0.001	-21 35 01.25	0.01
12.2	S100	19 30 04.660	0.002	-21 35 01.13	0.02
12.3	S100	19 30 04.662	0.003	-21 35 01.07	0.06
12.6	S100	19 30 04.708	0.002	-21 35 01.52	0.02
12.5	S100	19 30 04.882	0.001	-21 34 58.91	0.01
12.7	S100	19 30 04.684	0.002	-21 35 01.49	0.01
12.8	S100	19 30 04.883	0.001	-21 34 59.13	0.01
13.0	S102	19 37 13.851	0.001	-21 20 19.53	0.01
13.5	S102	19 37 13.858	0.001	-21 20 19.59	0.01
13.4	S102	19 37 13.861	0.001	-21 20 19.52	0.02
13.6	S102	19 37 13.813	0.001	-21 20 19.02	0.02
13.0	S103	19 40 38.219	0.001	-21 12 44.54	0.01
13.6	S103	19 40 38.233	0.001	-21 12 44.29	0.01
13.4	S103	19 40 38.225	0.001	-21 12 44.59	0.01
13.5	S103	19 40 38.237	0.001	-21 12 44.74	0.01
13.4	S104	19 40 58.414	0.001	-21 12 04.93	0.02
13.5	S104	19 40 58.610	0.001	-21 11 50.39	0.02
13.6	S104	19 40 58.619	0.004	-21 11 50.06	0.01
13.0	S105	19 43 39.127	0.001	-21 06 20.55	0.01
13.4	S105	19 43 39.123	0.001	-21 06 20.57	0.02
13.5	S105	19 43 39.133	0.001	-21 06 20.67	0.01
13.2	S105	19 43 39.133	0.003	-21 06 20.52	0.01
13.1	S105	19 43 39.151	0.004	-21 06 20.39	0.01
13.6	S105	19 43 39.141	0.001	-21 06 20.46	0.01

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
13.0	S106	19 45 22.243	0.001	-21 02 26.57	0.01
13.6	S106	19 45 22.266	0.001	-21 02 26.53	0.01
13.4	S106	19 45 22.237	0.001	-21 02 26.57	0.01
13.5	S106	19 45 22.246	0.001	-21 02 26.68	0.01
13.1	S106	19 45 22.274	0.002	-21 02 26.41	0.01
13.2	S106	19 45 22.277	0.001	-21 02 26.57	0.02
13.0	S107	19 42 09.502	0.001	-21 14 32.77	0.01
13.2	S107	19 42 09.498	0.002	-21 14 32.59	0.01
13.4	S107	19 42 09.502	0.001	-21 14 32.82	0.02
13.5	S107	19 42 09.503	0.001	-21 14 32.89	0.01
13.1	S107	19 42 09.520	0.001	-21 14 32.60	0.02
13.6	S107	19 42 09.500	0.001	-21 14 32.60	0.01
12.4	S110	19 33 19.561	0.001	-21 37 50.68	0.02
12.6	S110	19 33 19.598	0.001	-21 37 50.55	0.03
12.5	S110	19 33 19.784	0.001	-21 37 48.20	0.01
12.0	S111	19 32 59.784	0.001	-21 38 29.07	0.01
12.2	S111	19 32 59.696	0.003	-21 38 29.19	0.01
12.1	S111	19 32 59.700	0.002	-21 38 29.29	0.02
12.4	S111	19 32 59.712	0.001	-21 38 29.31	0.01
12.3	S111	19 32 59.720	0.001	-21 38 29.26	0.01
12.6	S111	19 32 59.781	0.001	-21 38 29.13	0.02
12.5	S111	19 32 59.931	0.001	-21 38 26.85	0.01
12.7	S111	19 32 59.756	0.001	-21 38 29.53	0.01
12.8	S111	19 32 59.938	0.001	-21 38 27.06	0.01
12.4	S112	19 30 30.737	0.001	-21 44 50.45	0.01
12.4	S113	19 29 21.966	0.001	-21 47 34.80	0.01
12.6	S113	19 29 22.016	0.002	-21 47 34.81	0.01
12.5	S113	19 29 22.184	0.001	-21 47 32.59	0.01
12.4	S114	19 28 12.537	0.001	-21 50 22.58	0.01
12.4	S115	19 27 02.680	0.001	-21 53 07.32	0.01
12.6	S115	19 27 02.718	0.001	-21 53 06.41	0.02
12.5	S115	19 27 02.911	0.001	-21 53 05.16	0.01
12.6	S116	19 25 43.413	0.001	-21 56 17.55	0.01
12.0	S117	19 24 53.862	0.001	-21 58 03.13	0.01
12.4	S117	19 24 53.825	0.001	-21 58 03.31	0.01
12.2	S117	19 24 53.831	0.001	-21 58 03.56	0.01
12.6	S117	19 24 53.858	0.001	-21 58 03.05	0.02

TABLE A.2
Measured Coordinates of Stars in Paper I
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
12.3	S117	19 24 53.864	0.001	-21 58 03.35	0.01
12.1	S117	19 24 53.866	0.001	-21 58 03.91	0.02
12.5	S117	19 24 54.055	0.001	-21 58 01.40	0.01
12.7	S117	19 24 53.827	0.001	-21 58 03.27	0.01
12.8	S117	19 24 54.057	0.001	-21 58 01.27	0.02
12.0	S118	19 20 30.906	0.001	-22 08 30.17	0.01
12.7	S118	19 20 30.887	0.001	-22 08 29.93	0.01
12.8	S118	19 20 31.128	0.001	-22 08 28.06	0.01
12.4	S118	19 20 30.900	0.001	-22 08 30.27	0.01
12.6	S118	19 20 30.904	0.001	-22 08 30.04	0.02
12.3	S118	19 20 30.916	0.001	-22 08 30.38	0.01
12.2	S118	19 20 30.931	0.001	-22 08 30.54	0.01
12.1	S118	19 20 30.946	0.001	-22 08 30.67	0.01
12.5	S118	19 20 31.120	0.001	-22 08 28.54	0.01
12.4	S119	19 22 47.843	0.001	-22 08 33.29	0.01
12.3	S119	19 22 47.858	0.001	-22 08 33.50	0.02
12.6	S119	19 22 47.859	0.001	-22 08 32.92	0.01
12.2	S119	19 22 47.859	0.001	-22 08 33.65	0.01
12.1	S119	19 22 47.875	0.001	-22 08 33.81	0.01
12.5	S119	19 22 48.058	0.001	-22 08 31.54	0.01
12.0	S120	19 24 19.112	0.001	-22 06 07.18	0.01
12.4	S120	19 24 19.102	0.001	-22 06 07.34	0.01
12.3	S120	19 24 19.109	0.001	-22 06 07.63	0.02
12.2	S120	19 24 19.109	0.001	-22 06 07.70	0.01
12.6	S120	19 24 19.113	0.001	-22 06 07.06	0.01
12.1	S120	19 24 19.125	0.001	-22 06 07.83	0.01
12.5	S120	19 24 19.317	0.001	-22 06 05.49	0.01
12.7	S120	19 24 19.093	0.001	-22 06 07.09	0.01
12.8	S120	19 24 19.316	0.001	-22 06 05.13	0.02
12.4	S122	19 28 26.080	0.001	-21 58 42.43	0.01
12.5	S122	19 28 26.329	0.002	-21 58 40.02	2.67
12.6	S122	19 28 27.530	0.001	-21 59 12.10	0.01
12.0	S123	19 31 35.900	0.001	-21 52 25.93	0.01
12.4	S123	19 31 35.873	0.001	-21 52 25.73	0.01
12.6	S123	19 31 35.903	0.001	-21 52 25.97	0.02
12.5	S123	19 31 36.093	0.001	-21 52 23.17	0.01
12.7	S123	19 31 35.908	0.002	-21 52 25.79	0.01

TABLE A.2

Measured Coordinates of Stars in Paper I

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
12.8	S123	19 31 36.095	0.001	-21 52 23.35	0.03
12.0	S124	19 33 21.787	0.001	-21 49 03.29	0.01
12.7	S124	19 33 21.761	0.001	-21 49 03.45	0.01
12.8	S124	19 33 21.950	0.001	-21 49 00.99	0.02
12.2	S124	19 33 21.704	0.002	-21 49 03.21	0.01
12.1	S124	19 33 21.711	0.001	-21 49 03.32	0.02
12.4	S124	19 33 21.723	0.001	-21 49 03.23	0.01
12.3	S124	19 33 21.728	0.002	-21 49 03.26	0.02
12.6	S124	19 33 21.789	0.001	-21 49 03.18	0.01
12.5	S124	19 33 21.950	0.001	-21 49 00.76	0.01
16.0	S126	20 21 27.803	0.001	-19 42 53.87	0.01
16.3	S126	20 21 27.821	0.002	-19 42 54.18	0.02
16.4	S126	20 21 27.822	0.001	-19 42 54.04	0.01
16.1	S126	20 21 27.849	0.001	-19 42 54.22	0.03
16.2	S126	20 21 27.867	0.002	-19 42 54.17	0.02
16.7	S126	20 21 27.828	0.002	-19 42 54.21	0.02
16.5	S126	20 21 27.843	0.002	-19 42 54.32	0.02
16.6	S126	20 21 27.871	0.002	-19 42 54.28	0.02
16.0	S127	20 22 19.250	0.001	-19 40 10.96	0.01
16.7	S127	20 22 19.255	0.002	-19 40 11.34	0.02
16.5	S127	20 22 19.282	0.002	-19 40 11.59	0.02
16.6	S127	20 22 19.296	0.001	-19 40 11.43	0.02
16.3	S127	20 22 19.259	0.001	-19 40 11.25	0.02
16.4	S127	20 22 19.270	0.001	-19 40 11.25	0.01
16.1	S127	20 22 19.288	0.002	-19 40 11.48	0.01
16.2	S127	20 22 19.300	0.002	-19 40 11.28	0.01
16.0	S128	20 26 40.720	0.001	-19 26 29.25	0.01
16.4	S128	20 26 40.746	0.001	-19 26 29.72	0.02
17.0	S129	20 31 45.852	0.001	-19 10 44.39	0.01
17.1	S129	20 31 45.823	0.001	-19 10 43.38	0.04
17.2	S129	20 31 45.829	0.002	-19 10 43.71	0.02
17.3	S129	20 31 45.833	0.002	-19 10 43.86	0.02
17.5	S129	20 31 45.861	0.001	-19 10 43.61	0.01
17.4	S129	20 31 45.868	0.001	-19 10 44.15	0.01
17.6	S129	20 31 45.877	0.001	-19 10 43.74	0.01
17.0	S130	20 33 55.275	0.001	-19 04 18.44	0.01
17.6	S130	20 33 55.293	0.001	-19 04 17.92	0.02

TABLE A.2
Measured Coordinates of Stars in Paper I
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950 (° ' ")	Error (arcsec)
17.4	S130	20 33 55.279	0.001	-19 04 18.32	0.01
17.5	S130	20 33 55.281	0.001	-19 04 17.75	0.01
16.3	S133	20 22 52.726	0.005	-19 52 25.31	0.05
16.2	S133	20 22 52.727	0.001	-19 52 25.08	0.04
16.4	S133	20 22 52.731	0.001	-19 52 24.86	0.01
16.1	S133	20 22 52.824	0.003	-19 52 24.89	0.02
16.4	S134	20 18 49.686	0.001	-20 07 20.52	0.01
16.4	S135	20 17 11.560	0.001	-20 13 02.33	0.01
16.4	S136	20 21 44.647	0.001	-20 02 20.23	0.01
16.3	S136	20 21 44.656	0.005	-20 02 20.56	0.01
16.2	S136	20 21 44.661	0.004	-20 02 20.47	0.02
16.1	S136	20 21 44.688	0.002	-20 02 20.23	0.02

TABLE A.3
Average Coordinates for Stars from Paper I

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
S30	17 6 49.302	0.001	-21 22 21.470	0.010
S32	17 13 12.192	0.001	-21 29 46.950	0.010
S33	17 13 16.738	0.002	-21 29 3.728	0.013
S34	17 13 19.041	0.003	-21 29 7.081	0.024
S36	17 12 3.505	0.001	-21 21 13.930	0.020
S37	17 12 1.702	0.004	-21 21 1.601	0.027
S38	17 11 53.644	0.001	-21 20 54.503	0.012
S39	17 11 29.628	0.001	-21 20 13.318	0.012
S40	17 11 29.620	0.001	-21 20 12.980	0.013
S41	17 9 2.160	0.001	-21 17 20.915	0.017
S44	17 0 35.808	0.001	-21 8 40.832	0.011
S45	16 56 18.737	0.001	-21 4 16.782	0.012
S46	16 55 13.922	0.001	-21 3 10.658	0.014
S47	16 52 13.529	0.001	-21 1 40.618	0.012
S48	16 52 38.110	0.001	-21 9 48.157	0.012
S50	16 59 1.150	0.001	-21 25 39.025	0.027
S51	17 55 29.414	0.001	-22 19 36.093	0.012
S52	18 0 30.903	0.001	-22 19 16.495	0.013
S53	18 5 8.060	0.001	-22 18 29.196	0.016
S54	18 5 15.411	0.001	-22 18 36.235	0.014
S55	18 6 58.314	0.002	-22 17 55.700	0.016
S57	18 5 35.632	0.001	-22 16 20.797	0.010
S58	18 5 10.582	0.001	-22 16 33.405	0.014
S59	17 56 6.227	0.001	-22 17 31.700	0.011
S60	17 55 33.612	0.001	-22 38 25.875	0.018
S62	18 41 7.238	0.001	-22 24 57.216	0.014
S63	18 41 14.842	0.001	-22 24 42.513	0.015
S64	18 41 14.851	0.002	-22 24 42.380	0.027
S65	18 42 28.137	0.001	-22 23 35.590	0.010
S66	18 44 7.560	0.001	-22 22 4.207	0.013
S67	18 46 40.537	0.002	-22 19 18.029	0.014
S68	18 47 4.921	0.001	-22 19 5.279	0.011
S69	18 51 18.190	0.001	-22 14 8.703	0.010
S70	18 56 24.373	0.001	-22 7 45.935	0.013
S71	18 57 9.796	0.002	-22 6 44.431	0.154
S72	18 57 41.088	0.001	-22 6 11.767	0.014
S74	18 57 16.037	0.001	-22 6 52.377	0.013

TABLE A.3

Average Coordinates for Stars from Paper I

(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
S75	18 56 40.683	0.001	-22 7 59.416	0.012
S76	18 55 24.800	0.001	-22 9 54.141	0.012
S77	18 53 13.848	0.002	-22 13 12.437	0.011
S78	18 51 36.336	0.001	-22 15 24.670	0.020
S79	18 50 24.791	0.001	-22 16 59.330	0.020
S80	18 50 17.003	0.001	-22 17 26.750	0.020
S81	18 50 5.172	0.002	-22 17 14.560	0.010
S82	18 48 42.060	0.001	-22 19 40.055	0.010
S83	18 43 19.804	0.002	-22 26 46.636	0.024
S84	18 41 40.527	0.001	-22 28 57.486	0.014
S87	18 29 35.544	0.002	-22 47 47.735	0.014
S88	18 29 58.520	0.002	-22 48 26.094	0.011
S89	18 34 24.102	0.003	-22 47 41.290	0.010
S90	18 35 51.244	0.003	-22 47 11.200	0.036
S91	18 37 7.729	0.001	-22 46 28.544	0.011
S92	18 37 35.429	0.001	-22 46 8.028	0.013
S93	18 38 5.820	0.001	-22 45 58.010	0.013
S95	18 39 53.951	0.001	-22 44 56.740	0.010
S96	18 41 8.589	0.001	-22 43 58.304	0.012
S98	18 46 11.113	0.001	-22 39 56.515	0.010
S99	18 46 19.553	0.001	-22 39 41.890	0.010
S100	19 30 4.764	0.001	-21 35 0.545	0.013
S102	19 37 13.846	0.001	-21 20 19.502	0.013
S103	19 40 38.229	0.001	-21 12 44.540	0.010
S104	19 40 58.611	0.001	-21 11 50.126	0.013
S105	19 43 39.131	0.001	-21 6 20.520	0.011
S106	19 45 22.255	0.001	-21 2 26.553	0.011
S107	19 42 9.505	0.001	-21 14 32.712	0.012
S110	19 33 19.648	0.001	-21 37 48.847	0.015
S111	19 32 59.798	0.001	-21 38 28.650	0.011
S112	19 30 30.737	0.001	-21 44 50.450	0.010
S113	19 29 22.068	0.001	-21 47 34.067	0.010
S114	19 28 12.537	0.001	-21 50 22.580	0.010
S115	19 27 2.770	0.001	-21 53 6.259	0.012
S116	19 25 43.413	0.001	-21 56 17.550	0.010
S117	19 24 53.894	0.001	-21 58 2.974	0.012

TABLE A.3
Average Coordinates for Stars from Paper I
(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
S118	19 20 30.960	0.001	-22 8 29.827	0.010
S119	19 22 47.892	0.001	-22 8 33.064	0.011
S120	19 24 19.155	0.001	-22 6 7.051	0.011
S122	19 28 26.130	0.001	-21 58 42.430	0.014
S123	19 31 35.970	0.001	-21 52 25.156	0.012
S124	19 33 21.804	0.001	-21 49 2.817	0.012
S126	20 21 27.831	0.001	-19 42 54.067	0.015
S127	20 22 19.271	0.001	-19 40 11.274	0.013
S128	20 26 40.733	0.001	-19 26 29.344	0.013
S129	20 31 45.854	0.001	-19 10 43.944	0.012
S130	20 33 55.282	0.001	-19 4 18.151	0.011
S133	20 22 52.734	0.001	-19 52 24.889	0.017
S134	20 18 49.686	0.001	-20 7 20.520	0.010
S135	20 17 11.560	0.001	-20 13 2.330	0.010
S136	20 21 44.655	0.002	-20 2 20.386	0.013

TABLE A.4
Measured Coordinates for New Occultation Candidates

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
1.9	1S2	16 55 31.553	0.001	-21 07 13.72	0.03
1.10	1S2	16 55 31.533	0.001	-21 07 14.77	0.01
1.0	1S3	16 55 39.445	0.001	-21 07 22.24	0.01
1.9	1S3	16 55 39.461	0.004	-21 07 21.00	0.04
1.10	1S3	16 55 39.413	0.001	-21 07 21.92	0.01
1.0	1S5	16 58 15.164	0.001	-21 11 32.66	0.01
1.7	1S5	16 58 15.135	0.005	-21 11 32.22	0.03
1.8	1S5	16 58 15.173	0.001	-21 11 32.34	0.01
1.9	1S5	16 58 15.179	0.001	-21 11 31.53	0.03
1.10	1S5	16 58 15.150	0.001	-21 11 32.45	0.01
1.0	1S6	16 59 02.327	0.001	-21 12 33.11	0.01
1.10	1S6	16 59 02.315	0.001	-21 12 32.85	0.01
1.8	1S6	16 59 02.335	0.002	-21 12 32.74	0.02
1.7	1S6	16 59 02.346	0.006	-21 12 32.15	0.05
1.9	1S6	16 59 02.348	0.001	-21 12 31.79	0.03
1.0	1S10	17 00 32.283	0.001	-21 14 31.47	0.01
1.7	1S10	17 00 32.262	0.002	-21 14 31.14	0.01
1.10	1S10	17 00 32.266	0.001	-21 14 31.24	0.01
1.8	1S10	17 00 32.274	0.002	-21 14 31.15	0.01
1.9	1S10	17 00 32.304	0.002	-21 14 30.27	0.04
1.0	1S20	16 59 38.019	0.001	-21 07 26.18	0.01
1.10	1S20	16 59 37.990	0.001	-21 07 26.00	0.01
1.8	1S20	16 59 38.011	0.001	-21 07 24.90	0.01
1.9	1S20	16 59 38.022	0.001	-21 07 24.94	0.03
1.0	1S30	16 53 08.178	0.001	-21 02 07.79	0.01
1.10	1S30	16 53 08.184	0.001	-21 02 07.41	0.01
1.9	1S30	16 53 08.187	0.001	-21 02 06.49	0.03
1.8	1S30	16 53 08.200	0.008	-21 02 07.53	0.01
1.7	1S30	16 53 08.214	0.007	-21 02 07.32	0.01
2.0	2S1	17 06 49.302	0.001	-21 22 21.52	0.01
2.4	2S1	17 06 49.299	0.001	-21 22 20.41	0.02
2.0	2S2	17 07 50.875	0.001	-21 23 36.82	0.01
2.4	2S2	17 07 50.851	0.002	-21 23 35.67	0.02
2.0	2S4	17 09 13.738	0.001	-21 25 08.73	0.01
2.4	2S4	17 09 13.717	0.001	-21 25 07.77	0.01
2.0	2S6	17 09 49.043	0.001	-21 25 59.62	0.01
2.4	2S6	17 09 49.027	0.002	-21 25 58.91	0.03

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
2.0	2S16	17 16 47.197	0.001	-21 27 01.14	0.01
2.4	2S16	17 16 47.185	0.002	-21 27 00.98	0.02
2.0	2S20	17 10 40.227	0.001	-21 19 12.81	0.01
2.4	2S20	17 10 40.201	0.001	-21 19 11.83	0.01
2.0	2S21	17 10 08.276	0.001	-21 18 59.34	0.01
2.4	2S21	17 10 08.256	0.001	-21 18 58.53	0.01
2.0	2S22	17 10 04.175	0.001	-21 19 03.19	0.01
2.4	2S22	17 10 04.178	0.001	-21 19 02.38	0.02
2.0	2S23	17 10 01.896	0.001	-21 18 56.44	0.01
2.4	2S23	17 10 01.880	0.002	-21 18 55.93	0.10
2.0	2S24	17 09 33.206	0.001	-21 18 19.14	0.01
2.4	2S24	17 09 33.186	0.001	-21 18 18.45	0.02
2.0	2S25	17 05 51.723	0.001	-21 14 21.85	0.01
2.0	2S26	17 05 43.427	0.001	-21 14 04.77	0.01
2.0	2S33	17 14 32.445	0.001	-21 51 02.10	0.01
2.4	2S33	17 14 32.440	0.001	-21 51 01.83	0.02
2.0	2S34	17 16 50.177	0.001	-21 53 58.45	0.01
2.4	2S34	17 16 50.178	0.002	-21 53 58.26	0.02
3.2	2S34	17 16 50.175	0.002	-21 53 58.22	0.04
3.3	2S34	17 16 50.181	0.002	-21 53 58.33	0.01
3.0	3S6	17 30 33.850	0.001	-22 08 16.49	0.01
3.1	3S6	17 30 33.784	0.005	-22 08 15.63	0.05
3.3	3S6	17 30 33.794	0.006	-22 08 15.79	0.07
3.2	3S6	17 30 33.822	0.007	-22 08 15.45	0.09
4.0	4S1	17 36 32.969	0.001	-22 12 22.96	0.01
4.1	4S1	17 36 32.938	0.001	-22 12 22.96	0.01
4.2	4S1	17 36 32.958	0.002	-22 12 22.49	0.01
4.3	4S1	17 36 32.963	0.002	-22 12 22.29	0.03
4.0	4S13	17 45 30.511	0.001	-22 32 07.79	0.01
4.1	4S13	17 45 30.497	0.001	-22 32 07.86	0.01
4.2	4S13	17 45 30.507	0.001	-22 32 07.53	0.01
4.3	4S13	17 45 30.511	0.001	-22 32 07.27	0.01
5.0	5S1	17 50 57.170	0.001	-22 19 04.67	0.01
5.7	5S1	17 50 57.150	0.001	-22 19 05.58	0.01
5.8	5S1	17 50 57.160	0.001	-22 19 05.49	0.01
5.0	5S2	17 51 09.898	0.001	-22 18 45.07	0.01

TABLE A.4
Measured Coordinates for New Occultation Candidates
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
5.0	5S2	17 51 09.900	0.001	-22 18 45.06	0.01
5.7	5S2	17 51 09.876	0.001	-22 18 45.96	0.01
5.8	5S2	17 51 09.885	0.001	-22 18 45.90	0.01
5.0	5S6	17 53 28.770	0.001	-22 19 03.46	0.01
5.7	5S6	17 53 28.714	0.001	-22 19 04.06	0.01
5.8	5S6	17 53 28.721	0.001	-22 19 04.03	0.01
5.0	5S9	17 58 11.281	0.001	-22 19 25.29	0.01
5.7	5S9	17 58 11.215	0.001	-22 19 25.61	0.02
5.8	5S9	17 58 11.226	0.001	-22 19 25.71	0.01
5.0	5S12	17 59 33.521	0.001	-22 19 45.05	0.01
5.7	5S12	17 59 33.456	0.001	-22 19 45.16	0.02
5.8	5S12	17 59 33.470	0.001	-22 19 45.30	0.01
5.0	5S13	17 59 39.136	0.001	-22 19 18.11	0.01
5.7	5S13	17 59 39.078	0.001	-22 19 18.30	0.02
5.8	5S13	17 59 39.090	0.001	-22 19 18.41	0.01
5.0	5S21	18 01 12.716	0.001	-22 16 38.72	0.01
5.7	5S21	18 01 12.645	0.001	-22 16 38.60	0.02
5.8	5S21	18 01 12.655	0.001	-22 16 38.75	0.01
5.0	5S23	18 00 50.650	0.001	-22 16 47.95	0.01
5.7	5S23	18 00 50.583	0.001	-22 16 47.97	0.01
5.8	5S23	18 00 50.600	0.001	-22 16 48.15	0.01
5.0	5S25	17 59 54.471	0.001	-22 16 47.77	0.01
5.8	5S25	17 59 54.419	0.001	-22 16 47.85	0.01
5.7	5S25	17 59 54.411	0.001	-22 16 47.72	0.02
5.0	5S26	17 58 46.836	0.001	-22 16 54.18	0.01
5.7	5S26	17 58 46.806	0.001	-22 16 54.01	0.02
5.8	5S26	17 58 46.820	0.001	-22 16 54.19	0.01
5.0	5S27	17 58 02.912	0.001	-22 17 34.93	0.01
5.8	5S27	17 58 02.854	0.003	-22 17 35.34	0.03
5.7	5S27	17 58 02.856	0.002	-22 17 35.29	0.04
5.0	5S36	17 53 28.207	0.001	-22 37 18.39	0.01
5.7	5S36	17 53 28.169	0.001	-22 37 19.03	0.01
5.8	5S36	17 53 28.174	0.001	-22 37 19.06	0.01
5.0	5S39	17 56 35.862	0.001	-22 38 22.89	0.01
5.7	5S39	17 56 35.805	0.001	-22 38 23.19	0.02
5.8	5S39	17 56 35.809	0.001	-22 38 23.30	0.01

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
5.0	5S44	17 59 51.522	0.001	-22 39 22.39	0.01
5.7	5S44	17 59 51.450	0.002	-22 39 22.55	0.03
5.8	5S44	17 59 51.453	0.002	-22 39 22.65	0.02
5.0	5S45	18 00 05.012	0.001	-22 39 49.04	0.01
5.7	5S45	18 00 04.937	0.001	-22 39 49.12	0.02
5.8	5S45	18 00 04.946	0.001	-22 39 49.31	0.01
5.0	5S47	18 00 30.978	0.001	-22 39 54.94	0.01
5.7	5S47	18 00 30.903	0.001	-22 39 54.77	0.02
5.8	5S47	18 00 30.912	0.001	-22 39 54.98	0.01
6.0	6S16	18 08 07.411	0.001	-22 17 15.45	0.01
6.0	6S20	18 08 31.697	0.001	-22 16 08.99	0.01
6.6	6S20	18 08 31.704	0.003	-22 16 09.03	0.04
6.5	6S20	18 08 31.706	0.003	-22 16 09.05	0.03
6.7	6S20	18 08 31.716	0.003	-22 16 09.33	0.03
6.0	6S23	18 08 17.670	0.001	-22 15 58.84	0.01
6.0	6S28	18 07 12.598	0.001	-22 15 59.01	0.01
6.0	6S31	18 06 23.445	0.001	-22 16 29.02	0.01
6.7	6S31	18 06 23.432	0.001	-22 16 28.80	0.02
6.5	6S31	18 06 23.436	0.002	-22 16 28.79	0.02
6.6	6S31	18 06 23.458	0.002	-22 16 28.91	0.02
6.0	6S43	18 04 01.167	0.001	-22 16 40.05	0.01
6.0	6S44	18 03 51.572	0.001	-22 16 42.95	0.01
7.0	7S5	18 03 05.594	0.001	-22 40 16.30	0.01
7.0	7S6	18 03 30.308	0.001	-22 40 12.64	0.01
7.0	7S7	18 03 51.562	0.001	-22 40 04.40	0.01
7.0	7S15	18 04 36.948	0.001	-22 40 09.43	0.01
7.2	7S15	18 04 36.957	0.001	-22 40 09.38	0.01
7.3	7S15	18 04 36.974	0.003	-22 40 09.36	0.02
7.1	7S15	18 04 37.031	0.003	-22 40 09.88	0.02
7.0	7S17	18 05 02.138	0.001	-22 40 22.05	0.01
7.0	7S23	18 05 56.895	0.001	-22 40 19.54	0.01
7.0	7S25	18 06 21.534	0.001	-22 40 28.58	0.01
7.0	7S28	18 07 21.318	0.001	-22 40 43.89	0.01
7.2	7S28	18 07 21.320	0.001	-22 40 43.76	0.01
7.3	7S28	18 07 21.338	0.003	-22 40 43.52	0.05
7.1	7S28	18 07 21.397	0.003	-22 40 44.41	0.02

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
7.0	7S33	18 07 53.360	0.001	-22 40 42.21	0.01
7.2	7S33	18 07 53.367	0.003	-22 40 42.15	0.03
7.1	7S33	18 07 53.387	0.003	-22 40 42.59	0.03
7.0	7S34	18 07 59.368	0.001	-22 40 26.08	0.01
7.0	7S39	18 08 26.396	0.001	-22 40 31.66	0.01
7.0	7S40	18 08 38.540	0.001	-22 40 41.09	0.01
7.2	7S40	18 08 38.520	0.002	-22 40 40.97	0.03
7.3	7S40	18 08 38.554	0.001	-22 40 41.15	0.02
7.1	7S40	18 08 38.606	0.001	-22 40 41.66	0.02
7.0	7S43	18 09 01.979	0.001	-22 40 28.70	0.01
7.0	7S44	18 09 15.866	0.001	-22 40 29.35	0.01
7.0	7S49	18 10 04.923	0.001	-22 40 25.81	0.01
7.0	7S53	18 10 21.437	0.001	-22 40 25.55	0.01
7.0	7S54	18 10 25.808	0.001	-22 40 14.18	0.01
7.0	7S56	18 10 30.567	0.001	-22 40 39.96	0.01
7.0	7S57	18 10 43.440	0.001	-22 40 18.16	0.01
7.0	7S63	18 11 08.208	0.001	-22 40 34.25	0.01
7.0	7S64	18 11 12.683	0.001	-22 40 35.75	0.01
7.0	7S67	18 11 48.681	0.001	-22 40 10.66	0.01
7.3	7S67	18 11 48.641	0.002	-22 40 10.58	0.01
7.2	7S67	18 11 48.654	0.002	-22 40 10.77	0.03
7.1	7S67	18 11 48.711	0.003	-22 40 11.43	0.03
7.0	7S68	18 11 50.874	0.001	-22 40 18.21	0.01
7.0	7S69	18 11 56.300	0.001	-22 40 22.16	0.01
7.0	7S70	18 12 00.553	0.001	-22 40 19.15	0.01
7.0	7S71	18 12 22.934	0.001	-22 40 05.57	0.01
7.0	7S73	18 12 39.137	0.001	-22 40 01.00	0.01
7.0	7S75	18 12 59.184	0.001	-22 39 57.66	0.01
7.0	7S76	18 13 01.179	0.001	-22 39 54.10	0.01
7.0	7S80	18 13 31.397	0.001	-22 40 03.52	0.01
7.2	7S80	18 13 31.375	0.002	-22 40 03.88	0.02
7.1	7S80	18 13 31.375	0.005	-22 40 04.33	0.01
7.0	7S82	18 13 40.787	0.001	-22 40 10.11	0.01
7.0	7S91	18 15 37.682	0.001	-22 39 34.34	0.01
7.0	7S95	18 15 50.499	0.001	-22 39 32.02	0.01
7.0	7S99	18 16 19.697	0.001	-22 39 30.53	0.01

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
7.0	7S100	18 16 30.066	0.001	-22 39 17.09	0.01
7.0	7S102	18 16 52.328	0.001	-22 39 19.60	0.01
8.0	8S1	18 20 02.644	0.001	-22 38 07.14	0.01
8.5	8S1	18 20 02.733	0.001	-22 38 07.97	0.01
8.7	8S1	18 20 02.738	0.001	-22 38 08.07	0.02
8.6	8S1	18 20 02.745	0.001	-22 38 08.21	0.01
8.0	8S2	18 20 14.722	0.001	-22 38 25.08	0.01
8.7	8S2	18 20 14.807	0.001	-22 38 26.05	0.01
8.5	8S2	18 20 14.808	0.002	-22 38 25.96	0.01
8.6	8S2	18 20 14.817	0.001	-22 38 26.09	0.01
8.0	8S5	18 22 44.783	0.001	-22 37 22.19	0.01
8.6	8S5	18 22 44.823	0.001	-22 37 22.91	0.01
8.5	8S5	18 22 44.823	0.002	-22 37 22.95	0.01
8.7	8S5	18 22 44.827	0.002	-22 37 22.73	0.02
8.0	8S7	18 23 48.988	0.001	-22 36 53.79	0.01
8.7	8S7	18 23 48.997	0.002	-22 36 54.36	0.01
8.5	8S7	18 23 48.998	0.003	-22 36 54.40	0.01
8.6	8S7	18 23 49.001	0.002	-22 36 54.44	0.01
8.0	8S10	18 26 51.298	0.001	-22 35 03.22	0.01
8.5	8S10	18 26 51.254	0.001	-22 35 03.09	0.01
8.6	8S10	18 26 51.257	0.001	-22 35 03.16	0.02
8.7	8S10	18 26 51.260	0.001	-22 35 03.17	0.01
8.0	8S11	18 27 19.919	0.001	-22 35 03.36	0.01
8.6	8S11	18 27 19.891	0.002	-22 35 03.52	0.02
8.7	8S11	18 27 19.895	0.001	-22 35 03.64	0.02
8.5	8S11	18 27 19.895	0.002	-22 35 03.31	0.01
8.0	8S12	18 30 16.168	0.001	-22 33 10.85	0.01
8.5	8S12	18 30 16.111	0.002	-22 33 10.65	0.01
8.6	8S12	18 30 16.121	0.002	-22 33 10.59	0.01
8.7	8S12	18 30 16.134	0.002	-22 33 10.79	0.01
8.0	8S13	18 31 31.038	0.001	-22 32 34.59	0.01
8.0	8S13	18 31 31.068	0.001	-22 32 34.76	0.01
8.5	8S13	18 31 31.000	0.002	-22 32 34.27	0.01
8.6	8S13	18 31 31.003	0.002	-22 32 34.27	0.01
8.7	8S13	18 31 31.019	0.002	-22 32 34.49	0.01
8.0	8S15	18 32 36.455	0.001	-22 31 59.16	0.01

TABLE A.4
Measured Coordinates for New Occultation Candidates
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
8.5	8S15	18 32 36.396	0.002	-22 31 58.56	0.01
8.6	8S15	18 32 36.405	0.002	-22 31 58.47	0.01
8.7	8S15	18 32 36.430	0.002	-22 31 58.57	0.01
8.0	8S16	18 32 48.902	0.001	-22 31 43.71	0.01
8.5	8S16	18 32 48.865	0.003	-22 31 43.20	0.01
8.6	8S16	18 32 48.867	0.002	-22 31 43.01	0.01
8.7	8S16	18 32 48.880	0.002	-22 31 43.24	0.01
8.0	8S22	18 30 14.260	0.001	-22 44 29.94	0.01
8.5	8S22	18 30 14.205	0.002	-22 44 29.78	0.01
8.6	8S22	18 30 14.210	0.002	-22 44 29.81	0.01
8.7	8S22	18 30 14.214	0.001	-22 44 29.82	0.01
8.0	8S24	18 33 54.439	0.001	-22 48 14.45	0.01
9.0	9S4	18 49 08.713	0.001	-22 18 50.28	0.01
9.7	9S4	18 49 08.708	0.001	-22 18 49.32	0.01
9.8	9S4	18 49 08.721	0.001	-22 18 49.36	0.01
9.0	9S8	18 44 19.413	0.001	-22 25 22.40	0.01
9.7	9S8	18 44 19.420	0.001	-22 25 22.23	0.01
9.8	9S8	18 44 19.429	0.001	-22 25 22.26	0.01
9.0	9S11	18 41 22.814	0.001	-22 29 20.95	0.01
9.7	9S11	18 41 22.794	0.001	-22 29 21.06	0.01
9.8	9S11	18 41 22.797	0.001	-22 29 21.06	0.01
9.0	9S14	18 37 06.497	0.001	-22 34 45.83	0.01
9.8	9S14	18 37 06.506	0.001	-22 34 46.41	0.01
9.7	9S14	18 37 06.506	0.001	-22 34 46.46	0.01
9.0	9S19	18 39 52.282	0.001	-22 44 54.48	0.01
9.7	9S19	18 39 52.288	0.001	-22 44 54.34	0.01
9.8	9S19	18 39 52.307	0.001	-22 44 54.57	0.01
9.0	9S23	18 41 25.659	0.001	-22 43 53.56	0.01
9.7	9S23	18 41 25.654	0.001	-22 43 53.77	0.01
9.8	9S23	18 41 25.661	0.001	-22 43 53.76	0.01
9.0	9S25	18 44 35.680	0.001	-22 41 07.10	0.01
9.7	9S25	18 44 35.676	0.001	-22 41 06.77	0.01
9.8	9S25	18 44 35.684	0.001	-22 41 06.80	0.01
9.0	9S28	18 47 55.818	0.001	-22 38 30.47	0.01
9.7	9S28	18 47 55.813	0.003	-22 38 29.75	0.03
9.8	9S28	18 47 55.837	0.002	-22 38 29.75	0.03

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
9.0	9S29	18 49 07.046	0.001	-22 37 14.25	0.01
9.7	9S29	18 49 07.010	0.001	-22 37 13.45	0.01
9.8	9S29	18 49 07.024	0.001	-22 37 13.48	0.01
10.0	10S2	18 53 12.916	0.001	-22 12 00.94	0.01
10.6	10S2	18 53 12.957	0.001	-22 12 00.36	0.01
10.0	10S3	18 53 47.243	0.001	-22 11 20.78	0.01
10.6	10S3	18 53 47.283	0.004	-22 11 20.31	0.04
10.0	10S5	18 54 04.095	0.001	-22 10 30.12	0.01
10.6	10S5	18 54 04.093	0.004	-22 10 28.73	0.03
10.0	10S6	18 54 24.631	0.001	-22 10 11.15	0.01
10.0	10S7	18 54 36.073	0.001	-22 10 14.76	0.01
10.6	10S7	18 54 36.087	0.003	-22 10 14.22	0.02
10.0	10S10	18 57 02.567	0.001	-22 06 40.16	0.01
10.6	10S10	18 57 02.572	0.001	-22 06 39.54	0.02
10.0	10S17	18 56 20.995	0.001	-22 08 09.61	0.01
10.0	10S17	18 56 20.991	0.001	-22 08 09.64	0.01
10.6	10S17	18 56 20.992	0.001	-22 08 09.16	0.02
10.0	10S18	18 55 23.713	0.001	-22 09 54.32	0.01
10.0	10S22	18 53 28.592	0.001	-22 12 52.15	0.01
10.6	10S22	18 53 28.606	0.002	-22 12 51.80	0.03
10.0	10S23	18 53 23.573	0.002	-22 13 06.76	0.01
10.6	10S23	18 53 23.587	0.001	-22 13 06.20	0.01
10.0	10S29	18 54 33.417	0.001	-22 31 34.55	0.01
10.6	10S29	18 54 33.392	0.002	-22 31 33.63	0.03
10.0	10S30	18 54 34.803	0.001	-22 31 26.14	0.01
10.6	10S30	18 54 34.803	0.002	-22 31 25.29	0.05
10.0	10S31	18 55 12.617	0.001	-22 31 00.06	0.01
10.6	10S31	18 55 12.604	0.001	-22 30 59.39	0.01
10.0	10S34	18 57 16.974	0.001	-22 28 27.16	0.01
10.6	10S34	18 57 17.001	0.001	-22 28 26.19	0.02
10.0	10S37	19 01 57.883	0.001	-22 22 23.45	0.01
10.6	10S37	19 01 57.807	0.001	-22 22 23.11	0.02
10.0	10S41	19 03 22.274	0.001	-22 20 22.14	0.01
10.6	10S41	19 03 22.178	0.003	-22 20 22.17	0.04
11.0	10S41	19 03 22.244	0.001	-22 20 21.46	0.01
11.1	10S41	19 03 22.232	0.002	-22 20 21.48	0.01

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
11.2	10S41	19 03 22.245	0.002	-22 20 21.43	0.01
11.3	10S41	19 03 22.267	0.003	-22 20 21.44	0.01
11.0	11S8	19 05 47.532	0.001	-22 17 00.33	0.01
11.1	11S8	19 05 47.500	0.001	-22 17 00.15	0.01
11.0	11S17	19 11 09.268	0.001	-22 08 50.22	0.01
11.0	11S17	19 11 09.295	0.001	-22 08 50.39	0.01
11.1	11S17	19 11 09.278	0.005	-22 08 50.42	0.06
11.3	11S17	19 11 09.282	0.005	-22 08 50.59	0.06
11.2	11S17	19 11 09.284	0.006	-22 08 50.53	0.07
11.0	11S18	19 11 33.899	0.001	-22 08 34.38	0.01
11.3	11S18	19 11 33.842	0.002	-22 08 34.37	0.02
11.1	11S18	19 11 33.869	0.001	-22 08 33.97	0.02
11.2	11S18	19 11 33.883	0.003	-22 08 34.55	0.03
11.0	11S20	19 11 49.148	0.001	-22 07 58.67	0.01
11.1	11S20	19 11 49.075	0.001	-22 07 58.10	0.01
11.3	11S20	19 11 49.075	0.002	-22 07 58.87	0.04
11.2	11S20	19 11 49.102	0.004	-22 07 58.26	0.01
11.0	11S23	19 15 32.647	0.001	-22 01 50.29	0.01
11.3	11S23	19 15 32.538	0.004	-22 01 50.48	0.04
11.1	11S23	19 15 32.574	0.002	-22 01 50.20	0.02
11.2	11S23	19 15 32.584	0.002	-22 01 50.38	0.02
11.0	11S27	19 16 49.764	0.001	-21 59 44.70	0.01
11.0	11S27	19 16 49.734	0.001	-21 59 44.42	0.01
11.3	11S27	19 16 49.689	0.001	-21 59 44.46	0.01
11.1	11S27	19 16 49.698	0.001	-21 59 44.27	0.01
11.2	11S27	19 16 49.703	0.001	-21 59 44.32	0.01
12.0	12S2	19 19 52.229	0.001	-21 54 42.71	0.01
12.7	12S2	19 19 52.202	0.001	-21 54 42.34	0.01
12.8	12S2	19 19 52.446	0.001	-21 54 40.52	0.01
12.0	12S6	19 22 46.037	0.001	-21 49 03.86	0.01
12.7	12S6	19 22 46.014	0.001	-21 49 03.75	0.01
12.8	12S6	19 22 46.252	0.001	-21 49 01.80	0.01
12.0	12S7	19 23 44.794	0.001	-21 47 29.70	0.01
12.7	12S7	19 23 44.787	0.003	-21 47 29.74	0.05
12.8	12S7	19 23 44.950	0.007	-21 47 27.96	0.06
12.0	12S11	19 27 23.235	0.001	-21 40 42.57	0.01

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
12.7	12S11	19 27 23.217	0.001	-21 40 42.64	0.01
12.8	12S11	19 27 23.429	0.001	-21 40 40.40	0.01
12.0	12S12	19 28 18.369	0.001	-21 38 41.00	0.01
12.7	12S12	19 28 18.354	0.001	-21 38 41.12	0.01
12.8	12S12	19 28 18.548	0.001	-21 38 38.94	0.01
12.0	12S16	19 32 03.706	0.001	-21 30 57.83	0.01
12.7	12S16	19 32 03.677	0.001	-21 30 58.15	0.01
12.8	12S16	19 32 03.870	0.001	-21 30 55.71	0.02
12.0	12S19	19 32 50.756	0.001	-21 29 45.81	0.01
12.7	12S19	19 32 50.745	0.003	-21 29 46.09	0.03
12.8	12S19	19 32 50.913	0.003	-21 29 43.89	0.04
12.0	12S22	19 33 59.934	0.001	-21 36 21.06	0.01
12.7	12S22	19 33 59.930	0.003	-21 36 21.22	0.04
12.8	12S22	19 34 00.084	0.004	-21 36 19.17	0.06
12.0	12S23	19 33 41.893	0.001	-21 37 00.41	0.01
12.7	12S23	19 33 41.867	0.002	-21 37 00.69	0.01
12.8	12S23	19 33 42.050	0.001	-21 36 58.27	0.02
12.0	12S24	19 33 22.558	0.001	-21 37 31.03	0.01
12.7	12S24	19 33 22.534	0.001	-21 37 31.15	0.01
12.8	12S24	19 33 22.714	0.001	-21 37 28.56	0.02
12.0	12S26	19 32 23.354	0.001	-21 39 50.11	0.01
12.7	12S26	19 32 23.334	0.001	-21 39 50.37	0.01
12.8	12S26	19 32 23.524	0.001	-21 39 47.78	0.02
12.0	12S38	19 20 51.946	0.001	-22 07 58.10	0.01
12.7	12S38	19 20 51.919	0.001	-22 07 58.09	0.01
12.8	12S38	19 20 52.156	0.001	-22 07 56.32	0.02
12.0	12S39	19 20 39.981	0.001	-22 08 29.63	0.01
12.7	12S39	19 20 39.965	0.001	-22 08 29.42	0.01
12.8	12S39	19 20 40.208	0.001	-22 08 27.52	0.01
12.0	12S42	19 20 27.272	0.001	-22 12 37.80	0.01
12.7	12S42	19 20 28.343	0.001	-22 12 39.80	0.01
12.8	12S42	19 20 28.600	0.002	-22 12 38.08	0.05
12.0	12S46	19 22 11.238	0.001	-22 09 40.21	0.01
12.7	12S46	19 22 11.216	0.001	-22 09 40.07	0.01
12.8	12S46	19 22 11.450	0.001	-22 09 38.18	0.02
12.0	12S47	19 22 31.139	0.001	-22 09 26.60	0.01

TABLE A.4
Measured Coordinates for New Occultation Candidates
(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
12.7	12S47	19 22 31.112	0.001	-22 09 26.44	0.01
12.8	12S47	19 22 31.347	0.001	-22 09 24.54	0.02
12.0	12S55	19 26 21.060	0.001	-22 02 42.08	0.01
12.7	12S55	19 26 21.033	0.001	-22 02 42.25	0.01
12.8	12S55	19 26 21.246	0.001	-22 02 40.19	0.02
12.0	12S56	19 27 02.969	0.001	-22 01 04.44	0.01
12.7	12S56	19 27 02.934	0.001	-22 01 04.56	0.01
12.8	12S56	19 27 03.145	0.001	-22 01 02.43	0.02
12.0	12S64	19 34 14.452	0.001	-21 46 51.91	0.01
12.7	12S64	19 34 14.431	0.002	-21 46 52.10	0.01
12.8	12S64	19 34 14.627	0.001	-21 46 49.56	0.02
13.0	13S3	19 38 12.209	0.001	-21 18 21.44	0.01
13.6	13S3	19 38 12.216	0.002	-21 18 21.56	0.12
13.0	13S4	19 38 22.144	0.001	-21 17 36.59	0.01
13.6	13S4	19 38 22.121	0.001	-21 17 36.15	0.01
13.0	13S5	19 38 39.311	0.001	-21 17 00.27	0.01
13.6	13S5	19 38 39.292	0.001	-21 16 59.88	0.01
13.0	13S7	19 40 19.241	0.001	-21 13 29.82	0.01
13.6	13S7	19 40 19.248	0.001	-21 13 29.54	0.03
13.0	13S9	19 40 35.545	0.001	-21 13 15.19	0.01
13.6	13S9	19 40 35.505	0.002	-21 13 14.67	0.01
13.0	13S12	19 41 30.216	0.001	-21 11 11.49	0.01
13.6	13S12	19 41 30.199	0.001	-21 11 11.25	0.03
13.0	13S13	19 42 07.827	0.001	-21 09 52.77	0.01
13.6	13S13	19 42 07.887	0.002	-21 09 52.79	0.02
13.0	13S18	19 45 29.580	0.001	-21 02 37.07	0.01
13.6	13S18	19 45 29.612	0.001	-21 02 37.23	0.02
13.0	13S23	19 45 03.771	0.001	-21 06 26.44	0.01
13.6	13S23	19 45 03.789	0.002	-21 06 26.32	0.04
13.0	13S24	19 45 00.369	0.001	-21 06 31.36	0.01
13.6	13S24	19 45 00.425	0.003	-21 06 31.24	0.02
13.0	13S26	19 43 53.498	0.001	-21 09 36.42	0.01
13.6	13S26	19 43 53.507	0.001	-21 09 36.39	0.01
13.0	13S28	19 41 56.796	0.001	-21 15 12.80	0.01
13.6	13S28	19 41 56.788	0.001	-21 15 12.62	0.01
13.0	13S29	19 41 43.307	0.001	-21 15 37.65	0.01

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
13.6	13S29	19 41 43.299	0.001	-21 15 37.43	0.01
13.0	13S31	19 40 58.484	0.001	-21 17 33.37	0.01
13.6	13S31	19 40 58.476	0.001	-21 17 33.20	0.01
13.0	13S33	19 39 45.990	0.001	-21 20 55.84	0.01
13.6	13S33	19 39 45.970	0.001	-21 20 55.49	0.01
13.0	13S35	19 37 37.595	0.001	-21 26 26.73	0.01
13.6	13S35	19 37 37.563	0.001	-21 26 26.37	0.01
14.0	14S4	19 43 54.971	0.001	-21 25 56.56	0.01
14.0	14S5	19 44 16.629	0.001	-21 25 06.04	0.01
14.0	14S8	19 45 27.943	0.001	-21 22 18.51	0.01
14.0	14S9	19 46 20.324	0.001	-21 20 13.62	0.01
14.0	14S12	19 49 42.421	0.001	-21 12 02.75	0.01
15.0	15S4	19 59 02.274	0.001	-20 47 38.51	0.01
15.0	15S5	20 00 04.703	0.001	-20 44 55.95	0.01
15.0	15S10	20 02 17.563	0.001	-20 38 55.94	0.01
15.0	15S11	20 04 26.023	0.001	-20 33 15.14	0.01
15.0	15S19	20 10 23.411	0.001	-20 36 09.22	0.01
15.0	15S21	20 07 35.235	0.001	-20 45 42.83	0.01
15.0	15S22	20 07 54.601	0.001	-20 45 03.31	0.01
15.0	15S23	20 08 53.612	0.001	-20 42 26.86	0.01
15.0	15S24	20 10 07.959	0.001	-20 38 44.79	0.01
16.0	16S11	20 21 08.119	0.001	-19 43 34.89	0.01
16.0	16S18	20 26 46.870	0.001	-19 26 25.24	0.01
16.0	16S20	20 29 03.760	0.001	-19 18 48.74	0.01
16.5	16S20	20 29 03.780	0.001	-19 18 49.68	0.02
16.7	16S20	20 29 03.800	0.002	-19 18 49.65	0.02
16.6	16S20	20 29 03.806	0.002	-19 18 49.59	0.02
16.0	16S21	20 29 06.963	0.001	-19 19 07.49	0.01
17.0	17S4	20 33 08.199	0.001	-19 06 45.69	0.01
17.6	17S4	20 33 08.209	0.001	-19 06 45.04	0.01
17.0	17S7	20 32 42.427	0.001	-19 14 13.15	0.01
17.6	17S7	20 32 42.441	0.001	-19 14 12.65	0.01
17.0	17S11	20 29 33.525	0.001	-19 26 52.98	0.01
17.0	17S14	20 30 58.351	0.001	-19 31 42.83	0.01
17.6	17S14	20 30 58.385	0.001	-19 31 42.15	0.01
17.0	17S18	20 35 08.854	0.001	-19 16 56.62	0.01

TABLE A.4

Measured Coordinates for New Occultation Candidates

(Continued)

Field ID	Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
17.6	17S18	20 35 08.882	0.001	-19 16 56.31	0.01
17.0	17S27	20 38 25.551	0.001	-19 05 15.88	0.01
17.6	17S27	20 38 25.561	0.001	-19 05 15.74	0.01
17.0	17S28	20 38 39.061	0.001	-19 04 43.38	0.01
17.6	17S28	20 38 39.058	0.001	-19 04 43.28	0.01

TABLE A.5
Average Coordinates for New Occultation Candidates

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
1S2	16 55 31.541	0.001	-21 7 14.815	0.011
1S3	16 55 39.430	0.001	-21 7 22.047	0.012
1S5	16 58 15.166	0.001	-21 11 32.441	0.012
1S6	16 59 2.331	0.001	-21 12 32.886	0.014
1S10	17 0 32.276	0.001	-21 14 31.235	0.011
1S20	16 59 38.011	0.001	-21 7 25.666	0.011
1S30	16 53 8.183	0.001	-21 2 7.485	0.011
2S1	17 6 49.300	0.001	-21 22 21.298	0.013
2S2	17 7 50.870	0.001	-21 23 36.590	0.013
2S4	17 9 13.727	0.001	-21 25 8.250	0.010
2S6	17 9 49.040	0.001	-21 25 59.549	0.013
2S16	17 16 47.195	0.001	-21 27 1.108	0.013
2S20	17 10 40.214	0.001	-21 19 12.320	0.010
2S21	17 10 8.266	0.001	-21 18 58.935	0.010
2S22	17 10 4.177	0.001	-21 19 3.028	0.013
2S23	17 10 1.893	0.001	-21 18 56.435	0.014
2S24	17 9 33.196	0.001	-21 18 19.002	0.013
2S25	17 5 51.723	0.001	-21 14 21.850	0.010
2S26	17 5 43.427	0.001	-21 14 4.770	0.010
2S33	17 14 32.442	0.001	-21 51 2.046	0.013
2S34	17 16 50.181	0.001	-21 53 58.407	0.012
3S6	17 30 33.846	0.002	-22 8 16.433	0.019
4S1	17 36 32.955	0.001	-22 12 22.785	0.011
4S13	17 45 30.506	0.001	-22 32 7.613	0.010
5S1	17 50 57.160	0.001	-22 19 5.247	0.010
5S2	17 51 9.890	0.001	-22 18 45.498	0.010
5S6	17 53 28.735	0.001	-22 19 3.850	0.010
5S9	17 58 11.241	0.001	-22 19 25.512	0.012
5S12	17 59 33.482	0.001	-22 19 45.173	0.012
5S13	17 59 39.101	0.001	-22 19 18.264	0.012
5S21	18 1 12.672	0.001	-22 16 38.720	0.012
5S23	18 0 50.611	0.001	-22 16 48.023	0.010
5S25	17 59 54.434	0.001	-22 16 47.800	0.012
5S26	17 58 46.821	0.001	-22 16 54.166	0.012
5S27	17 58 2.897	0.001	-22 17 34.988	0.016
5S36	17 53 28.183	0.001	-22 37 18.827	0.010
5S39	17 56 35.825	0.001	-22 38 23.106	0.012

TABLE A.5

Average Coordinates for New Occultation Candidates

(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
5S44	17 59 51.498	0.001	-22 39 22.451	0.015
5S45	18 0 4.965	0.001	-22 39 49.169	0.012
5S47	18 0 30.931	0.001	-22 39 54.939	0.012
6S16	18 8 7.411	0.001	-22 17 15.450	0.010
6S20	18 8 31.700	0.002	-22 16 9.027	0.018
6S23	18 8 17.670	0.001	-22 15 58.840	0.010
6S28	18 7 12.598	0.001	-22 15 59.010	0.010
6S31	18 6 23.440	0.001	-22 16 28.940	0.015
6S43	18 4 1.167	0.001	-22 16 40.050	0.010
6S44	18 3 51.572	0.001	-22 16 42.950	0.010
7S5	18 3 5.594	0.001	-22 40 16.300	0.010
7S6	18 3 30.308	0.001	-22 40 12.640	0.010
7S7	18 3 51.562	0.001	-22 40 4.400	0.010
7S15	18 4 36.958	0.001	-22 40 9.448	0.013
7S17	18 5 2.138	0.001	-22 40 22.050	0.010
7S23	18 5 56.895	0.001	-22 40 19.540	0.010
7S25	18 6 21.534	0.001	-22 40 28.580	0.010
7S28	18 7 21.324	0.001	-22 40 43.884	0.013
7S33	18 7 53.363	0.002	-22 40 42.239	0.016
7S34	18 7 59.368	0.001	-22 40 26.080	0.010
7S39	18 8 26.396	0.001	-22 40 31.660	0.010
7S40	18 8 38.563	0.001	-22 40 41.179	0.016
7S43	18 9 1.979	0.001	-22 40 28.700	0.010
7S44	18 9 15.866	0.001	-22 40 29.350	0.010
7S49	18 10 4.923	0.001	-22 40 25.810	0.010
7S53	18 10 21.437	0.001	-22 40 25.550	0.010
7S54	18 10 25.808	0.001	-22 40 14.180	0.010
7S56	18 10 30.567	0.001	-22 40 39.960	0.010
7S57	18 10 43.440	0.001	-22 40 18.160	0.010
7S63	18 11 8.208	0.001	-22 40 34.250	0.010
7S64	18 11 12.683	0.001	-22 40 35.750	0.010
7S67	18 11 48.673	0.002	-22 40 10.668	0.013
7S68	18 11 50.874	0.001	-22 40 18.210	0.010
7S69	18 11 56.300	0.001	-22 40 22.160	0.010
7S70	18 12 0.553	0.001	-22 40 19.150	0.010
7S71	18 12 22.934	0.001	-22 40 5.570	0.010

TABLE A.5

Average Coordinates for New Occultation Candidates

(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
7S73	18 12 39.137	0.001	-22 40 1.000	0.010
7S75	18 12 59.184	0.001	-22 39 57.660	0.010
7S76	18 13 1.179	0.001	-22 39 54.100	0.010
7S80	18 13 31.392	0.002	-22 40 3.920	0.012
7S82	18 13 40.787	0.001	-22 40 10.110	0.010
7S91	18 15 37.682	0.001	-22 39 34.340	0.010
7S95	18 15 50.499	0.001	-22 39 32.020	0.010
7S99	18 16 19.697	0.001	-22 39 30.530	0.010
7S100	18 16 30.066	0.001	-22 39 17.090	0.010
7S102	18 16 52.328	0.001	-22 39 19.600	0.010
8S1	18 20 2.715	0.001	-22 38 7.796	0.011
8S2	18 20 14.784	0.001	-22 38 25.795	0.010
8S5	18 22 44.807	0.001	-22 37 22.687	0.011
8S7	18 23 48.992	0.002	-22 36 54.248	0.010
8S10	18 26 51.267	0.001	-22 35 3.160	0.011
8S11	18 27 19.904	0.001	-22 35 3.384	0.013
8S12	18 30 16.148	0.002	-22 33 10.720	0.010
8S13	18 31 31.041	0.001	-22 32 34.476	0.010
8S15	18 32 36.436	0.002	-22 31 58.690	0.010
8S16	18 32 48.891	0.002	-22 31 43.290	0.010
8S22	18 30 14.231	0.001	-22 44 29.838	0.010
8S24	18 33 54.439	0.001	-22 48 14.450	0.010
9S4	18 49 8.714	0.001	-22 18 49.653	0.010
9S8	18 44 19.421	0.001	-22 25 22.297	0.010
9S11	18 41 22.802	0.001	-22 29 21.023	0.010
9S14	18 37 6.503	0.001	-22 34 46.233	0.010
9S19	18 39 52.292	0.001	-22 44 54.463	0.010
9S23	18 41 25.658	0.001	-22 43 53.697	0.010
9S25	18 44 35.680	0.001	-22 41 6.890	0.010
9S28	18 47 55.821	0.001	-22 38 30.339	0.016
9S29	18 49 7.027	0.001	-22 37 13.727	0.010
10S2	18 53 12.937	0.001	-22 12 0.650	0.010
10S3	18 53 47.245	0.001	-22 11 20.752	0.014
10S5	18 54 4.095	0.001	-22 10 29.981	0.013
10S6	18 54 24.631	0.001	-22 10 11.150	0.010
10S7	18 54 36.074	0.001	-22 10 14.652	0.013

TABLE A.5
Average Coordinates for New Occultation Candidates
(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
10S10	18 57 2.569	0.001	-22 6 40.036	0.013
10S17	18 56 20.993	0.001	-22 8 9.573	0.012
10S18	18 55 23.713	0.001	-22 9 54.320	0.010
10S22	18 53 28.595	0.001	-22 12 52.115	0.013
10S23	18 53 23.584	0.001	-22 13 6.480	0.010
10S29	18 54 33.412	0.001	-22 31 34.458	0.013
10S30	18 54 34.803	0.001	-22 31 26.107	0.014
10S31	18 55 12.610	0.001	-22 30 59.725	0.010
10S34	18 57 16.988	0.001	-22 28 26.966	0.013
10S37	19 1 57.845	0.001	-22 22 23.382	0.013
10S41	19 3 22.252	0.001	-22 20 21.597	0.011
11S8	19 5 47.516	0.001	-22 17 0.240	0.010
11S17	19 11 9.281	0.002	-22 8 50.313	0.016
11S18	19 11 33.880	0.001	-22 8 34.327	0.016
11S20	19 11 49.107	0.001	-22 7 58.354	0.011
11S23	19 15 32.621	0.002	-22 1 50.298	0.016
11S27	19 16 49.718	0.001	-21 59 44.434	0.010
12S2	19 19 52.292	0.001	-21 54 41.857	0.010
12S6	19 22 46.101	0.001	-21 49 3.137	0.010
12S7	19 23 44.796	0.002	-21 47 29.656	0.017
12S11	19 27 23.294	0.001	-21 40 41.870	0.010
12S12	19 28 18.424	0.001	-21 38 40.353	0.010
12S16	19 32 3.751	0.001	-21 30 57.737	0.012
12S19	19 32 50.769	0.002	-21 29 45.734	0.016
12S22	19 33 59.942	0.002	-21 36 21.021	0.017
12S23	19 33 41.960	0.001	-21 37 0.297	0.012
12S24	19 33 22.602	0.001	-21 37 30.809	0.012
12S26	19 32 23.404	0.001	-21 39 49.967	0.012
12S38	19 20 52.007	0.001	-22 7 57.898	0.012
12S39	19 20 40.051	0.001	-22 8 28.857	0.010
12S42	19 20 27.896	0.001	-22 12 38.786	0.012
12S46	19 22 11.301	0.001	-22 9 39.922	0.012
12S47	19 22 31.199	0.001	-22 9 26.300	0.012
12S55	19 26 21.113	0.001	-22 2 41.946	0.012
12S56	19 27 3.016	0.001	-22 1 4.270	0.012
12S64	19 34 14.527	0.001	-21 46 51.733	0.012

TABLE A.5

Average Coordinates for New Occultation Candidates

(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
13S3	19 38 12.210	0.001	-21 18 21.441	0.014
13S4	19 38 22.132	0.001	-21 17 36.370	0.010
13S5	19 38 39.302	0.001	-21 17 0.075	0.010
13S7	19 40 19.244	0.001	-21 13 29.792	0.013
13S9	19 40 35.537	0.001	-21 13 14.930	0.010
13S12	19 41 30.207	0.001	-21 11 11.466	0.013
13S13	19 42 7.839	0.001	-21 9 52.774	0.013
13S18	19 45 29.596	0.001	-21 2 37.102	0.013
13S23	19 45 3.775	0.001	-21 6 26.433	0.014
13S24	19 45 0.375	0.001	-21 6 31.336	0.013
13S26	19 43 53.503	0.001	-21 9 36.405	0.010
13S28	19 41 56.792	0.001	-21 15 12.710	0.010
13S29	19 41 43.303	0.001	-21 15 37.540	0.010
13S31	19 40 58.480	0.001	-21 17 33.285	0.010
13S33	19 39 45.980	0.001	-21 20 55.665	0.010
13S35	19 37 37.579	0.001	-21 26 26.550	0.010
14S4	19 43 54.971	0.001	-21 25 56.560	0.010
14S5	19 44 16.629	0.001	-21 25 6.040	0.010
14S8	19 45 27.943	0.001	-21 22 18.510	0.010
14S9	19 46 20.324	0.001	-21 20 13.620	0.010
14S12	19 49 42.421	0.001	-21 12 2.750	0.010
15S4	19 59 2.274	0.001	-20 47 38.510	0.010
15S5	20 0 4.703	0.001	-20 44 55.950	0.010
15S10	20 2 17.563	0.001	-20 38 55.940	0.010
15S11	20 4 26.023	0.001	-20 33 15.140	0.010
15S19	20 10 23.411	0.001	-20 36 9.220	0.010
15S21	20 7 35.235	0.001	-20 45 42.830	0.010
15S22	20 7 54.601	0.001	-20 45 3.310	0.010
15S23	20 8 53.612	0.001	-20 42 26.860	0.010
15S24	20 10 7.959	0.001	-20 38 44.790	0.010
16S11	20 21 8.119	0.001	-19 43 34.890	0.010
16S18	20 26 46.870	0.001	-19 26 25.240	0.010
16S20	20 29 3.777	0.001	-19 18 49.126	0.015
16S21	20 29 6.963	0.001	-19 19 7.490	0.010
17S4	20 33 8.204	0.001	-19 6 45.365	0.010
17S7	20 32 42.434	0.001	-19 14 12.900	0.010

TABLE A.5

Average Coordinates for New Occultation Candidates

(Continued)

Star ID	RA (1950) (h m s)	Error (sec)	Dec (1950) (° ' ")	Error (arcsec)
17S11	20 29 33.525	0.001	-19 26 52.980	0.010
17S14	20 30 58.368	0.001	-19 31 42.490	0.010
17S18	20 35 8.868	0.001	-19 16 56.465	0.010
17S27	20 38 25.556	0.001	-19 5 15.810	0.010
17S28	20 38 39.059	0.001	-19 4 43.330	0.010

TABLE A.6

Improved Geocentric Occultation Predictions For Stars in Paper I

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
S30	1987 1 28	01:42:57	17 6 49.302	-21 22 21.470	8.75
S32	1987 2 15	19:59:43	17 13 12.192	-21 29 46.950	47.47 M
S33	1987 2 16	01:58:27	17 13 16.738	-21 29 3.728	0.46
S34	1987 2 16	05:10:10	17 13 19.041	-21 29 7.081	1.66
S36	1987 5 19	04:28:44	17 12 3.505	-21 21 13.930	10.28
S37	1987 5 19	07:07:48	17 12 1.702	-21 21 1.601	0.46
S38	1987 5 19	18:29:27	17 11 53.644	-21 20 54.503	2.26
S39	1987 5 21	04:11:03	17 11 29.628	-21 20 13.318	11.47 M
S40	1987 5 21	04:11:50	17 11 29.620	-21 20 12.980	11.66 M
S41	1987 5 29	09:33:28	17 9 2.160	-21 17 20.915	17.02 M
S44	1987 6 25	11:25:15	17 0 35.808	-21 8 40.832	9.91
S45	1987 7 11	08:03:21	16 56 18.737	-21 4 16.782	7.83
S46	1987 7 16	02:04:09	16 55 13.922	-21 3 10.658	21.12 M
S47	1987 8 3	07:47:54	16 52 13.529	-21 1 40.618	27.80 M
S48	1987 9 8	00:21:25	16 52 38.110	-21 9 48.157	20.96 M
S50	1987 10 6	14:11:32	16 59 1.150	-21 25 39.025	12.74 M
S51	1988 2 8	02:49:35	17 55 29.414	-22 19 36.093	6.20
S52	1988 2 22	04:12:58	18 0 30.903	-22 19 16.495	9.70
S53	1988 3 10	02:56:42	18 5 8.060	-22 18 29.196	2.97
S54	1988 3 10	16:19:50	18 5 15.411	-22 18 36.235	6.32
S55	1988 3 19	20:09:33	18 6 58.314	-22 17 55.700	4.22
S57	1988 5 11	05:28:08	18 5 35.632	-22 16 20.797	0.99
S58	1988 5 13	06:33:45	18 5 10.582	-22 16 33.405	11.06 M
S59	1988 6 15	03:19:53	17 56 6.227	-22 17 31.700	0.73
S60	1988 11 7	10:14:50	17 55 33.612	-22 38 25.875	13.92 M
S62	1989 2 10	03:21:30	18 41 7.238	-22 24 57.216	5.52
S63	1989 2 10	10:34:03	18 41 14.842	-22 24 42.513	2.11
S64	1989 2 10	10:34:35	18 41 14.851	-22 24 42.380	2.31
S65	1989 2 13	08:46:11	18 42 28.137	-22 23 35.590	0.42
S66	1989 2 17	11:20:05	18 44 7.560	-22 22 4.207	5.85
S67	1989 2 24	04:35:00	18 46 40.537	-22 19 18.029	2.00
S68	1989 2 25	07:29:33	18 47 4.921	-22 19 5.279	11.37 M
S69	1989 3 10	07:14:34	18 51 18.190	-22 14 8.703	2.03
S70	1989 4 2	19:13:41	18 56 24.373	-22 7 45.935	1.21
S71	1989 4 9	04:22:39	18 57 9.796	-22 6 44.431	1.63
S72	1989 4 16	16:35:03	18 57 41.088	-22 6 11.767	*

TABLE A.6

Improved Geocentric Occultation Predictions For Stars in Paper I

(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
S74	1989 5 5	13:36:00	18 57 16.037	-22 6 52.377	6.04
S75	1989 5 11	03:08:57	18 56 40.683	-22 7 59.416	5.21
S76	1989 5 19	12:47:06	18 55 24.800	-22 9 54.141	3.63
S77	1989 5 30	04:07:26	18 53 13.848	-22 13 12.437	7.35
S78	1989 6 5	17:17:44	18 51 36.336	-22 15 24.670	1.57
S79	1989 6 10	02:57:55	18 50 24.791	-22 16 59.330	8.67
S80	1989 6 10	14:17:08	18 50 17.003	-22 17 26.750	7.70
S81	1989 6 11	06:48:25	18 50 5.172	-22 17 14.560	21.01 M
S82	1989 6 16	01:49:58	18 48 42.060	-22 19 40.055	8.42
S83	1989 7 3	07:37:28	18 43 19.804	-22 26 46.636	1.55
S84	1989 7 8	12:35:58	18 41 40.527	-22 28 57.486	3.07
S87	1989 9 21	20:33:27	18 29 35.544	-22 47 47.735	16.02 M
S88	1989 9 25	10:02:18	18 29 58.520	-22 48 26.094	4.64
S89	1989 10 19	15:55:41	18 34 24.102	-22 47 41.290	8.97
S90	1989 10 24	22:11:24	18 35 51.244	-22 47 11.200	1.20
S91	1989 10 29	03:03:24	18 37 7.729	-22 46 28.544	4.42
S92	1989 10 30	13:48:24	18 37 35.429	-22 46 8.028	9.61
S93	1989 11 1	02:56:36	18 38 5.820	-22 45 58.010	1.92
S95	1989 11 6	08:24:23	18 39 53.951	-22 44 56.740	4.95
S99	1989 11 22	15:42:54	18 46 19.553	-22 39 41.890	8.57
S100	1990 2 21	17:33:41	19 30 4.764	-21 35 0.545	9.81
S102	1990 3 12	13:27:00	19 37 13.846	-21 20 19.502	1.92
S103	1990 3 23	15:58:37	19 40 38.229	-21 12 44.540	9.08
S104	1990 3 24	20:00:54	19 40 58.611	-21 11 50.126	18.75 M
S105	1990 4 5	06:42:20	19 43 39.131	-21 6 20.520	2.78
S106	1990 4 15	14:11:28	19 45 22.255	-21 2 26.553	11.44 M
S107	1990 6 11	08:08:59	19 42 9.505	-21 14 32.712	0.40
S110	1990 7 12	14:21:37	19 33 19.648	-21 37 48.847	3.41
S111	1990 7 13	15:31:18	19 32 59.798	-21 38 28.650	6.33
S112	1990 7 21	14:06:04	19 30 30.737	-21 44 50.450	6.73
S113	1990 7 25	07:03:34	19 29 22.068	-21 47 34.067	3.08
S114	1990 7 29	03:04:10	19 28 12.537	-21 50 22.580	3.66
S115	1990 8 2	02:05:09	19 27 2.770	-21 53 6.259	0.48
S116	1990 8 6	19:01:18	19 25 43.413	-21 56 17.550	2.72

TABLE A.6
Improved Geocentric Occultation Predictions For Stars in Paper I
(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
S117	1990 8 9	20:42:27	19 24 53.894	-21 58 2.974	9.01
S118	1990 8 30	06:56:52	19 20 30.960	-22 8 29.827	8.99
S119	1990 10 27	21:20:45	19 22 47.892	-22 8 33.064	16.30 M
S120	1990 11 2	20:05:43	19 24 19.155	-22 6 7.051	6.05
S122	1990 11 16	02:34:28	19 28 26.130	-21 58 42.430	1.88
S123	1990 11 24	18:12:04	19 31 35.970	-21 52 25.156	3.81
S124	1990 11 29	05:17:44	19 33 21.804	-21 49 2.817	8.56
S126	1991 3 12	20:00:17	20 21 27.831	-19 42 54.067	4.62
S127	1991 3 15	02:36:12	20 22 19.271	-19 40 11.274	1.58
S128	1991 3 27	19:36:47	20 26 40.733	-19 26 29.344	2.93
S129	1991 4 16	11:38:11	20 31 45.854	-19 10 43.944	0.79
S130	1991 4 30	02:06:31	20 33 55.282	-19 4 18.151	10.78
S133	1991 7 21	19:17:21	20 22 52.734	-19 52 24.889	7.72
S134	1991 8 4	01:54:31	20 18 49.686	-20 7 20.520	10.24
S135	1991 8 9	13:16:57	20 17 11.560	-20 13 2.330	6.77
S136	1991 12 10	05:01:22	20 21 44.655	-20 2 20.386	5.82

* Impact Parameter ≥ 50 arcseconds.

TABLE A.7
Geocentric Occultation Predictions for New Candidates

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
1S2	1987 1 2	00:34:22	16 55 31.541	-21 7 14.815	1.64
1S3	1987 1 2	07:13:34	16 55 39.430	-21 7 22.047	3.32
1S5	1987 1 7	21:21:33	16 58 15.166	-21 11 32.441	13.80 M
1S6	1987 1 9	14:45:52	16 59 2.331	-21 12 32.886	6.31
1S10	1987 1 12	23:04:50	17 00 32.276	-21 14 31.235	1.46
1S20	1987 6 28	18:45:00	16 59 38.011	-21 7 25.666	6.48
1S30	1987 7 27	09:17:34	16 53 8.183	-21 2 7.485	8.20
2S1	1987 1 28	01:42:42	17 6 49.300	-21 22 21.298	8.95
2S2	1987 1 30	18:34:07	17 7 50.870	-21 23 36.590	3.31
2S4	1987 2 3	13:24:47	17 9 13.727	-21 25 8.250	1.42
2S6	1987 2 5	05:40:05	17 9 49.040	-21 25 59.549	13.17 M
2S16	1987 4 29	14:54:32	17 16 47.195	-21 27 1.108	16.06 M
2S20	1987 5 23	23:50:44	17 10 40.214	-21 19 12.320	16.05 M
2S21	1987 5 25	18:30:04	17 10 8.266	-21 18 58.935	6.62
2S22	1987 5 25	23:54:17	17 10 4.177	-21 19 3.028	15.33 M
2S23	1987 5 26	02:56:08	17 10 1.893	-21 18 56.435	11.32 M
2S24	1987 5 27	16:51:19	17 9 33.196	-21 18 19.002	6.09
2S25	1987 6 8	12:07:54	17 5 51.723	-21 14 21.850	14.38 M
2S26	1987 6 8	22:39:39	17 5 43.427	-21 14 4.770	6.36
2S33	1987 11 14	17:38:33	17 14 32.442	-21 51 2.046	4.13
2S34	1987 11 19	14:03:27	17 16 50.181	-21 53 58.407	1.79
3S6	1987 12 17	01:33:19	17 30 33.846	-22 8 16.433	4.15
4S1	1987 12 28	20:19:23	17 36 32.955	-22 12 22.785	13.86 M
4S13	1988 10 9	06:46:09	17 45 30.506	-22 32 7.613	10.74
5S1	1988 1 28	03:20:44	17 50 57.160	-22 19 5.247	14.85 M
5S2	1988 1 28	15:04:16	17 51 9.890	-22 18 45.498	7.65
5S6	1988 2 3	02:34:13	17 53 28.735	-22 19 3.850	13.31 M
5S9	1988 2 15	07:43:43	17 58 11.241	-22 19 25.512	8.87
5S12	1988 2 19	06:27:24	17 59 33.482	-22 19 45.173	14.18 M
5S13	1988 2 19	13:09:07	17 59 39.101	-22 19 18.264	12.26 M
5S21	1988 5 29	06:22:28	18 1 12.672	-22 16 38.720	14.18 M
5S23	1988 5 30	13:34:47	18 0 50.611	-22 16 48.023	7.81
5S25	1988 6 2	19:04:38	17 59 54.434	-22 16 47.800	15.83 M
5S26	1988 6 6	13:21:16	17 58 46.821	-22 16 54.166	17.51 M
5S27	1988 6 8	22:40:17	17 58 2.897	-22 17 34.988	17.90 M
5S36	1988 11 2	05:33:11	17 53 28.183	-22 37 18.827	2.03

TABLE A.7

Geocentric Occultation Predictions for New Candidates

(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
5S39	1988 11 9	21:42:45	17 56 35.825	-22 38 23.106	12.61 M
5S44	1988 11 17	09:02:47	17 59 51.498	-22 39 22.451	12.58 M
5S45	1988 11 17	21:02:38	18 0 4.965	-22 39 49.169	10.75
5S47	1988 11 18	20:00:34	18 0 30.931	-22 39 54.939	10.48
6S16	1988 3 29	02:49:27	18 8 7.411	-22 17 15.450	0.86
6S20	1988 4 18	05:59:08	18 8 31.700	-22 16 9.027	11.52 M
16S23	1988 4 21	21:17:55	18 8 17.670	-22 15 58.840	17.14 M
6S28	1988 5 1	18:15:50	18 7 12.598	-22 15 59.010	13.54 M
6S31	1988 5 6	22:49:59	18 6 23.440	-22 16 28.940	13.55 M
6S43	1988 5 18	10:55:24	18 4 1.167	-22 16 40.050	9.40
6S44	1988 5 19	03:03:30	18 3 51.572	-22 16 42.950	11.08 M
7S5	1988 11 24	09:56:43	18 3 5.594	-22 40 16.300	3.50
7S6	1988 11 25	06:56:18	18 3 30.308	-22 40 12.640	3.61
7S7	1988 11 26	00:54:37	18 3 51.562	-22 40 4.400	14.49 M
7S15	1988 11 27	15:04:25	18 4 36.958	-22 40 9.448	14.20 M
7S17	1988 11 28	12:06:49	18 5 2.138	-22 40 22.050	3.87
7S23	1988 11 30	09:32:59	18 5 56.895	-22 40 19.540	10.09
7S25	1988 12 1	05:52:08	18 6 21.534	-22 40 28.580	2.22
7S28	1988 12 3	06:51:57	18 7 21.324	-22 40 43.884	11.46 M
7S33	1988 12 4	08:57:10	18 7 53.363	-22 40 42.239	9.69
7S34	1988 12 4	13:49:50	18 7 59.368	-22 40 26.080	6.59
7S39	1988 12 5	11:44:15	18 8 26.396	-22 40 31.660	0.70
7S40	1988 12 5	21:34:29	18 8 38.563	-22 40 41.179	9.36
7S43	1988 12 6	16:28:16	18 9 1.979	-22 40 28.700	2.48
7S44	1988 12 7	03:39:10	18 9 15.866	-22 40 29.350	1.30
7S49	1988 12 8	19:01:09	18 10 4.923	-22 40 25.810	1.97
7S53	1988 12 9	08:13:39	18 10 21.437	-22 40 25.550	0.98
7S54	1988 12 9	11:43:22	18 10 25.808	-22 40 14.180	11.94 M
7S56	1988 12 9	15:30:54	18 10 30.567	-22 40 39.960	14.23 M
7S57	1988 12 10	01:47:43	18 10 43.440	-22 40 18.160	6.54
7S63	1988 12 10	21:31:05	18 11 8.208	-22 40 34.250	11.90 M
7S64	1988 12 11	01:04:42	18 11 12.683	-22 40 35.750	13.80 M
7S68	1988 12 12	07:24:59	18 11 50.874	-22 40 18.210	0.63
7S69	1988 12 12	11:42:59	18 11 56.300	-22 40 22.160	5.15

TABLE A.7
Geocentric Occultation Predictions for New Candidates
(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
7S70	1988 12 12	15:05:19	18 12 0.553	-22 40 19.150	2.80
7S71	1988 12 13	08:48:59	18 12 22.934	-22 40 5.570	7.89
7S73	1988 12 13	21:37:49	18 12 39.137	-22 40 1.000	10.14
7S75	1988 12 14	13:27:49	18 12 59.184	-22 39 57.660	10.44
7S76	1988 12 14	15:02:26	18 13 1.179	-22 39 54.100	13.85 M
7S80	1988 12 15	14:51:16	18 13 31.392	-22 40 3.920	1.01
7S82	1988 12 15	22:14:54	18 13 40.787	-22 40 10.110	8.78
7S91	1988 12 19	18:02:55	18 15 37.682	-22 39 34.340	3.31
7S95	1988 12 20	04:05:40	18 15 50.499	-22 39 32.020	2.81
7S99	1988 12 21	02:56:13	18 16 19.697	-22 39 30.530	2.86
7S100	1988 12 21	11:03:33	18 16 30.066	-22 39 17.090	7.96
7S102	1988 12 22	04:27:35	18 16 52.328	-22 39 19.600	0.44
8S1	1988 12 28	09:09:54	18 20 2.715	-22 38 7.796	12.73 M
8S2	1988 12 28	18:33:30	18 20 14.784	-22 38 25.795	9.50
8S5	1989 1 2	15:54:25	18 22 44.807	-22 37 22.687	5.34
8S7	1989 1 4	18:17:20	18 23 48.992	-22 36 54.248	5.27
8S10	1989 1 10	18:26:53	18 26 51.267	-22 35 3.160	14.77 M
8S11	1989 1 11	17:14:29	18 27 19.904	-22 35 3.384	1.13
8S12	1989 1 17	15:16:43	18 30 16.148	-22 33 10.720	7.03
8S13	1989 1 20	04:32:37	18 31 31.041	-22 32 34.476	5.26
8S15	1989 1 22	10:35:44	18 32 36.436	-22 31 58.690	14.04 M
8S16	1989 1 22	20:58:48	18 32 48.891	-22 31 43.290	7.27
8S22	1989 8 25	12:45:35	18 30 14.231	-22 44 29.838	15.31 M
8S24	1989 10 17	17:14:10	18 33 54.439	-22 48 14.450	13.26 M
9S4	1989 6 14	13:29:49	18 49 8.714	-22 18 49.653	5.05
9S8	1989 6 30	04:44:50	18 44 19.421	-22 25 22.297	4.37
9S11	1989 7 9	11:04:33	18 41 22.802	-22 29 21.023	3.68
9S14	1989 7 23	14:33:46	18 37 6.503	-22 34 46.233	1.73
9S19	1989 11 6	06:33:52	18 39 52.292	-22 44 54.463	1.60
9S23	1989 11 10	12:10:14	18 41 25.658	-22 43 53.697	5.67
9S25	1989 11 18	12:44:16	18 44 35.680	-22 41 6.890	13.01 M
9S28	1989 11 26	08:19:39	18 47 55.821	-22 38 30.339	7.80
9S29	1989 11 29	00:21:17	18 49 7.027	-22 37 13.727	0.67
10S2	1989 3 17	10:08:36	18 53 12.937	-22 12 0.650	12.92 M

TABLE A.7
Geocentric Occultation Predictions for New Candidates
(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
10S3	1989 3 19	19:22:24	18 53 47.245	-22 11 20.752	15.69 M
10S5	1989 3 21	01:12:55	18 54 4.095	-22 10 29.981	13.86 M
10S6	1989 3 22	14:32:25	18 54 24.631	-22 10 11.150	7.04
10S7	1989 3 23	11:55:39	18 54 36.074	-22 10 14.652	10.87
10S10	1989 4 7	23:59:47	18 57 2.569	-22 6 40.036	15.15 M
10S17	1989 5 13	14:14:32	18 56 20.993	-22 8 9.573	15.09 M
10S18	1989 5 19	15:13:49	18 55 23.713	-22 9 54.320	2.21
10S22	1989 5 29	02:31:41	18 53 28.595	-22 12 52.115	8.72
10S23	1989 5 29	11:23:15	18 53 23.584	-22 13 6.480	15.56 M
10S29	1989 12 10	16:32:12	18 54 33.412	-22 31 34.458	3.95
10S30	1989 12 10	17:43:39	18 54 34.803	-22 31 26.107	2.73
10S31	1989 12 12	01:01:31	18 55 12.610	-22 30 59.725	13.91 M
10S34	1989 12 16	07:07:09	18 57 16.988	-22 28 26.966	7.41
10S37	1989 12 25	16:34:19	19 1 57.845	-22 22 23.382	0.41
10S41	1989 12 28	11:25:23	19 3 22.252	-22 20 21.597	8.09
11S8	1990 1 2	05:50:37	19 5 47.516	-22 17 0.240	0.32
11S17	1990 1 12	18:56:58	19 11 9.281	-22 8 50.313	14.72 M
11S18	1990 1 13	14:13:14	19 11 33.880	-22 8 34.327	7.85
11S20	1990 1 14	02:19:29	19 11 49.107	-22 7 58.354	3.96
11S23	1990 1 21	12:06:08	19 15 32.621	-22 1 50.298	8.55
11S27	1990 1 24	02:05:15	19 16 49.718	-21 59 44.434	4.25
12S2	1990 1 30	06:57:35	19 19 52.292	-21 54 41.857	10.86
12S6	1990 2 5	08:41:54	19 22 46.101	-21 49 3.137	12.89 M
12S7	1990 2 7	10:46:03	19 23 44.796	-21 47 29.656	2.48
12S11	1990 2 15	11:22:43	19 27 23.294	-21 40 41.870	11.64 M
12S12	1990 2 17	13:51:48	19 28 18.424	-21 38 40.353	1.68
12S16	1990 2 26	13:38:47	19 32 3.751	-21 30 57.737	10.96
12S19	1990 2 28	12:51:05	19 32 50.769	-21 29 45.734	13.61 M
12S22	1990 7 10	11:03:28	19 33 59.942	-21 36 21.021	16.63 M
12S23	1990 7 11	09:58:39	19 33 41.960	-21 37 0.297	10.63
12S24	1990 7 12	10:25:08	19 33 22.602	-21 37 30.809	7.18
12S26	1990 7 15	13:44:23	19 32 23.404	-21 39 49.967	15.61 M
12S38	1990 8 28	04:35:59	19 20 52.007	-22 7 57.898	10.26
12S39	1990 8 29	09:06:57	19 20 40.051	-22 8 28.857	11.99 M

TABLE A.7
Geocentric Occultation Predictions for New Candidates
(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
12S42	1990 10 16	05:18:49	19 20 27.896	-22 12 38.786	7.72
12S46	1990 10 25	05:24:27	19 22 11.301	-22 9 39.922	10.01
12S47	1990 10 26	16:25:06	19 22 31.199	-22 9 26.300	8.97
12S55	1990 11 9	18:27:50	19 26 21.113	-22 2 41.946	7.55
12S56	1990 11 11	23:24:08	19 27 3.016	-22 1 4.270	12.67 M
12S64	1990 12 1	09:12:06	19 34 14.527	-21 46 51.733	13.23 M
13S3	1990 3 15	12:24:04	19 38 12.210	-21 18 21.441	9.57
13S4	1990 3 16	01:08:14	19 38 22.132	-21 17 36.370	13.67 M
13S5	1990 3 16	22:52:22	19 38 39.302	-21 17 0.075	12.78 M
13S7	1990 3 22	12:46:05	19 40 19.244	-21 13 29.792	5.51
13S9	1990 3 23	11:10:40	19 40 35.537	-21 13 14.930	15.06 M
13S12	1990 3 26	21:28:39	19 41 30.207	-21 11 11.466	11.61 M
13S13	1990 3 29	09:35:14	19 42 7.839	-21 9 52.774	15.33 M
13S18	1990 4 16	11:57:37	19 45 29.596	-21 2 37.102	13.81 M
13S23	1990 5 26	22:20:10	19 45 3.775	-21 6 26.433	15.30 M
13S24	1990 5 27	07:26:44	19 45 0.375	-21 6 31.336	9.93
13S26	1990 6 2	23:41:18	19 43 53.503	-21 9 36.405	1.46
13S28	1990 6 12	06:18:13	19 41 56.792	-21 15 12.710	4.89
13S29	1990 6 13	04:58:01	19 41 43.303	-21 15 37.540	7.46
13S31	1990 6 16	06:17:06	19 40 58.480	-21 17 33.285	14.49 M
13S33	1990 6 20	21:55:18	19 39 45.980	-21 20 55.665	8.61
13S35	1990 6 28	12:11:54	19 37 37.579	-21 26 26.550	18.13 M
14S4	1990 12 23	00:10:22	19 43 54.971	-21 25 56.560	11.22 M
14S5	1990 12 23	18:21:07	19 44 16.629	-21 25 6.040	11.17 M
14S8	1990 12 26	05:49:39	19 45 27.943	-21 22 18.510	11.05 M
14S9	1990 12 28	01:10:33	19 46 20.324	-21 20 13.620	10.63
14S12	1991 1 3	22:15:39	19 49 42.421	-21 12 2.750	9.66
15S4	1991 1 22	15:09:50	19 59 2.274	-20 47 38.510	14.80 M
15S5	1991 1 24	17:11:00	20 0 4.703	-20 44 55.950	9.71
15S10	1991 1 29	04:15:27	20 2 17.563	-20 38 55.940	8.09
15S11	1991 2 2	12:34:46	20 4 26.023	-20 33 15.140	6.45
15S19	1991 9 5	22:22:30	20 10 23.411	-20 36 9.220	3.99
15S21	1991 10 2	05:41:17	20 7 35.235	-20 45 42.830	*
15S22	1991 10 15	01:04:03	20 7 54.601	-20 45 3.310	3.97

TABLE A.7
Geocentric Occultation Predictions for New Candidates
(Continued)

Star ID	Date	UT	RA (1950) (h m s)	Dec (1950) (° ' ")	Closest Approach (arcsec)
15S23	1991 10 24	13:27:02	20 8 53.612	-20 42 26.860	12.68 M
15S24	1991 11 1	06:09:54	20 10 7.959	-20 38 44.790	*
16S11	1991 3 11	23:46:12	20 21 8.119	-19 43 34.890	15.11 M
16S18	1991 3 28	03:12:34	20 26 46.870	-19 26 25.240	11.86 M
16S20	1991 4 5	00:46:22	20 29 3.777	-19 18 49.126	14.44 M
16S21	1991 4 5	04:53:59	20 29 6.963	-19 19 7.490	13.21 M
17S4	1991 4 24	05:09:41	20 33 8.204	-19 6 45.365	6.04
17S7	1991 6 12	13:46:41	20 32 42.434	-19 14 12.900	9.53
17S11	1991 6 27	21:25:31	20 29 33.525	-19 26 52.980	8.78
17S14	1991 12 31	16:49:47	20 30 58.368	-19 31 42.490	10.18
17S18	1992 1 9	15:07:16	20 35 8.868	-19 16 56.465	2.08
17S27	1992 1 16	11:03:22	20 38 25.556	-19 5 15.810	2.69
17S28	1992 1 16	21:59:57	20 38 39.059	-19 4 43.330	12.77 M

* Impact parameter ≥ 50 arcseconds.

X. APPENDIX B

Program Used to Calculate Average Coordinates

```
/*START*/
/*TITLE star_avg */
/*
Source File : star_avg.c
Author(s) :  Stephen Levine
Description : Take stars from Anita's list and average their coordinates
Algorithm :
Calling Sequence :
Parameter(s) :
Returned Value(s) :
Routines Called :
Bugs and Restrictions : Good only with Anita's particular list
See also :
Revisions :
      3/5/87 - development version (q and d version) - sel
*/
/*FINISH*/

#include <stdio.h>
#include <math.h>
#define IDENTICAL 0
main(argc, argv)
char **argv;
int argc;
{
      struct COORDS
      {
```

```
        double field, ras, rasig, des, desig;
        int rah, ram, ded, dem;
        char label[10];
    } new_line, old_line;

    FILE *fp, *fopen();
    char comment[80];
    int flag, i, j;
    double sum_of_ras = 0.0, sum_of_des = 0.0;
    double sum_of_ra_w = 0.0, sum_of_de_w = 0.0;

/* Check that there is a filename */
    if (argc != 2)
    {
        printf("Usage: star_avg filename \n");
        exit(-1);
    }
/* Open file that is arg 1 */
    if((fp = fopen(argv[1],"r")) == NULL)
    {
        printf("Unable to open file %s for reading\n", argv[1]);
        exit(-1);
    }

/* read/skip first comment line */
    fscanf(fp,"%s",comment);

/* set up table format header */
    printf(".nr PS 12\n.nr VS 14\n.nr HM 1i\n.nr FM 1i\n");
    printf(".sp 5\n");
    printf(".TS\n");
    printf("tab (#) expand center ;\n");
    printf("c s s\nc c c\nl r r.\n");
```

```
printf("Averaged Coordinates for Saturn Occultation Stars\n");
printf("_\n");
printf("ID#R.A.#Dec.\n");
printf("=\n");

flag = j = i = 0;
/* HAVE TO DEAL WITH FIRST LINE CASE !! */
while (flag == 0)
{
    if((fscanf(fp,"%f %s %d %d %f %f %d %d %f %f",
    &new_line.field, new_line.label, &new_line.rah,
    &new_line.ram, &new_line.ras, &new_line.rasig, &new_line.ded,
     &new_line.dem, &new_line.des, &new_line.desig)) == EOF)
    {
        flag++;
    }

    if(i == 0){ /* handle first line case */
        strcpy(old_line.label, new_line.label);
        i++;
    }

    if((strcmp(new_line.label,old_line.label) == IDENTICAL)
            && (flag == 0))
    {
        sum_of_ras += (new_line.rah * 3600. + new_line.ram *
            60. + new_line.ras) /
            (new_line.rasig * new_line.rasig);
        if(new_line.ded < 0){
            new_line.dem *= -1;
            new_line.des *= -1;
        }
         sum_of_des += (new_line.ded * 3600. + new_line.dem *
```

```
            60. + new_line.des) /
            (new_line.desig * new_line.desig);
        sum_of_ra_w += 1./(new_line.rasig * new_line.rasig);
        sum_of_de_w += 1./(new_line.desig * new_line.desig);
        j++;
        old_line = new_line;
    } else
    {
        old_line.ras = sum_of_ras / sum_of_ra_w;
        old_line.rah = (int)(old_line.ras/3600.);
        old_line.ram = (int)((old_line.ras - old_line.rah *
                3600) / 60.);
        old_line.ras -= (old_line.rah * 3600 +
                old_line.ram * 60.);

        old_line.des = sum_of_des / sum_of_de_w;
        old_line.ded = (int)(old_line.des/3600.);
        old_line.dem = (int)((old_line.des - old_line.ded *
                3600) / 60.);
        old_line.des -= (old_line.ded * 3600 +
                old_line.dem * 60.);

        old_line.rasig = 1./sqrt(sum_of_ra_w / j);
        old_line.desig = 1./sqrt(sum_of_de_w / j);

        j = 0;
        printf("%-.5s#%d %d %.3f \\(+- %.3f#%d %d %.3f \\(+- %.3f\n",
            old_line.label, old_line.rah, old_line.ram,
            old_line.ras, old_line.rasig, old_line.ded,
            old_line.dem, old_line.des,
            old_line.desig);

/* Check if end */
```

```
            if(flag == 1)  /* this is a kludge to get last point */
                break;

/* zero counters/reset  */
            sum_of_ras= sum_of_des= sum_of_ra_w= sum_of_de_w= 0.0;
            sum_of_ras += (new_line.rah * 3600. + new_line.ram *
                60. + new_line.ras) /
                (new_line.rasig * new_line.rasig);
            if(new_line.ded < 0){
                new_line.dem *= -1;
                new_line.des *= -1;
            }
            sum_of_des += (new_line.ded * 3600. + new_line.dem *
                60. + new_line.des) /
                (new_line.desig * new_line.desig);
            sum_of_ra_w += 1./(new_line.rasig * new_line.rasig);
            sum_of_de_w += 1./(new_line.desig * new_line.desig);
            j++;
            old_line = new_line;
        }
    }
    printf(".TE\n");
    fclose(fp);
}
```

XI. APPENDIX C

Software Reference

Program Name	Author*	Program Address	Dates Used	Purpose
HSPSIM	RLW	STScI directory: [white.hsp.model. doc]hspsim	2/86 - 4/86	Calculated signal-to-noise ratios for occultation candidates from Paper I for HST observations
SAOPLT	LHW	Lowell Obs. Dec PDP-11/34	6/86 - 8/86	Identifies all SAO stars within a specified region
PLFIND	LHW	Lowell Obs. Dec PDP-11/34	6/86 - 8/86	Performs a preliminary plate fit & creates a file of approx. (x,y) centers for SAO stars & unknowns
PLSCAN	LHW	Lowell Obs. Dec PDP-11/34	6/86 - 8/86	Performs raster scan centered on each (x,y) coordinate provided by PLFIND
PLCTR	LHW	Lowell Obs. Dec PDP-11/55 directory: [pack.utility]plctr	6/86 - 8/86	Determines the exact center of each star from density grid & fits gaussians to the profiles
PLFIT	LHW	Lowell Obs. Dec PDP-11/55 directory: [pack.utility]plfit	6/86 - 8/86	Performs final plate solution & calculates coordinates of unknowns
PLANETXYZ	LHW	Lowell Obs. Dec PDP-11/55 disk: test directory: [lhwoc.vax]planetxyz	6/86 - 8/86	Generates planet ephemeris

Software Reference
(Continued)

Program Name	Author*	Program Address	Dates Used	Purpose
CATPRD	LHW	Lowell Obs. Dec PDP-11/55 disk:work directory: [lhwoc.vax]catprd	6/86 - 8/86	Made predictions of occultations by comparing ephemeris generated with PLANETXYZ with coordinates from PLFIT
STAR_AVG	SEL	mit-astron Vax-11/750 directory: /usr/sel/space_tel /anita/star_avg	3/87	Calculated average coordinates for occultation candidates
OCCL_ PREDICT3.4	JAK	mit-astron Vax-11/750 directory: /usr/space_tel /stellar_occl /program_devl /occl_predict3 /occl_predict3.1 /bin/occl_predict3.4	3/87 - 4/87	Calculated final occultation circumstances for all stars

* RLW = Richard White, Space Telescope Science Institute (STScI)
LHW = Larry Wasserman, Lowell Observatory
SEL = Stephen Levine, Massachusetts Institute of Technology (MIT)
JAK = Julie Kangas, MIT

XII. APPENDIX D

Reprint Of Paper I
(Killian and Dalton, 1985)

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STELLAR OCCULTATIONS BY SATURN'S RINGS FOR 1985–1991

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ABSTRACT

Predictions are presented for occultations by Saturn's rings for 136 stars during the period 30 September 1985 through 15 December 1991, except for a few brief periods in 1988–1991.

I. INTRODUCTION

Because the rings of Saturn are very bright in the visible spectrum, they have proven to be difficult for providing quality photometric data for stellar occultations. Although crude ground-based visible work has been done, Voyager has been the only truly successful observer of a Saturnian ring occultation. However, the Space Telescope will be particularly well suited to observe these stellar occultations in the optical spectrum because its small focal-plane aperture affords the opportunity to observe stars fainter than possible with ground-based instruments. Furthermore, Saturn has a methane band reducing its brightness at 2 μ, and its rings have an ice band reducing their brightness at 3 μ. Hence, stars too faint in the visible region of the spectrum may allow the possibility for an event of reasonable signal-to-noise ratio in the infrared. For both the infrared and Space Telescope observing opportunities, stars fainter than those of the SAO catalog yield occultations of interest.

II. PROCEDURE

The National Geographic Society-Palomar Observatory Sky Survey (NGS-PSS) was used to search for candidate stars that were fainter than the limits of the SAO catalog. The Lowell Observatory PDS Microdensitometer, programmed to follow the Saturn ephemeris, was driven across $9'' \times 9''$ sheet film reproductions of the pertinent NGS-PSS E prints. We recorded what appeared (by eye) to be the brightest occultation candidates on the E prints for the period of 1985–1991. The plate reduction was performed using the SAO catalog as described by Millis *et al.* (1983). The search is complete through 15 December 1991, except for the periods given in Table I. The E prints were used so that the survey would necessarily include the brightest red stars, and these are the ones we anticipate being the brightest infrared stars as well.

To view as much of the print at a time as possible, the PDS aperture was left open and all "occultations" of the brightest stars, including near misses, were recorded. Circumstances were computed for all possible occultations by making a least-squares fit of the Saturn orbit to a daily ephemeris by using the software developed by L. Wasserman and E. Bowell (Millis *et al.* 1983) specifically for predicting occultations using the PDS. Stars within a strip 105 000 km from the center of the planet were included. 105 000 km was used as a large *planet* radius. As most of Saturn's motion was in right ascension, every occultation (including those by the *rings) would be included in a strip this wide in* declination, as well as allow enough margin for error. This yielded a preliminary list of 287 occultation candidates. We estimate that all of these 287 stars were within 40″ of the center of the planet's projected path.

At MIT, a more rigorous comparison was made between the coordinates of the stars that would be occulted by Saturn's A ring and the Saturn ephemeris by running D. Mink's occultation-prediction program for occultations by Saturn's A ring (the same software as used in Mink and Klemola 1985). Also, all stars closer than 40° from the Sun at the time of occultation were eliminated because of the poor observability of the events. Together, these left 136 of the original 287 stars as candidates. The diameters of the remaining 136 stars were measured on both the E and the O NGS-PSS prints with a Bausch and Lomb Acu-Rite II measuring system. This was done by recording the difference in position of the crosshairs of the eyepiece as they were aligned tangentially to the edge of the star image in both the *x* and *y* directions. Two people measured each star in both directions, and all values of the diameter measurements were averaged to give a single value for each star and for each print, O and E. The difference in diameter on the two prints can serve as a guide to relative spectral type for each star (King and Raff 1977). Thus, diameter size on the print was used as a relative measure of the actual magnitudes of the candidate stars, and the difference in a star's diameter on the two prints as a measure of color difference.

III. RESULTS AND DISCUSSION

Figure 1 shows the results of these diameter measurements. The values for the E diameter minus the O diameter (μm) versus the corresponding value for the E diameter (μm) are plotted for each of the 136 occultation stars. There is an estimated $\pm 10\,\mu$m error in the final diameter values due to inaccuracy in determining the actual edge of a star's image. We stress that these are not strict measurements of actual magnitudes but are merely size differences (and, therefore, approximate color differences) on the two prints. We expect the best infrared occultation candidates to be located toward the upper right-hand corner of the cluster of stars in the center of Fig. 1. These stars had the largest images on the E prints, as well as the greatest difference in image size between the E print and the O print, indicating

TABLE. I. Intervals not included in search.

Dates	Reason Not Included
1 Mar 1988 - 24 May 1988	Starfield too Dense
23 Nov 1988 - 21 Jan 1989	Starfield too Dense
14 Jan 1991 - 10 Mar 1991	Equipment Problems
2 Aug 1991 - 5 Dec 1991	Lack of time

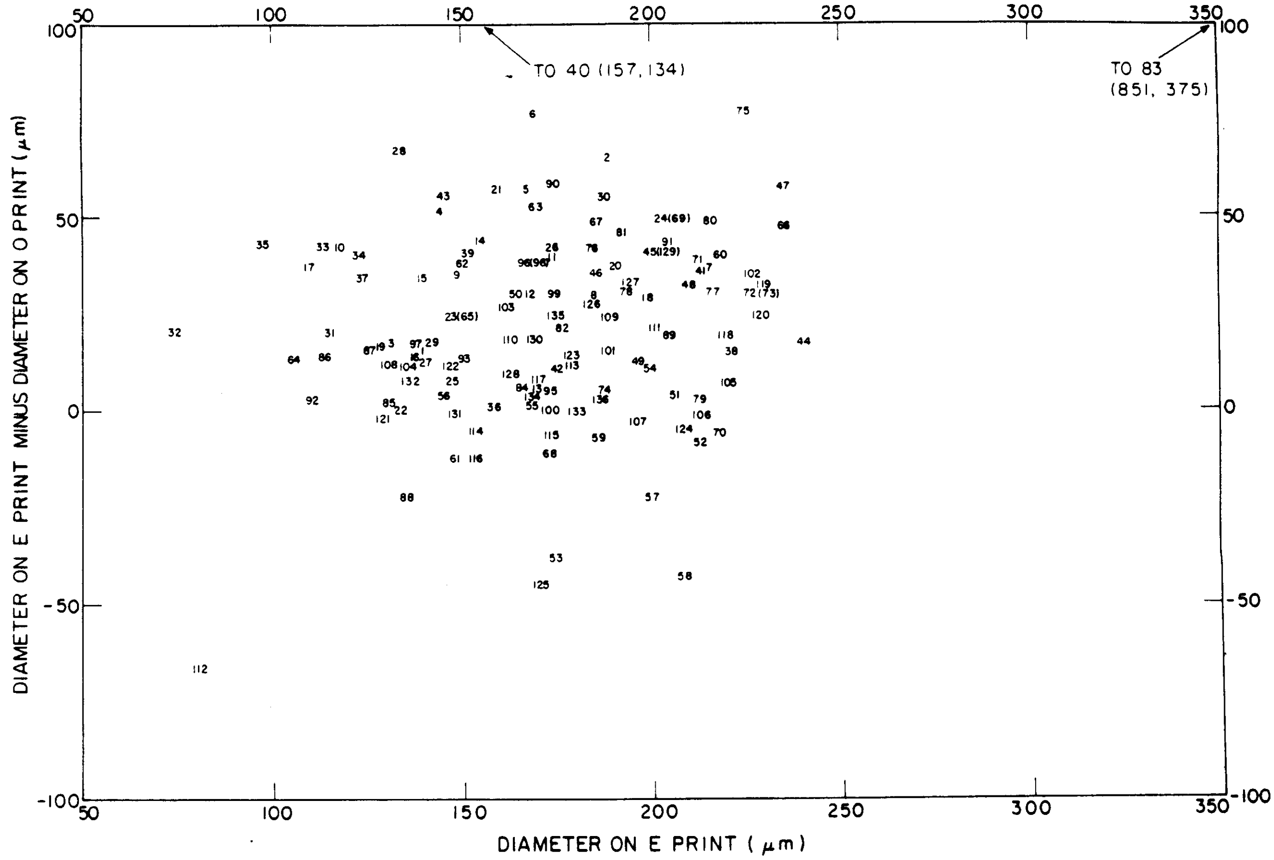

FIG. 1. Diameter of occultation stars on E print minus diameter of occultation stars on O print versus diameter of occultation stars on E print (see Table II). Numbers refer to stars listed in Table II with the "S" prefix dropped. Those in parentheses are stars located too close to neighboring stars to have been plotted clearly and can be assumed to lie directly under the numbers adjacent to them on the left. Stars 40 (S40) and 83 (S83) had diameter measurements too large to fit in the figure, and the numbers in parentheses beside them are their coordinates as given in Table II.

that the color of the star is shifted toward the red end of the spectrum. The best Space Telescope candidates will be those that lie on the right-hand side of the central cluster of stars in Fig. 1.

Table II gives the geocentric circumstances for all occultations plotted in Fig. 1. The stars occulted by Saturn are numbered chronologically, and the UT date and time of closest approach of the planet to the star as would be observed from the center of the Earth are given. "Imp." refers to the impact parameter or apparent minimum distance in arcseconds of the star from the center of the planet. As Saturn itself has a radius of 5″, any event with an impact parameter of 5″ or less would be a planetary occultation as well as a ring occultation. "Vel." refers to the apparent velocity in the plane of the sky of the planet relative to the star given in kilometers per second. The right ascension and declination are equinox 1950 and have no greater error than 0.1″. "E" and "E − O" refer to the diameter measurements in μm for each star on both prints and are the values plotted in Fig. 1. Numbers S44, S58, S60, and S83 have already been observed in *V* and *I* (French *et al.* 1985).

The search is complete through the time period already mentioned, and others are strongly urged to investigate the regions not covered (see Table I) for possible events.

Our prediction of the occultation of SAO 187255 (S83) in 1989 agrees with that made by Gordon Taylor (1983) to within 5″. We attribute this error to the fact that reproducing the NGS-PSS prints on a reduced scale caused an uncertainty in the actual star positions greater than that already inherent in the prints. This was our biggest source of error. It is important to note that the epoch of star positions is the epoch of the NGS-PSS prints at the time the prints were taken. No proper motion has been accounted for, and one would need the coordinates of each star at the epoch of its occultation to acheive the greatest possible accuracy in the predictions. As seen in Fig. 1, S83 (SAO 187255) is located so far to the upper right of the diagram that it is beyond the scale of the figure. The SAO catalog gives the red magnitude of SAO 187255 to be 4.5, which is why it has an enormous diameter (approximately 850 μm) on the E print. Photoelectric photometry done by French *et al.* (1985) on SAO 187255 (S83) confirms both of these observations.

Finally, a word of caution to all potential observers. The usefulness of these stars for occultation work greatly depends upon the many factors (outside the size of their image diameters on the NGS-PSS) that influence their observability: seeing, exact magnitudes (red and infrared), telescope size and location (ground-based or Space Telescope), instrument signal-to-noise, etc. We make no claims as to where these stars fall in any of these categories. Consequently, we stress that all observers thoroughly check an event that is of interest before planning to observe the actual occultation.

TABLE. II. Saturn ring occultations 1985–1991.

Num.	Date	U.T.	Imp. (arc sec)	Vel. (km/sec)	α(1950.0)			δ(1950.0)			E (μm)	E-O (μm)
	1985											
S1	30 Sep	14:12:56	4.86	29.69	15	29	47.264	-17	00	39.00	140	16
	1986											
S2	9 Jan	23:54:22	4.81	31.26	16	16	00.215	-19	26	54.31	194	65
S3	9 Jan	23:56:43	3.64	31.26	16	16	00.268	-19	26	53.25	131	17
S4	16 Jan	13:37:00	5.99	28.95	16	18	35.239	-19	32	35.38	145	51
S5	26 Jan	10:15:44	0.74	25.10	16	22	06.423	-19	40	12.46	167	57
S6	31 Jan	12:03:37	6.36	22.93	16	23	44.042	-19	43	33.30	169	76
S7	3 Feb	20:08:14	6.94	21.45	16	24	43.798	-19	45	28.60	215	36
S8	8 Feb	04:04:23	2.29	19.48	16	25	55.817	-19	47	36.56	185	29
S9	8 Feb	10:18:59	2.17	19.36	16	25	59.972	-19	47	39.51	149	35
S10	9 Feb	06:45:34	5.64	18.95	16	26	13.309	-19	47	59.75	118	42
S11	21 Feb	15:09:27	2.84	12.85	16	28	55.973	-19	52	25.89	174	40
S12	23 Feb	00:01:04	1.45	12.30	16	29	10.367	-19	52	50.27	168	30
S13	11 Mar	20:59:59	7.66	3.89	16	31	05.280	-19	54	39.27	170	6
S14	24 Apr	21:11:09	0.42	15.00	16	26	54.495	-19	40	06.67	155	44
S15	15 Jun	12:10:36	7.56	18.58	16	11	56.586	-19	05	08.88	140	34
S16	16 Jun	17:55:22	3.05	18.37	16	11	35.419	-19	04	34.45	138	14
S17	22 Jun	19:19:52	5.24	17.10	16	09	56.828	-19	01	00.15	110	37
S18	26 Jun	04:25:15	8.21	16.26	16	09	05.296	-18	59	13.04	198	29
S19	27 Jun	06:58:14	1.37	15.99	16	08	48.921	-18	58	50.26	129	17
S20	30 Jun	06:41:56	6.54	15.16	16	08	06.472	-18	57	33.06	190	37
S21	3 Jul	04:10:12	4.10	14.30	16	07	27.772	-18	56	18.07	159	58
S22	9 Jul	04:40:43	7.10	12.28	16	06	15.383	-18	54	00.49	133	0
S23	16 Jul	04:19:38	0.32	9.72	16	05	06.226	-18	52	26.32	147	24
S24	17 Aug	22:32:50	7.99	5.18	16	03	48.529	-18	56	23.31	203	49
S25	22 Aug	06:47:06	3.87	7.27	16	04	10.211	-18	58	30.07	147	8
S26	25 Aug	20:36:54	2.24	9.02	16	04	33.626	-19	00	32.11	174	41
S27	30 Aug	13:18:05	4.93	11.31	16	05	12.098	-19	03	27.20	140	13
S28	15 Sep	23:10:53	0.31	18.99	16	08	32.076	-19	16	05.40	134	67
S29	22 Sep	07:47:10	0.19	21.79	16	10	14.960	-19	21	58.55	141	17
	1987											
S30	28 Jan	01:53:06	3.12	28.98	17	06	49.410	-21	22	33.48	187	55
S31	9 Feb	20:52:26	0.83	23.87	17	11	22.442	-21	27	18.30	115	19
S32	15 Feb	21:33:08	7.69	21.21	17	13	13.515	-21	29	08.27	74	20
S33	16 Feb	01:46:17	1.21	21.16	17	13	16.602	-21	29	04.45	113	42
S34	16 Feb	05:22:24	4.94	21.08	17	13	19.188	-21	29	10.42	123	40
S35	17 Feb	03:54:39	5.50	20.66	17	13	35.294	-21	29	24.71	97	43
S36	19 May	04:30:57	4.19	18.06	17	12	03.531	-21	21	07.72	158	1
S37	19 May	07:07:00	4.31	18.08	17	12	01.696	-21	21	05.73	124	34
S38	19 May	18:30:24	3.57	18.17	17	11	53.640	-21	20	55.74	221	15
S39	21 May	04:04:24	6.64	18.44	17	11	29.696	-21	20	18.08	151	40
S40	21 May	04:25:22	2.66	18.44	17	11	29.390	-21	20	27.05	157	134
S41	29 May	09:15:39	2.56	19.62	17	09	02.322	-21	17	35.61	213	36
S42	21 Jun	15:05:39	3.72	19.47	17	01	45.288	-21	09	46.64	175	11
S43	25 Jun	00:35:31	1.85	19.03	17	00	43.903	-21	08	40.98	145	55
S44	25 Jun	11:27:09	8.56	18.96	17	00	35.807	-21	08	39.38	240	17
S45	11 Jul	08:30:56	2.79	15.47	16	56	18.432	-21	04	27.08	200	40
S46	16 Jul	02:32:31	2.60	14.06	16	55	13.610	-21	03	28.82	185	35
S47	3 Aug	09:01:55	2.89	7.31	16	52	13.239	-21	02	11.34	235	57
S48	8 Sep	00:47:47	6.33	9.57	16	52	37.842	-21	10	15.28	210	32
S49	11 Sep	14:26:38	1.43	11.40	16	53	09.036	-21	11	41.04	196	12
S50	6 Oct	14:16:41	5.70	22.82	16	59	01.303	-21	25	32.25	164	30
	1988											
S51	8 Feb	02:59:04	2.31	29.13	17	55	29.585	-22	19	27.50	206	4
S52	22 Feb	04:32:26	6.23	23.52	18	00	31.179	-22	19	19.83	212	-8
S53	10 Mar	03:48:48	4.07	15.78	18	05	08.551	-22	18	27.90	173	-38
S54	10 Mar	17:23:50	4.44	15.52	18	05	16.001	-22	18	34.11	198	11
S55	19 Mar	21:02:57	6.37	11.02	18	06	58.680	-22	17	57.73	168	3
S56	6 May	10:50:05	2.13	11.07	18	06	28.592	-22	16	12.83	145	4
S57	11 May	04:28:58	1.21	12.79	18	05	36.134	-22	16	18.45	200	-22
S58	13 May	05:29:36	6.80	13.51	18	05	11.154	-22	16	29.11	208	-43
S59	15 Jun	02:43:49	7.53	20.05	17	56	06.714	-22	17	23.37	185	-7
S60	7 Nov	10:29:05	5.62	30.92	17	55	33.888	-22	38	17.71	218	39
S61	8 Nov	03:47:47	4.45	31.16	17	55	51.857	-22	38	14.71	148	-13

TABLE. II. (continued)

Num.	Date	U.T.	Imp. (arc sec)	Vel. (km/sec)	α(1950.0)			δ(1950.0)			E (μm)	E-O (μm)
	1989											
S62	10 Feb	03:25:57	4.16	31.99	18	41	07.323	-22	24	55.71	150	39
S63	10 Feb	10:30:52	7.45	31.89	18	41	14.773	-22	24	37.20	169	52
S64	10 Feb	11:38:01	2.52	31.88	18	41	15.981	-22	24	41.02	106	13
S65	13 Feb	08:49:01	2.85	30.94	18	42	28.197	-22	23	32.67	147	24
S66	17 Feb	11:28:15	0.03	29.53	18	44	07.677	-22	21	58.14	235	47
S67	24 Feb	04:54:39	3.96	27.03	18	46	40.837	-22	19	15.74	185	48
S68	25 Feb	08:02:56	3.32	26.60	18	47	05.387	-22	18	56.69	172	-11
S69	10 Mar	07:16:42	1.39	21.12	18	51	18.208	-22	14	05.22	203	49
S70	2 Apr	20:06:09	1.96	9.94	18	56	24.672	-22	07	42.29	217	-6
S71	9 Apr	00:21:22	2.59	6.88	18	57	08.827	-22	06	44.60	212	38
S72	16 Apr	16:35:03	4.15	2.83	18	57	41.426	-22	06	10.97	227	30
S73	29 Apr	02:54:31	5.57	2.68	18	57	41.426	-22	06	10.97	227	30
S74	5 May	12:21:14	6.31	5.72	18	57	16.320	-22	06	51.67	187	5
S75	11 May	02:30:28	3.54	8.17	18	56	40.882	-22	07	57.46	224	77
S76	19 May	16:24:19	6.13	11.51	18	55	23.143	-22	09	46.82	184	42
S77	30 May	04:15:31	3.95	15.02	18	53	13.758	-22	13	09.06	216	30
S78	5 Jun	16:49:40	5.52	16.80	18	51	36.627	-22	15	20.14	193	31
S79	10 Jun	06:14:42	3.40	17.82	18	50	22.557	-22	17	07.68	212	3
S80	10 Jun	13:42:53	0.39	17.92	18	50	17.363	-22	17	18.82	215	49
S81	11 Jun	09:20:37	6.80	18.05	18	50	03.497	-22	17	31.14	192	46
S82	16 Jun	01:12:31	0.07	18.86	18	48	42.477	-22	19	31.15	176	21
S83	3 Jul	07:20:38	0.10	20.17	18	43	20.031	-22	26	44.75	851	375
S84	8 Jul	12:22:26	2.96	20.00	18	41	40.718	-22	28	57.10	166	6
S85	2 Aug	17:04:43	8.94	15.72	18	34	25.411	-22	38	02.29	131	2
S86	4 Aug	01:11:40	1.91	15.34	18	34	06.085	-22	38	38.47	114	14
S87	21 Sep	11:37:21	5.34	4.87	18	29	38.143	-22	48	01.25	126	16
S88	25 Sep	08:34:39	5.70	6.82	18	29	58.195	-22	48	15.63	135	-22
S89	19 Oct	16:24:41	5.13	18.65	18	34	24.437	-22	47	44.88	204	19
S90	24 Oct	22:20:34	2.97	21.04	18	35	51.364	-22	47	09.20	174	58
S91	29 Oct	03:12:43	2.55	22.90	18	37	07.869	-22	46	30.36	203	41
S92	30 Oct	13:54:19	6.60	23.54	18	37	35.530	-22	46	10.90	110	3
S93	1 Nov	02:46:15	0.87	24.17	18	38	05.693	-22	45	59.15	150	14
S94	4 Nov	23:55:57	4.64	25.77	18	39	25.186	-22	45	15.39	51	-4
S95	6 Nov	08:36:38	4.13	26.32	18	39	54.143	-22	44	55.85	171	6
S96	9 Nov	17:48:19	1.33	27.63	18	41	08.408	-22	44	01.74	166	38
S97	14 Nov	04:53:08	6.71	29.28	18	42	51.145	-22	42	37.17	138	17
S98	22 Nov	07:58:45	6.07	32.02	18	46	11.320	-22	39	51.62	165	38
S99	22 Nov	15:47:28	1.62	32.11	18	46	19.694	-22	39	51.90	174	30
	1990											
S100	21 Feb	17:28:58	3.85	31.99	19	30	04.754	-21	35	06.58	172	0
S101	7 Mar	03:46:18	3.01	27.28	19	35	20.552	-21	24	15.81	188	15
S102	12 Mar	13:14:45	3.70	25.15	19	37	13.625	-21	20	14.19	226	34
S103	23 Mar	15:15:21	6.68	20.39	19	40	37.769	-21	12	48.00	161	27
S104	24 Mar	20:50:00	0.97	19.86	19	40	58.024	-21	12	09.39	135	12
S105	5 Apr	05:55:13	1.02	14.52	19	43	38.730	-21	06	19.60	220	7
S106	15 Apr	11:12:20	5.51	9.54	19	45	21.331	-21	02	34.48	212	-1
S107	11 Jun	09:13:01	7.96	15.03	19	42	09.014	-21	14	41.86	195	-3
S108	29 Jun	18:35:28	8.46	19.09	19	37	15.596	-21	27	51.04	131	12
S109	5 Jul	10:50:38	4.76	19.72	19	35	32.737	-21	32	03.43	188	24
S110	12 Jul	14:56:26	1.70	20.12	19	33	19.185	-21	37	48.29	163	18
S111	13 Jul	15:51:20	6.19	20.13	19	32	59.550	-21	38	29.42	200	21
S112	21 Jul	14:18:57	9.33	19.93	19	30	30.615	-21	44	53.40	80	-66
S113	25 Jul	07:18:02	6.80	19.62	19	29	21.943	-21	47	38.13	178	12
S114	29 Jul	03:04:29	6.81	19.16	19	28	12.584	-21	50	25.64	153	-5
S115	2 Aug	02:05:03	2.70	18.55	19	27	02.813	-21	53	08.64	173	-6
S116	6 Aug	19:04:21	3.24	17.65	19	25	43.319	-21	56	11.73	153	-12
S117	9 Aug	20:25:15	5.01	16.97	19	24	54.143	-21	58	06.40	169	7
S118	30 Aug	08:35:47	9.24	10.52	19	20	30.315	-22	08	31.11	219	19
S119	27 Oct	21:18:58	3.77	17.05	19	22	47.994	-22	08	45.52	229	31
S120	2 Nov	20:20:18	4.31	19.83	19	24	19.371	-22	06	08.40	228	24
S121	5 Nov	12:19:47	1.06	21.02	19	25	04.340	-22	04	52.21	129	-2
S122	16 Nov	02:41:16	3.50	25.59	19	28	26.255	-21	58	43.75	147	12
S123	24 Nov	17:55:06	4.41	28.95	19	31	35.703	-21	52	25.00	178	14
S124	29 Nov	04:59:23	5.66	30.51	19	33	21.477	-21	49	00.47	208	-5
S125	4 Dec	21:08:23	4.07	32.35	19	35	42.487	-21	43	56.45	170	-45
	1991											
S126	12 Mar	19:57:07	7.00	29.55	20	21	27.828	-19	42	56.51	184	28
S127	15 Mar	02:27:27	3.39	28.74	20	22	19.174	-19	40	13.49	194	32
S128	27 Mar	19:33:43	0.72	23.73	20	26	40.737	-19	26	31.58	162	9
S129	16 Apr	11:45:08	3.72	14.90	20	31	45.968	-19	10	46.54	201	40
S130	30 Apr	02:29:05	8.15	8.22	20	33	55.435	-19	04	20.38	168	18
S131	3 Jul	05:16:11	7.62	17.47	20	28	13.380	-19	32	26.43	148	-1
S132	16 Jul	12:55:03	5.84	19.61	20	24	28.137	-19	46	45.01	136	8
S133	21 Jul	19:15:18	6.21	19.99	20	22	52.799	-19	52	26.11	179	0
S134	4 Aug	01:25:23	8.36	19.82	20	18	50.032	-20	07	17.44	168	5
S135	9 Aug	12:27:13	5.49	19.27	20	17	12.159	-20	12	58.97	174	24
S136	10 Dec	05:10:38	5.32	30.36	20	21	44.825	-20	02	20.24	186	4

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