the
WASP
Journal of the Warren Astronomical Society

SEPTEMBER 1982

WARREN ASTRONOMICAL SOCIETY HOSTS SUCCESSFUL REGIONAL CONVENTION

Warren Astronomical Society Paper

EDITORS: Frank McCullough
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The W.A.S.P. is the official publication of the Warren Astronomical Society and is available free to all club members. Requests by other clubs to receive the W.A.S.P. and all other correspondence should be addressed to the editor at the above address. Articles should be submitted at least one week prior to the general meeting.

W.A.S.

Warren Astronomical Society
P.O. Box 474
East Detroit, MI 48021

President:	Doug Bock	533-0898
1st V.P.:	Frank McCullough	759-5215
2nd V.P.:	Ron Vogt	545-7309
Secretary:	Ken Kelly	839-7250
Treasurer:	John Wetzel	882-6816

The Warren Astronomical Society is a local, non-profit organization of amateur astronomers. The Society holds meetings on the first and third Thursdays of each month. The two meeting locations are listed below:

1st Thursday – Cranbrook Institute of Science
500 Lone Pine Road
Bloomfield Hills, MI

3rd Thursday – Macomb County Community College – South Campus
B Building (b209)
14500 Twelve Mile Rd.
Warren, MI

Membership is open to those interested in astronomy and its related fields. Dues are as follows and include a year's subscription to Sky and Telescope.

Student $18.00	College $22.00	Senior Citizen $22.00
Individual $27.00	Family $32.00	

Stargate

Observatory Chairman: Ron Vogt 545-7309

Stargate Observatory is owned and operated by the Warren Astronomical Society in conjunction with Rotary International. Located on the grounds of Camp Rotary, Stargate features a 12½" club-built Cassegrainian telescope under an aluminum dome. The observatory is open to all club members in accordance with the "Stargate Observatory Code of Conduct".

Lectures are given at Stargate Observatory each weekend. The lecture will be either Friday or Saturday night, depending on the weather and the lecturer's personal schedule. If you cannot lecture on your scheduled weekend, please call the Chairman as early as possible or contact an alternative lecturer. Those wishing to use Stargate must call by 7:00 p.m. on the evening of the observing session. The lecturers for the coming month are:

Sep 3/4	Doug Bock	533-0898	Oct 1/2	Dave Harrington	879-6765
Sep 10/11	Ken Strom	977-9489	Oct 8/9	Frank McCullough	254-1786
Sep 17/18	John Root	464-7908	Oct 15/16	Ron Vogt	545-7309
Sep 24/25	Lou Faix	781-3338	Oct 22/23	Alan Rothenberg	355-5844
			Oct 29/30	Doug Bock	533-0898

MINUTES OF THE JUNE 17, 1982 GENERAL MEETING

The meeting was called to order at about 7:45 p.m.
a TV movie, 'the greatest adventure' was shown.
Under old business, the President, Doug Bock, reiterated the election of officers which was held during the May meeting:

President: Doug Bock
1st V.P. : Frank McCullough
2nd V.P. : Ron Vogt
Secretary: Ken Kelly
Treasurer: John Wetzel

The campout on Memorial Day weekend was discussed.

Under new business, the President discussed coming events as follows:

June 19 - members' night at Cranbrook. bring telescopes – 7:00 p.m.
June 25 - observing session at Stargate. If cloudy, it will be held at Frank McCullough's apartment.
July 1 - Cranbrook meeting - 7:30 p.m.
July 6 - lunar eclipse.
July 15 - general meeting at M.C.C.C. - 7:30 p.m.
July 16 thru 18 - 1982 Great Lakes Astronomical League Convention at Cranbrook. Open to the public. Program starts at 9:00 a.m. on July 17. there will be amateur talks, lunch, afternoon talks, and a banquet with a professional speaker. On Sunday, there will be a barbecue and an observing session. Awards will be given at a telescope fair.
July 23 - star party at Stargate or Frank's at 9:30 p.m.

The president stated that our by-laws have been revised and that we will soon be incorporated. We will have to get our own tax exemption under section 501(c)(3). Hopefully, the revised by-laws will be ready for final approval before our July 15 meeting.

In order to speed up the process, we will send out a letter to each member with a copy of the by-laws, giving notification that a vote will be taken at the Cranbrook meeting on whether or not to approve the revised by-laws, so that the incorporation can be completed before the convention.

Under current events, it was stated that there was a giant naked-eye sunspot on the sun.
Awards were given to Roger Tanner, Ken Kelly and Craig Kruman.
Frank McCullough gave a good talk on the July 6 lunar eclipse. he also showed slides of previous eclipses.

The meeting ended at about 11:00 p.m.

Respectfully submitted.
Ken Kelly,
Secretary

MINUTES OF THE JULY 15, 1982 GENERAL MEETING

The meeting was called to order at about 8:00 p.m.
Doug Bock discussed finding Messier objects near the Big Dipper.
Doug Bock also showed his slides on the lunar eclipse.

Under future events:

There will be a star party on July 25 at Stargate.
The August campout will be held Aug. 13 thru 15. It will cost $5.00 for the weekend. Bring your own food and equipment.
Other proposed field trips were discussed.

Under old business:

The lunar eclipse events were described.

Under new business:

The articles of incorporation are being filed, so we will be incorporated for the convention. We will be voting on the revised by-laws in September. The latter were discussed briefly. The convention starts tomorrow.
The treasurer gave a brief report.

Comet Austin, 1982g was announced and discussed.

A movie, 'the sunspot mystery' was shown.

The meeting ended at about 10:50 p.m.

Respectfully submitted.
Ken Kelly,
Secretary.

ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

Comets Section July 15, 1982

NEW COMET AUSTIN 19829 was discovered at 10th magnitude on June 18th by Rodney Austin of New Plymouth, New Zealand. Albert Jones at Nelson, New Zealand, estimated its magnitude as 10.8 on June 26.76 UT in a 12½-inch reflector. The comet should be 4th magnitude when it becomes visible to United States observers about August 14th in the evening sky. Conditions are very favorable for the week following Aug. 14th, with new moon occurring on the 19th.

This ephemeris was supplied by George East of the ATM's of Boston, using elements by Brian Marsden on IAU Circular 3708.

The columns give: RA and Dec for 1950 at Oh UT; Delta, the Earth to comet distance in astronomical units; R, sun to comet distance (AU); CBS, comet-earth-sun angle in degrees; TL, tail length as millions of kilometers per degree at R of comet; Mag, from 8.0 + 5 log delta + 10 log r; PA, tail position angle or apparent position angle of radius vector through comet; ALT, altitude of comet when the sun is 102° from the zenith (nautical twilight); Time, end of evening nautical twilight. The time is local standard time at latitude +40°. A correction must be added based on your longitude east or west of a standard meridian, as explained in the Graphic Ephemeris on page 55 of the January Sky and Telescope.

Perihelion date	Aug 24.5640, 1982
Perihelion distance	.648590
Longitude of perihelion	33.7190
Ascending node	325.3660
Inclination	84.5180
Eccentricity	1.000000

The enclosed section of the Skalnate Pleso Atlas of the Heavens has some visual magnitudes from (Sky Catalogue 2000) noted along the comet's path. In addition, the AAVSO Variable Star Atlas is a convenient source of magnitudes. Bright stars are listed in the Arizona Tonantzintla catalog.

Tail lengths can be estimated using these angular distances of circumpolar stars.

Alpha Cas	-	Gamma Cas	4°.7	Beta Cas	-	Epsilon Cas	13.3
Alpha UMa	-	Beta UMa	5.4	Alpha UMa	-	Epsidon UMa	15.2
Gamma Cas	-	Beta Cas	6.2	Polaris	-	Gamma Ca.	28.6
Gamma Cas	-	Epsilon Cas.	7.3	Polaris	-	Alpha UMa	28.7
Alpha UMa	-	Delta UMa	10.2	Polaris	-	Delta UMa	33.6
Beta UMa	-	Delta UMa	10.1	Polaris	-	Beta UMa	34.1

I have had to add additional postage to most of the envelopes for this mailing (120). Thus, if it has been a number of years since you sent me stamped envelopes, I would appreciate another batch. I'll be seeing you at the Peoria ALPO convention.

Dennis Milon, 8 Grant St., Maynard, Mass. 01754

AUSTIN 1982 G 1950 COORDINATES

Aug, 1982

	R	A	Dec		Delta	R	CES	TL	Mag	5logD	logR	P A	Alt	Time	
1	6	5.29	-15	24.1	.441	.814	51.1	1.2	5.3	-1 .78	-.089	309.8	.0	1	50
3	6	22.83	-10	31.6	.400	.191	45.9	1.1	5.0	-1 .99	-.102	307.7	.0	3	52
5	6	43.13	- 4	28.9	.366	.168	39.4	1.1	4.1	-2.18	-.115	304.3	.0	3	55
7	7	8.41	2	46.2	.340	.147	31.8	1.2	4.4	-2.34	-.127	297.9	.3	3	57
9	7	37.26	10	57.0	.326	.727	23.7	1.5	4.2	-2.43	-.138	285.3	1.8	3	59
11	8	9.73	19	21.0	.325	.709	17.2	2.0	4 .1	-2.44	-.149	279.9	3.2	4	2
13	8	44.74	27	2.5	.338	.694	15.7	2.2	4 .1	-2.35	-.159	318.3	4.2	4	4
15	9	20.37	33	18.4	.364	.680	19.2	1.9	4.1	-2.19	-.168	349.1	4.7	4	7
17	9	54.47	37	54.7	.400	.668	24.3	1.7	4.3	-1.99	-.175	7.0	1.4	19	60
19	10	25.31	41	1.6	.444	.659	29.0	1.6	4.4	-1.76	-.181	17.9	13.2	19	56
21	10	51.94	42	59.0	.494	.653	32.7	1.5	4.6	-1.53	-.185	25.1	17.5	19	53
23	11	14.20	44	7.0	.548	.649	35.6	1.6	4.8	-1.31	-.187	30.0	20.7	19	50
25	11	32.42	44	41.3	.604	.649	37.1	1.7	5.0	-1.09	-.188	33.3	23.1	19	46
27	11	41.17	44	53.1	.662	.651	39.3	1.8	5.2	-.90	-.187	35.4	24.1	19	43
29	11	59.04	44	49.9	.720	.655	40.3	1.9	5.5	-.11	-.183	36.6	25.8	19	40
31	12	8.58	44	36.6	.779	.663	41.0	2.0	5.7	-.54	-.179	37.0	26.4	19	36

Sep, 1982,

	R	A	Dec		Delta	R	CES	TL	Mag	5logD	logR	P A	Alt	Time	
3	12	19.54	44	4.9	.866	.679	41.6	2.3	6.0	-.31	-.168	36.1	26.8	19	31
8	12	31.70	42	55.5	1.007	.717	41.7	2.8	6.6	.01	-.144	34.3	26.4	19	22
13	12	39.30	41	38.5	1.138	.767	41.3	3.4	7 .1	.28	-.115	30.3	25.2	19	13
18	12	44.40	40	21.4	1.259	.825	40.9	11.1	7.7	.50	-.083	25.4	23.6	19	5
23	12	48.12	39	7.9	1.368	.890	40.5	4.9	8.2	.63	-.051	19.9	21.7	18	56
28	12	51.05	37	59.8	1.466	.959	40.5	5.6	8.6	.83	-.018	13.9	19.7	18	48

Oct, 1982

	R	A	Dec		Delta	R	CES	TL	Mag	5logD	logR	P A	Alt	Time	
3	12	53.52	36	58.2	1.554	1.031	40.8	6.4	9.1	.96	.013	7.8	17.7	18	39
8	12	55.69	36	3.5	1.631	1.104	41.6	7.1	9.5	1.06	.043	1.7	15.6	18	31
13	12	57.64	35	15.8	1.698	1.179	42.8	7.7	9.9	1.15	.072	355.6	17.9	5	9
18	12	59.40	34	35.2	1.756	1.255	44.4	8.3	10.2	1.22	.098	349.8	21.3	5	14
23	13	.96	34	1.9	1.804	1.330	46.4	8.7	10.5	1.28	.124	344.3	25.0	5	19
28	13	2.30	31	35.7	1.844	1.405	48.8	9.1	10.8	1.31	.148	339.1	28.9	5	24

Nov, 1982

	R	A	Dec		Delta	R	CES	TL	Mag	5logD	logR	P A	Alt	Time	
2	13	3.38	33	16.7	1.817	1.481	51.6	9.3	11.1	1.37	·170	334.3	33.0	5	29
7	13	4.16	33	4.9	1.901	1.555	54.7	9.5	11.3	1.40	.192	329.8	37.3	5	35
12	13	4.60	33	.4	1.919	1.630	58.1	9.7	11.5	1.42	.212	125.6	41 .9	5	40
17	13	4.64	33	3.2	1.930	1.703	61.8	9.9	11.7	1.43	.231	321.6	46.6	5	45
22	13	4.21	33	13.6	1.936	1.776	65.8	10.0	11.9	1.43	.249	317.8	51.4	5	50
27	13	8.23	33	31.3	1.987	1.849	70.0	10.1	12.1	1.44	.267	314.2	56.4	5	55

HERE COMES A BRAND NEW COMET

by
Larry F. Kalinowski

Late August should prove to be very interesting for sky watchers in the northern hemisphere. Comet Austin, recently discovered by Rodney Austin of New Plymouth, New Zealand, on June 18th, should be coming our way about the middle of August.

About August 17th, the comet should make itself visible for evening observers. However, its close proximity to the Sun and horizon will make it difficult for the casual observer to see.

Comet Austin (1982g) was tenth magnitude during the time of discovery but should reach fourth magnitude by the time it reaches perihelion, its closest approach to the Sun, on August 24th.

The best viewing will probably be during the third and fourth week in August when it will move higher into the northwest sky and should be visible for about two hours after evening twilight. The comet will reach an altitude of twenty-six degrees at the end of August according to the ephemeris mailed to me by Mr. Dennis Milon of the A.L.P.O. comets section.

Binoculars are suggested for initially locating the new celestial visitor. If a tail develops as it moves around the Sun, it could fill the entire view of your binoculars. Look for the comet's head as you scan the sky. Since the head is the brightest part of a comet, that will be the part you'll spot first. If there isn't any tail or a very small one, the head of the comet will resemble an out-of-focus star or compact nebula.

Fourth magnitude is just on the limit of visibility if you're a city dweller like me, so don't expect the comet to jump out at you if you're trying to spot it without any optical aid. It won't be easy in the country either.

For many of you, this may be the first comet you're going to get a chance to observe. If you have a tripod, buy a binocular to tripod adapter. They're only three or four dollars and can be a valuable asset in comet hunting. You'd be surprised how fast your arms become weary scanning the sky.

Here's a short ephemeris for the experienced observers:

DATE	R.A.	DEC.	ALT.
8/17	9h 54m	+37.9 deg.	7.4 deg.
8/19	10h 25m	+41.0 deg.	13.2 deg.
8/21	10h 52m	+43.0 deg.	17.5 deg.
8/23	11h 14m	+44.1 deg.	20.7 deg.
8/25	11h 32m	+44.7 deg.	23.1 deg.
8/27	11h 47m	+44.9 deg.	24.7 deg.
8/29	12h 00m	+44.8 deg.	25.8 deg.
8/31	12h 08m	+44.6 deg.	26.4 deg.

In all of the cases above, the positions and altitudes are given for the period just after evening twilight.

THE GREAT AURORA DISPLAY OF JULY 13, 1982

Jonathan Baditoi

The July 13th meeting of the Michigan State University Astronomy Club had just adjourned at 10:00 p.m., and I stepped outside to determine whether the skies were clear enough for a short observing session. Although twilight was still in progress, I immediately noticed a series of bright rays stretching out from the zenith in all directions. I remembered hearing on the radio that morning tha there had been an intense solar flare the previous day, and that auroral activity was expected.
As the spectacle went on, several club members noticed colors in the aurora. At about 10:30, the entire northern sky was bathed in a bright green light, especially to the northwest, where the dark silhouettes of distant clouds could be seen against the auroral glow. Higher up in the north, shades of pink and red could be seen and some of the bright rays emanating from the zenith were distinctly purple. At times, the aurora was so bright, it was difficult to see even the brighter stars, and the most frequent question asked by club members was, "Are you sure those aren't clouds?" Several members remained until 11:00 to watch the display, and it proved to be a perfect climax to the M.S.U.A.C. meeting.

By 11:30, I had made my way out to my favorite observing site, on Hagadorn Road, about four miles from campus. It's usually so dark out there that you have difficulty seeing more than a few feet in front of you, but on this night the whole landscape around me was clearly visible, and the reason was clear, the entire sky, from horizon to horizon, had taken on an eerie green glow. At first, I thought I was looking at cirrus clouds, but I soon noticed quite a bit of rapid movement to the glow. I watched for over an hour as bright patches and rays appeared and disappeared, and occasionally darted across the sky at amazing speeds. I have never seen such an active aurora!

An attack by mosquitoes forced me to head for home at 12:30, but brief checks of the sky at 1:00 and 2:00 revealed the show to still be in progress, although by 2:00, it seemed to have quieted down to an even glow, with no movement evident.

A LUNAR EPHEMERIS - PART I

by Ken Kelly

What is a lunar ephemeris? In general, an ephemeris is a table of positions of a celestial body for given instants of time. A lunar ephemeris is a table of positions of the moon. Tables of positions become more useful with a method of interpolation. See, for example, my third order interpolation program in the Dec.80/Jan.81 issue of the WASP. However, this method of interpolation is not too successful for the moon because of the complexities of its motions.

Many amateur astronomers now have home microcomputers, so it is now possible for them to compute the positions of celestial bodies for any given instant of time, providing that they have the proper programs, which are simply not available at the present time. The purpose of these articles in the wasp, then, is to provide the amateur astronomers ,with the programs, so that positions of all of the major solar system bodies can be computed for any given instant of time.

Prior to the advent of the 'almanac for computers' (Nautical Almanac Office, U.S. Naval Observatory) in 1977, there was really no possibility of an amateur astronomer computing his very own ephemeris of these bodies. Besides, he had to have access to a large computer because home computers were simply not on the market before that time.

As stated in my article in the July issue of the WASP it is really easy to use the Chebyshev Polynomials as given in the 'Almanac for Computers' (abbreviated a/c). However, it helps tremendously if one can load these on disks for future use so that they do not have to be typed in every time that one needs an ephemeris. The purpose of the three following programs is to: A. load (or create) the Chebyshev Polynomials and store them on disk. B. print out the polynomials so that they can be manually checked. C. update a polynomial in case an error was discovered later.

These programs were written for a TRS-80 model I with disk basic. However, it should be easy to change the program for use by most home computers, depending on your system and configuration.

The first program, 'LOADCHBY', loads the Chebyshev Polynomials on disk. The first and last valid Julian dates are used by the ephemeris program, to check to make sure that you are not using the polynomials for a time period beyond the validity of the series. Everything conceivable for use by a program is put on the file, including the sum of the terms so that the validity of the data can be checked. If the entered sum is not equal to the sum of terms added up in the program, then you should go into the recovery routine in order to correct the wrong terms. Sometimes a digit will be found in the 16th position to the right of the decimal point. This will cause the computer to give an unequal condition, but you have the option to bypass it, and write the file if the displays are otherwise equal. You should use double precision if it is available on your machine because many of the terms will exceed single digit precision.

The file and label conventions are as follows:

A. For sidereal time, use the terms in A/C on pages D2 thru D5. Only the apparent sidereal time is needed. For the label, use 'SIDTyyqq' where yy is the year and qq is the quarter of the year. For example, for July 1982 use 'sidt8203'.

B. For the lunar coordinates, use the terms on pages D8 thru D19. The first three polynomials on each page are needed. For the labels use 'LUNpyymm' where p is the polynomial designation as follows:

R = right ascension
D = declination
H = horizontal parallax
yy is the year, and mm is the month number.

For example, for the July 1982 right ascension, use 'lunr8207'. Only one set of lunar polynomials needs to be created for each month.

The second program, 'PRNTCHBY', prints out the contents of any Chebyshev file on disk. Because of a fluke in the TRS-80 'read' software, on occasion some extra digits are inserted to the right of the least significant digit. The program fixes this up by rounding to the proper significant digit immediately after reading each number.

The third and final preliminary program is UPDTCHBY' and is used in emergency situations where the polynomial was was created. but an error discovered later. With this program, a series can be corrected without having to recreate it from scratch.

Part II of this series will contain the program for calculating the lunar geocentric coordinates. Part III will contain the routines for calculating topocentric coordinates and will enable one to either predict an occultation, or calculate the position of an unknown occulted star for identification purposes.

```
10 ' "LOADCHf.Y" - PROGRAM TO LOAD CHEBYSHEV POLYNOMIALS TO DISK - BY KEN KELLY.
20 '
30 CLEAR5000: DEFSNGA: DEFDBLB-H:DEF INTI-N: DEFSTRO: DEFSNGW
40 DIMCC(37):OS="  ##      +###.#########"
50 INPUT"ENTER OUTPUT DISK LABEL AND DRIVE ";OL,ID
60 0D=":1":OI=STR$(ID)
70 MID$(OD,2,1)=MID$(OI,2,1)
80 OF=OL+OD:PRINTOF;:INPUT" OK";O:IFO="N"THEN50
90 INPUT"ENTER FIRST VALID JULIAN DATE ";DF:PRINTDF;: INPUT" OK";0:IFO="N"THEN90
100 INPUT"ENTER LAST VALID JULIAN DATE ";DL:PRINTDL;:INPUT" OK";O:IFO="N"THEN100
110 INPUT"ENTER CONSTANT A ";AA:PRINTAA;: INPUT" OK" ;0: IFO=”N"THEN110
120 INPUT"ENTER CONSTANT B ";BB:PRINTBB;I:INPUT" OK" ;0: IFO="N"THEN120
130 INPUT"ENTER CONSTANT W ";WW:PRINTWW;:INPUT" OK";O:IFO="N"THEN130
140 INPUT"ENTER HIGHEST N ";NN:PRINTNN;:INPUT" OK";0:IF0="N"THEN140
150 CZ=0,
160 FORN=0TONN:PRINTN;
170 INPUT"ENTER TERM ";CN
180 CC(N)=CN
190 CZ=CZ+CC(N) ' ADDS UP THE SUM OF THE TERMS.
200 NEXT
210 INPUT"ENTER SUM OF TERMS ";CS
220 PRINT USING OS;98;CS
230 PRINT USING OS;99;CZ
240 IFCS=CZTHEN360
250 INPUT"OK";O:IFO="Y"THEN360
260 '
270 ' *** ROUTINE TO RECOVER WRONG TERMS
280 '
290 N=12:CZ=0
300 PRINTN;:PRINTCC(N);:INPUT"CORRECT";O
310 IFO="Y"THEN330
320 INPUT"INPUT CORRECT TERM";CC(N):GOT0300
330 CZ=CZ+CC(N):N=N+1:IFN<=NNTHEN300
340 G0T0210 .
350 '
360 ' *** ROUTINE TO WRITE DISK FILE
370 '
380 OPEN"0",2,0F
390 PRINT#2,DF;DL;AA;BB;WW;NN
400 FORN=0TONN
410 PRINT#2,CC(N) ' WRITES ACTUAL POLYNOMIAL TO DISK.
420 NEXT
430 PRINT#2,CZ ' WRITES SUMMARY RECORD TO DISK.
440 CLOSE:END
```

```
10 ' "PRNTCHBY" — PROGRAM TO PRINT DISK FILES CONTAINING CHEBYSHEV POLYNOMIALS -
BY KEN KELLY.
20 '
30 CLEAR5000: DEFSNGA: DEFDBLB-H: DEFINTI-N: DEFSTRO: DEFDBLP-Z
40 DIMCC(37):OS=CHR$(10):CZ=0
50 INPUT"ENTER INPUT DISK LABEL AND DRIVE ";OL, ID
60 0D=":1":OI=STR$(ID)
70 MID$(OD,2,1)=MID$(OI,2,1)
80 INPUT"ENTER NUMBER OF DIGITS TO RIGHT OF DECIMAL POINT";IT
90 T8=100000000:T7=10000000:T6=1000000:T5=100000:T4=10000:CP=T8
100 IFIT=8THENCP=T8
110 IFIT=7THENCP=T7
120 IFIT=6THENCP=T6
130 IFIT=5THENCP=T5
140 IFIT=4THENCP=T4
150 OF=OL+OD:LPRINT"LISTING OF FILE ";OF;OS:PRINT"LISTING OF FILE ";OF:CZ=0
160 0PEN"I",1,OF
170 INPUT#1,DF.DL,AA,BB,WW,NN
180 FORN=0TONN
190 INPUT#1,CN
200 CO=INT(CP*CN+.5) ' ROUNDS NUMBER TO ELIMINATE UNWANTED DIGITS PICKED UP BY R
EAD SOFTWARE
210 CN=CO/CP
220 CC(N)=CN
230 CZ=CZ+CC(N)
240 NEXT
250 INPUT#1, CS
260 OJ=" %%            ########.# "
270 OA=" %%          ##.# "
280 OP·= %%        +###.##########"
290 OC=" ##       +###.##########"
300 OW=" %%        ### "
31(21 OM=" %%       ## "
320 LPRINT USING OJ;"DF";DF
330 LPRINT USING OJ;"DL";DL
340 LPRINT USING OA;"AA"; AA
350 LPRINT USING OB;"BB";BB
360 LPRINT USING OW;"WW";WW
370 LPRINT USING OM;"NN";NN;OS
380 FORN=0TONN
390 LPRINT USING OC;N;CC(N)
400 NEXT
410 LPRINT
420 LPRINT USING OB;"CS";CS
430 LPRINT USING OB?;"CZ";CZ
440 CLOSE:END
```

```
10 ' "UPDTCHBY" - PROGRAM TO UPDATE CHEBYSHEV POLYNOMIAL DISK FILES - BY KEN KELLY.
20 CLEAR5000:DEFSNGA:DEFDBLB-H:DEFINTI-N:DEF5TRO:DEFSNGW
30 DIMCC(37):OS=" ## +###.#########":CZ=0
40 INPUT"ENTER INPUT DISK LABEL AND DRIVE ";OL,ID
500D=":1":OI=STR$(ID)
60 MID$(OD,2,1)=MID$(OI,2,1)
70 OF=OL+OD:PRINTOF
80 INPUT"ENTER NUMBER OF DIGITS TO RIGHT OF DECIMAL POINT";IT
90 T8=100000000:T7=10000000:T6=000000:T5=100000:T4=10000:CP=T8
100 IFIT=7THENCP=T7
110 IFIT=6THENCP=T6
120 IFIT=5THENCP=T5
130 IFIT=4THENCP=T4
140 0PEN"I",1,0F
150 INPUT#1,DF,DL,AA,BB,WW,NN
160 PRINT"DF=";DF;:INPUT"OK";O
170 IFO="Y"THEN190
180 INPUT"ENTER DF";DF:GOT0160
190 PRINT"DL=";DL;:INPUT"OK";O
200 IFO="Y"THEN220
210 INPUT"ENTER DL";DL:GOT0190
220 PRINT"AA="'AA;:INPUT"OKa;O
230 IFO="Y"THEN250
240 INPUT"ENTER AA";AA:GOT0220
250 PRINT"BB=";BB;:INPUT"OK";O
260 IFO="Y"THEN280
270 INPUT"ENTER BB";BB:GOT0250
280 PRINT"WW=";WW;:INPUT"OK";O
290 IFO="Y"THEN310
300 INPUT"ENTER WW",WW:GOT0280
310 PRINT"NN=";NN;:INPUT"OK";O
320 IFO="Y"THEN340
330 INPUT"ENTER NN";NN:GOT0310
340 FORN=0TONN:INPUT#1,CN:CO=INT(CP*CN+.5):CN=CO/CP
350 CC(N)=CN
360 PRINTN;:PRINTCC(N);:INPUT"OK";O
370 IFO="Y"THEN390
380 INPUT"ENTER TERM";CN:GOT0350
390 CZ=CZ+CC(N)
400 NEXT:CLOSE
410 INPUT"ENTER SUM OF TERMS ";C8
420 PRINT USING OS;98;C5
430 PRINT USING 0S;99;CZ
440 IFCS=CZTHEN520
450 INPUT" OK";0: IFO="Y"THEN520
460 N=0:CZ=0
470 PRINTN;:PRINTCC(N);:INPUT"CORRECT";O
480 IFO="Y"THEN500
490 INPUT"INPUT CORRECT TERM";CC(N):GOT0470
500 CZ=CZ+CC(N):N=N+1:IFN<=NNTHEN470
510 GOT0410
520 OPEN"O",2,OF
530 PRINT#2,DF;DL;AA;BB;WW;NN
540 FORN=0TONN:PRINT#2,CC(N):NEXT
550 PRINT#2,CZ
560 CLOSE:END
```

FOURTH ORDER INTERPOLATION PROGRAM

```
10 ' "INTERP04" - PROGRAM TO COMPUTE FOURTH ORDER INTERPOLATION. FOR PLANETARY AND
COMETARY FOSITIONS - BY KEN KELLY.
20 '
30 CLS:PRINTCHR$(23):PRINT"4TH ORDER INTERPOLATION PROGRAM":DEFDPLA-H=DEFINTI-N:
DEFSTPO:DEFSNGP-Z:I=0:PRINT"ENTER FIVE POSITIONS"
40 OO="%              % ##   ## %                      % ## ##.## %          % +### +###.#"
50 I=1+1
60 FRINT"ENTER POSITI0N";I;:INPUT"R.A. HR. MIN";AH,AM
70 IFAH>250RAM>59.9GOT060
80 INPUT"DEC. DEG. MIN";DD,DM
90 IFDD<-89.90RDD>89.90RDM<-59.90RDM>59.9GOT080
100 AA=AH+AM/60
110 IFDD=0THEN130
120 DG=SGN(DD):DD=ABS(DD):DA=DG*(DD+DM/60):GOT0140
130 DA=DM/60
140 IFI=1THENA0=AA:D0=DA:GOT050
150 IFI=2THENA1=AA:D1=DA:GOT050
160 IFI=3THENA2=AA:D2=DA:GOT050
170 IFI=4THENA3=AA:D3=DA:GOT050
180 IFI=5THENA4=AA:D4=DA
190 AB=AI-A0:AC=A2-A1:AD=A3-A2:AE=A4-A3
200 AG=AC-AP:AH=AD-AC:AI=AE-AD
210 AL=AH-AG:AM=AI-AH
220 AQ=AM-AL
230 DA=DI-D0:DB=D2-D1:DD=D3-D2:DE=D4-D3
240 DG=DB-DA:DH=DD-DP:DI=DE-DD
250 DL=DH-DG:DM=DI-DH
260 DQ=DM-DL
270 INPUT"ENTER DAY AND E.T. OF FIRST POSITION";FD,FH
280 INPUT"ENTER TIME BETWEEN CONSECUTIVE POSITIONS IN DAYS";TL
290 INPUT"ENTER TIME INCREMENT IN DAYS, HRS";TD,TH
300 TZ=4*TL
310 TS=0:GOT0330
320 T0=TS/TL
330 T1=T0*(TS-TL)/2/TL
340 T2=T1*(TS-2*TL)/3/TL
350 T3=T2*(TE-3*TL)/4/TL
360 RA=A0+T0*AB+T1*AG+T2*AL+T3*AQ
370 DC=D13+T0*DA+T1*DG+T2*DL+T3*DG
380 GOSUB440
390 TS=TS+TD+TH/24
400 FD=FD+TD:FH=FH+TH
410 IFFH>23THENFD=FD+1:FH=FH-24
420 IFFD>31THENFD=FD-31
430 IFTS>TZTHEN460 ELSE320
440 LPRINT USING OO;"POSITION FOR DAY";FD;FH; "HOURS E.T. IS - R.A. =";INT(RA);(R
A-INT(RA))*60;"- DEC. =";SGN(DC)*INT(ABS(DC));SGN(DC)*(ABS(DC)-INT(ABS(DC)))*60
450 RETURN
460 END
```

Comet Austin, 1982g

POSITION FOR DAY	19	0	HOURS	E.T.	IS - R.A. =	10	25.28	- DEC. = +41	+1.0
POSITION FOR DAY	19	8	HOURS	E.T.	IS - R.A. =	10	30.10	- DEC. = +41	+23.9
POSITION FOR DAY	19	16	HOURS	E.T.	IS - R.A. =	10	34.78	- DEC. = +41	+45.2
POSITION FOR DAY	20	0	HOURS	E.T.	IS - R.A. =	10	39.31	- DEC. = +42	+5.0
POSITION FOR DAY	20	8	HOURS	E.T.	IS - R.A. =	10	43.70	- DEC. = +42	+23.4
POSITION FOP DAY	20	16	HOURS	E.T.	IS - R.A. =	10	47.96	- DEC. = +42	+40.4
POSITION FOR DAY	21	0	HOURS	E.T.	IS - R.A. =	10	52.09	- DEC. = +42	+56.1
POSITION FOR DAY	21	8	HOURS	E.T.	IS - R.A. =	10	51.09	- DEC. = +43	+10.5
POSITION FOR DAY	21	16	HOURS	E.T.	IS - R.A. =	10	59.96	- DEC. = +43	+23.7
POSITION FOR DAY	22	0	HOURS	E.T.	IS - R.A. =	11	3.70	- DEC. = +43	+35.8
POSITION FOR DAY	22	8	HOURS	E.T.	IS - R.A. =	11	7.33	- DEC. = +43	+46.8
POSITION FOR DAY	22	16	HOURS	E.T.	IS - R.A. =	11	10.84	- DEC. = +43	+56.7
POSITION FOR DAY	23	0	HOURS	E.T.	IS - R.A. =	11	14.24	- DEC. = +44	+5.7
POSITION FOR DAY	23	8	HOURS	E.T.	IS - R.A. =	11	17.52	- DEC. = +44	+13.7
POSITION FOR DAY	23	16	HOURS	E.T.	IS - R.A. =	11	20.70	- DEC. = +44	+20.9
POSITION FOR DAY	24	0	HOURS	E.T.	IS - R.A. =	11	23.77	- DEC. = +44	+27.2
POSITION FOR DAV	24	8	HOURS	E.T.	IS - R.A. =	11	26.74	- DEC. = +44	+32.7
POSITION FOR DAY	24	16	HOURS	E.T.	IS - R.A. =	11	29.61	- DEC. = +44	+37.5
POSITION FOR DAY	25	0	HOURS	E.T.	IS - R.A. =	11	32.38	- DEC. = +44	+41.6
POSITION FOR DAY	25	8	HOURS	E.T.	IS - R.A. =	11	35.06	- DEC. = +44	+45.0
POSITION FOR DAY	25	16	HOURS	E.T.	IS - R.A. =	11	37.65	- DEC. = +44	+47.8
POSITION FOR DAY	26	0	HOURS	E.T.	IS - R.A. =	11	40.14	- DEC. = +44	+50.0
POSITION FOR DAY	26	8	HOURS	E.T.	IS - R.A. =	11	42.56	- DEC. = +44	+51.7
POSITION FOR DAY	26	16	HOURS	E.T.	IS - R.A. =	11	44.88	- DEC. = +44	+52.9
POSITION FOR DAY	27	0	HOURS	E.T.	IS - R.A. =	11	47.13	- DEC. = +44	+53.6
POSITION FOR DAY	27	8	HOURS	E.T.	IS - R.A. =	11	49.30	- DEC. = +44	+53.8
POSITION FOR DAY	27	16	HOURS	E.T.	IS - R.A. =	11	51.39	- DEC. = +44	+53.7
POSITION FOR DAY	28	0	HOURS	E.T.	IS - R.A. =	11	53.41	- DEC. = +44	+53.2
POSITION FOR DAY	28	8	HOURS	E.T.	IS - R.A. =	11	55.35	- DEC. = +44	+52.3
POSITION FOR DAY	28	16	HOURS	E.T.	IS - R.A. =	11	57.23	- DEC. = +44	+51. 1
POSITION FOR DAY	29	0	HOURS	E.T.	IS - R.A. =	11	59.04	- DEC. = +44	+49.6
POSITION FOR DAY	29	8	HOURS	E.T.	IS - R.A. =	12	0.78	- DEC. = +44	+47.8
POSITION FOR DAY	29	16	HOURS	E.T.	IS - R.A. =	12	2.47	- DEC. = +44	+45.8
POSITION FOR DAY	30	0	HOURS	E.T.	IS - R.A. =	12	4.09	- DEC. = +44	+43.6
POSITION FOR DAY	30	8	HOURS	E.T.	IS - R.A. =	12	5.65	- DEC. = +44	+41.1
POSITION FOR DAY	30	16	HOURS	E.T.	IS - R.A. =	12	7.16	- DEC. = +44	+38.5
POSITION FOR DAY	31	0	HOURS	E.T.	IS - R.A. =	12	8.61	- DEC. = +44	+35.7
POSITION FOR DAY	31	8	HOURS	E.T.	IS - R.A. =	12	10.01	- DEC. = +44	+32.7
POSITION FOR DAY	31	16	HOURS	E.T.	IS - R.A. =	12	11.36	- DEC. = +44	+29.6
POSITION FOR DAY	1	0	HOURS	E.T.	IS - R.A. =	12	12.66	- DEC. = +44	+26.4
POSITION FOR DAY	1	8	HOURS	E.T.	IS - R.A. =	12	13.92	- DEC. = +44	+23.0
POSITION FOR DAY	1	16	HOURS	E.T.	IS - R.A. =	12	15.12	- DEC. = +44	+19. 6
POSITION FOR DAY	2	0	HOURS	E.T.	IS - R.A. =	12	16.29	- DEC. = +44	+16.0
POSITION FOR DAY	2	8	HOURS	E.T.	IS - R.A. =	12	17.42	- DEC. = +44	+12.4
POSITION FOR DAY	2	16	HOURS	E.T.	IS - R.A. =	12	18.50	- DEC. = +44	+8.6
POSITION FOR DAY	3	0	HOURS	E.T.	IS - R.A. =	12	19.55	- DEC. = +44	+4.8
POSITION FOR DAY	3	8	HOURS	E.T.	IS - R.A. =	12	20.56	- DEC. = +44	+0.9
POSITION FOR DAY	3	16	HOURS	E.T.	IS - R.A. =	12	21.54	- DEC. = +43	+56.9
POSITION FOR DAY	4	0	HOURS	E.T.	IS - R.A. =	12	22.48	- DEC. = +43	+52.8
POSITION.FOR DAY	4	8	HOURS	E.T.	IS - R.A. =	12	23.39	- DEC. = +43	+48.7
POSITION FOR DAY	4	16	HOURS	E.T.	IS - R.A. =	12	24.28	- DEC. = +43	+44.4
POSITION FOR DAY	5	0	HOURS	E.T.	IS - R.A. =	12	25.13	- DEC. = +43	+40.1
POSITION FOR DAY	5	8	HOURS	E.T.	IS - R.A. =	12	25.95	- DEC. = +43	+35.7
POSITION FOR DAY	5	16	HOURS	E.T.	IS - R.A. =	12	26.75	- DEC. = +43	+31.1
POSITION FOR DAY	6	0	HOURS	E.T.	IS - R.A. =	12	27.53	- DEC. = +43	+26.5
POSITION FOR DAY	6	8	HOURS	E.T.	IS - R.A. =	12	28.28	- DEC. = +43	+21.7
POSITION FOR DAY	6	16	HOURS	E.T.	IS - R.A. =	12	29.01	- DEC. = +43	+16.8
POSITION FOR DAY	7	0	HOURS	E.T.	IS - R.A. =	12	29.71	- DEC. = +43	+11.7
POSITION FOR DAY	7	8	HOURS	E.T.	IS - R.A. =	12	30.40	- DEC. = +43	+6.4
POSITION FOR DAY	7	16	HOURS	E.T.	IS - R.A. =	12	31.07	- DEC. = +43	+1.0
POSITION FOR DAY	8	0	HOURS	E.T.	IS - R.A. =	12	31.72	- DEC. = +42	+55.4

1982 PK = 1976 GF1
Epoch 1982 Aug. 19.0 ET = JDE 2445200.5 (JP)

M 265.26276		(1950.0)		P	Q
n	0.17289379	Peri.	309.34369	+0.78085709	+0.62341584
a	3.1911752	Node	12.26822	-0.49901030	+0.66114701
e	0.1714445	Incl.	10.90140	-0.37583363	+0.41741744
P	5.70	B(1,O)	11.5		

Residuals in seconds of arc

760401	095	2.4+	0.4+	820321	688	0.5+	0.3+	820425	688	0.7-	0.8+
760402	095	2.5-	0.4-	820414	688	0.2-	0.9-	820425	688	0.0	0.3-
C20321	688	0.8-	0.2+	820414	688	1.3+	0.2-				

* * * * *

EPHEMERIDES.

Comet Austin (1982g) Elements MPC 7021

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Phase	m1
1982	07 10	04 38.10	-34 41.7	0.989	1.121	68.0	57.2	8.5
1982	07 15	04 49.36	-32 43.6					7.8
1982	07 20	05 03.62	-30 01.3	0.736	0.975	65.3	71.3	7.2
1982	07 25	05 22.84	-25 57.8					6.4
1982	07 30	05 50.56	-19 18.0	0.486	0.839	55.2	96.4	5.7
1982	08 04	06 32.81	-07 40.5					4.9
1982	08 09	07 37.23	+10 56.0	0.326	0.727	23.7	145.9	4.2
1982	08 14	09 02.58	+30 21.9					4.3
1982	08 19	10 25.28	+41 01.0	0.444	0.659	28.9	132.0	4.4
1982	08 24	11 23.77	+44 27.2					4.9
1982	08 29	11 59.04	+44 49.6	0.720	0.655	40.3	94.3	5.5
1982	09 03	12 19.55	+44 04.8					
1982	09 08	12 31.72	+42 55.4	1.006	0.717	41.7	69.2	6.6
1982	09 13	12 39.31	+41 38.4					
1982	09 18	12 44.41	+40 21.3	1.258	0.825	40.9	52.8	7.7
1982	09 23	12 48.14	+39 07.8					
1982	09 28	12 51.07	+37 59.8	1.466	0.959	40.5	42.7	8.6
1982	10 03	12 53.54	+36 58.3					
1982	10 08	12 55.72	+36 03.5	1.631	1.104	41.6	36.9	9.5
1982	10 13	12 57.67	+35 15.8					
1982	10 18	12 59.43	+34 35.3	1.755	1.254	44.4	33.7	10.2

Periodic Comet Slaughter-Burnham (1981i) Elements NK 379

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Phase	m2
1982	08 19	07 28.49	+28 02.0	3.993	3.232	36.2	10.6	20.1
1982	08 29	07 42.95	+27 34.4					
1982	09 08	07 56.48	+27 05.5	3.888	3.315	49.0	13.3	20.2
1982	09 18	08 08.98	+26 36.6					
1982	09 28	08 20.33	+26 08.9	3.736	3.401	63.0	15.2	20.2
1982	10 08	08 30.41	+25 43.7					
1982	10 18	08 39.10	+25 22.3	3.549	3.487	78.3	16.2	20.2
1982	10 28	08 46.23	+25 06.0					
1982	11 07	08 51.64	+24 55.8	3.344	3.574	95.3	16.0	20.2
1982	11 17	08 55.19	+24 52.6					
1982	11 27	08 56.73	+24 56.6	3.146	3.662	114.2	14.2	20.1
1982	12 07	08 56.18	+25 07.6					
1982	12 17	08 53.55	+25 24.6	2.990	3.751	135.0	10.7	20.1
1982	12 27	08 48.98	+25 45.5					
1983	01 06	08 42.81	+26 07.5	2.914	3.840	157.2	5.7	20.2
1983	01 16	08 35.52	+26 27.8					
1983	01 26	08 27.77	+26 43.4	2.950	3.928	172.3	1.9	20.3