Jupiter. The bands across Jupiter’s surface are in the direction of the planet’s rotation, and the flattening of the poles caused by the rotation is also apparent. The famous red spot is in the upper left hand side of the photograph.

Mars. The system of dark markings across the surface reflects features of the Martian terrain. The small white area is the Martian polar cap, a layer of frost on the cold polar region. Yerkes Observatory.
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President : Ken Strom 977-9489  Warren Astronomical Society
1st. V.P. : Alan Rothenberg 355-5844  P.O. Box 474
2nd. V.P. : Riyad Matti 548-7511  East Detroit, MI 48021
Secretary : Ken Kelly 839-7250
Treasurer : Alice Strom 977-9489
Librarian : John Wetzel 882-6816
Deep Sky Group : Doug Bock 758-9369  Meets at Northern Cross Observatory, Fenton, MI
Lunar Group : Frank McCullough 683-4882  Meets at Stargate Observatory, Ray Center, MI

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East Detroit, MI 48021

WARREN ASTRONOMICAL SOCIETY PAPER

Editor: Ken Kelly / 839-7250  Send all articles to: THE WASP, P.O. Box 474, East Detroit, MI 48021

The W.A.S.P. is the official publication of the Warren Astronomical Society and is available free to all club members.

NEWSLETTER EXCHANGES: Send your Newsletter to: THE WASP, P.O. Box 474, East Detroit, MI 48021.

NOTE: Newsletters or change of address notices sent to other addresses may not reach the Editor. All articles and changes should be submitted at the Cranbrook meeting or before.

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LECTURER’S LIST

Lecturers should check with Camp Rotary to determine whether the Scouts are staying at the camp and to inform the Ranger the day and time of the lecture. If you cannot lecture on your scheduled weekend, please make arrangements to switch weekends with another lecturer or call the Chairman as early as possible. The lecturers for the coming weekends are:

July 18/19  Alan Rothenberg ...... 355-5844  Aug. 15/16  Russ Patten ...... 288-0799
25/26  Ken Strom ................ 977-9489  22/23  Mike Bennett ...... 651-7991
Aug. 1/2  Jon Root ................ 464-7906  29/30  Ken Kelly .......... 839-7250
8/9  Riyad Matti ............ 548-7511  Sep. 5/6  Clyde Burdette ...... 747-3295
July 19 & 26 - Mars observing at Metropolitan Beach. Bring your telescopes for public viewing of Mars. Starts at 9:00 P.M.

Aug. 2 - Deep Sky Group Meeting, Doug Bock’s 8:00 P.M. - call 750-9369 for details.

Aug. 5 - 9 - ALCON-86, Baltimore, MD.

Aug. 7 - Meeting at Cranbrook Institute of Science, 7:30 P.M.

Aug. 21 - General Meeting at Macomb Community College, 7:30 P.M. Bldg B, Room 216.

Sep. 5/6 - W.A.S. 25th Anniversary Celebration, Camp Rotary - Photo Contest, Historical look at a Dynamic Group.

Sep. 18 - General Meeting at Macomb Community College, 7:30 P.M. Bldg B, Room 216. Tim Skonieczny will talk on "The Life and Times of Nicholas Copernicus"
3 Letters
Ara (Altar)
Leo (Lion)
4 Letters
Apus (Bird of Paradise)
Crux (Southern Cross)
Grus (Crane)
Lyra (Lyre)
Pavo (Peacock)
Vela (Sails)
5 Letters
Cetus (Whale)
Mensa (Table)
Musca (Fly)
Pyxis (Compass)
6 Letters
Antlia (Air Pump)
Aquila (Eagle)
Auriga (Charioteer)
Carina (Keel)
Scutum (Shield)
Taurus (Bull)
Volans (Flying Fish)
7 Letters
Columba (Dove)
Pegasus (Winged Horse)
Sagitta (Arrow)
Serpens (Serpent)
Sextans (Sextant)
8 Letters
Aquarius (Water Bearer)
Borealis (Corona; Northern Cross)
Hercules (mythical strong man)
Scorpius (Scorpion)
9 Letters
Andromeda (Chained Lady)
Ursa Major (Great Bear)
Vulpecula (Little Foz)
10 Letters
Canis Major (Great Dog)
Cassiopeia (Seated Lady)
Triangulum (Triangle)

"You won't have another chance to see it for 76 years."
Set aside the first Weekend of September for the WAS 25th Anniversary Celebration at Camp Rotary

***************

Photo Contest........
We’re looking for your best shots:

- Halley’s Comet
- WAS Members in Action
- Astro photos of any object.

Ribbons will be awarded !!

First call for Speakers for the Program:

Observing 25 Years
Historical look at a dynamic group
CALCULATION OF AN EPHEMERIS FOR AN ELLIPTICAL ORBIT

By Ken Kelly

I

QUANTITIES NEEDED:

1. The elements of the Orbit:
   E1 = M = Mean Anomaly (in degrees from Perihelion).
   E2 = w = Argument of Perihelion (degrees from Ascending Node).
   E3 = Q = Longitude of Ascending Node (degrees from Vernal Equinox).
   E4 = I = Inclination of Orbit to Plane of Ecliptic (degrees).
   E5 = e = Eccentricity of Orbit.
   E6 = n = Mean Daily Motion (degrees).
   E7 = a = Semi-major Axis (Astronomical Units).

Divide E1 thru E4 and E6 by the value of the Radian (see below).

2. Also Needed:
   ε = Obliquity of the Ecliptic at Equinox and Equator 1950.0.
   \cos \varepsilon = \cos \varepsilon = 0.917437
   \sin \varepsilon = \sin \varepsilon = 0.3978811
   MJ = Epoch of the Orbit (in 5 day Julian Day format).
   MS = Starting date of the Ephemeris (5 Day JD format).
   IN = Increment to JD number.
   MX = Final Date of the Ephemeris.
   PD = 57.29578 == value of the radian (see below).
   PI = 3.141593

3. Geocentric Rectangular Coordinates (GRC) must be brought into the program. Use A.P.A.E. (Astronomical Papers of the American Ephemeris) Volume XIV, right hand pages. They are needed for Equinox 1950.0, and are no longer printed in the American Ephemeris. A future article will explain how to calculate GRC.

4. For a comet in an elliptical orbit, the elements M, n, and a are usually given in terms of T, P and q. In this Case:
   a = q / (1 - e). (Don’t use for a Parabolic Orbit!)
   n = 360 / P (in days). An alternate formula is:
   n = 0.9950076686 / SQR (a * a * a) where SQR is the square root function.
   M = n * (t - T) where t is the JD of the Epoch, and T is the time of Perihelion Passage, in Julian Days.

II

CALCULATION OF THE EQUATORIAL PARAMETERS:

1. G1 = \sin (E2) * \sin (E3)
   G2 = \sin (E2) * \cos (E3)
   G3 = \sin (E2) * \sin (E4)
   G4 = \cos (E2) * \sin (E3)
   G5 = \cos (E2) * \cos (E3)
   G6 = \cos (E2) * \sin (E4)
   G7 = G5 * \cos (E4) - 61
   G8 = G2 * \cos (E4) + 64

2. PX = G5 - G1 * \cos (E4)
   PY = G8 * C0 - G3 * S0
   PZ = G3 * C0 - G8 * S0
   QX = -G2 - G4 * \cos (E4)
   QY = G7 * C0 - G6 * S0
   QZ = G6 * C0 + G7 * S0
III  CALCULATION OF THE ELLIPTICAL PARAMETERS:
1. \( b = E^7 \cdot SQR(1 - E^5 \cdot E^5) \)
2. \( AX = E^7 \cdot PX \)
   \( AY = E^7 \cdot PY \)
   \( AZ = E^7 \cdot PZ \)
   \( BX = b \cdot QX \)
   \( BY = b \cdot QY \)
   \( BZ = b \cdot QZ \)

IV  CALCULATION OF THE ECCENTRIC ANOMALY (Solving Kepler’s Equation):
1. \( M_1 = M_5 \)
2. \( M_0 = E_1 + E_6 \cdot (M_1 - M_4) \)
3. \( M_1 = M_0 / (1 - E_5) \)
4. \( M_2 = M_1 - E_5 \cdot \sin(M_1) \)
5. \( M_3 = (M_0 - M_2) / (1 - E_5 \cdot \cos(M_1)) \)
6. \( M_4 = M_1 + M_3 \)
7. \( M_5 = M_4 - E_5 \cdot \sin(M_4) \)
8. \( M_6 = \text{ABS}(M_5 - M_0) \) where \( \text{ABS} \) is the Absolute Value function.
9. IF \( M_6 > 0.000001 \) THEN \( M_1 = M_4 ; M_2 = M_5 \); GOTO 5.
10. \( E = M_4 \)

V  CALCULATION OF \( r \), DISTANCE OF THE OBJECT FROM THE SUN:
\( r = E^7 \cdot (1 - E^5 \cdot \cos(E)) \)

VI  CALCULATION OF THE HELIOCENATIC EQUATORIAL COORDINATES:
\( X = AX \cdot (\cos(E) - E_5) + BX \cdot \sin(E) \)
\( Y = AY \cdot (\cos(E) \cdot E_5) + BY \cdot \sin(E) \)
\( Z = AZ \cdot (\cos(E) \cdot E_5) + BZ \cdot \sin(E) \)

VII GET GRC OF SUN FROM TABLES BROUGHT IN AT BEGINNING OF PROGRAM.
Call them XX,YY,ZZ.

VIII  CALCULATE GEOCENTRIC EQUATORIAL COORDINATES OF OBJECT:
\( X_1 = X + XX \)
\( Y_1 = Y + YY \)
\( Z_1 = Z + ZZ \)

IX  CALCULATE DELTA, THE DISTANCE OF THE OBJECT FROM THE EARTH:
\( DL = SQR(X_1 \cdot X_1 + Y_1 \cdot Y_1 + Z_1 \cdot Z_1) \)

X  CALCULATE THE DECLINATION OF THE OBJECT:
\( SD = Z_1 / DL \)
\( DC = \text{ATN}SD \cdot SQR(1 - SD \cdot SD) \cdot RD \) where \( \text{ATN} \) is the arctangent function.

XI  CALCULATE THE RIGHT ASCENSION OF THE OBJECT:
\( F_1 = X_1 \)
\( F_2 = Y_1 / X_1 \)
GOSUB (QUADRANT SUBROUTINE) (see next page).

XII  CONVERSION OF RIGHT ASCENSION AND DECLINATION:
\( RA = F_3 \cdot RD / 15 \)
\( RH = \text{INT}(RA) \) where \( \text{INT} \) is the integer function.
\( RM = (RA - RH) \cdot 60 \) (Right Ascension Minutes)
\( L = SGN(DC) : DC = \text{ABS}(DC) \) where \( SGN \) is the sign function.
\( DD = L \cdot \text{INT}(DC) \) (Declination Degrees)
\( DM = L \cdot (DC - DD) \cdot 60 \) (Declination Minutes)
Note that the sign will also appear on the Dec. minutes. This is necessary because the negative sign will not appear on negative zero degrees.

XIII  PRINTING OF COORDINATES:
\( ZS = "### ### #### ##.##" \)
PRINT USING ZS; RH; RM; DD; DM
ADD INCREMENT TO JULIAN DAY.
MI = MI + IN
IF MI > MX THEN CLOSE : END
GO TO STEP IV, LINE 2.

QUADRANT SUBROUTINE - Puts functions into their proper quadrant.
Enter cosine of function in F1, and tangent of function in F2, then GOSUB.
After the return, the arctangent will be in F3 in its proper quadrant.
1. F3 = ATN(F2)
2. IF F3 >= 0 THEN 4.
3. F3 = F3 + 2 * PI
4. IF F1 > 0 THEN 9.
5. IF F1 = 0 THEN 20.
6. IF F2 < 0 THEN 12.
7. IF F2 = 0 THEN 20.
8. IF F2 > 0 THEN 14.
9. IF F2 < 0 THEN 16.
10. IF F2 = 0 THEN 20.
11. IF F2 > 0 THEN 18.
12. IF F3 < PI THEN RETURN
13. F3 = F3 - PI : RETURN
14. IF F3 > PI THEN RETURN
15. F3 = F3 + PI : RETURN
16. IF F3 > (3 * PI / 2) THEN RETURN
17. F3 = F3 + PI : RETURN
18. IF F3 < (PI / 2) THEN RETURN
19. F3 = F3 + PI : RETURN
20. PRINT "THE COS OR TAN WAS ZERO" : RETURN
MINOR PLANETS FOR JULY - AUGUST
(CALCULATED BY KEN KELLY)

The following are positions for the four brightest Minor Planets for each Saturday during this time period. The opposition dates and visual magnitudes are also given. The diameters of these asteroids are as follows: Isis, 95 km; Aquitania, 113 km; Amphitrite, 281 km; Vesta, 555 km.

<table>
<thead>
<tr>
<th>EPOCH</th>
<th>HR</th>
<th>EQUINOX &amp; EQUATER 1950.0</th>
<th>EQUINOX &amp; EQUATER 1986.5</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONTH</td>
<td>DAY</td>
<td>RT. ASC.</td>
<td>DECLINATION</td>
<td>RT. ASC.</td>
</tr>
<tr>
<td>Jul 20</td>
<td>0</td>
<td>21h 40.23m</td>
<td>-26° -30.1’</td>
<td>21h 42.33m</td>
</tr>
<tr>
<td>Jul 27</td>
<td>0</td>
<td>21h 37.85m</td>
<td>-27° -52.4’</td>
<td>21h 39.18m</td>
</tr>
<tr>
<td>Aug 3</td>
<td>0</td>
<td>21h 32.60m</td>
<td>-29° -3.8’</td>
<td>21h 34.74m</td>
</tr>
<tr>
<td>Aug 10</td>
<td>0</td>
<td>21h 27.36m</td>
<td>-30° -6.9’</td>
<td>21h 29.53m</td>
</tr>
<tr>
<td>Aug 17</td>
<td>0</td>
<td>21h 21.98m</td>
<td>-30° -57.6’</td>
<td>21h 24.08m</td>
</tr>
<tr>
<td>Aug 24</td>
<td>0</td>
<td>21h 16.08m</td>
<td>-31° -32.9’</td>
<td>21h 19.00m</td>
</tr>
</tbody>
</table>

(387) AQUITANIA - Opposition Aug. 23

EPOCH | HR | EQUINOX & EQUATER 1950.0 | EQUINOX & EQUATER 1986.5 | V |
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>MONTH</td>
<td>DAY</td>
<td>RT. ASC.</td>
<td>DECLINATION</td>
<td>RT. ASC.</td>
</tr>
<tr>
<td>Jul 20</td>
<td>0</td>
<td>22h 24.12m</td>
<td>-14° -59.4’</td>
<td>22h 26.08m</td>
</tr>
<tr>
<td>Jul 27</td>
<td>0</td>
<td>22h 22.68m</td>
<td>-16° -39.8’</td>
<td>22h 24.65m</td>
</tr>
<tr>
<td>Aug 3</td>
<td>0</td>
<td>22h 19.93m</td>
<td>-18° -27.7’</td>
<td>22h 21.92m</td>
</tr>
<tr>
<td>Aug 10</td>
<td>0</td>
<td>22h 16.12m</td>
<td>-20° -18.1’</td>
<td>22h 18.12m</td>
</tr>
<tr>
<td>Aug 17</td>
<td>0</td>
<td>22h 11.54m</td>
<td>-22° -6.2’</td>
<td>22h 13.57m</td>
</tr>
<tr>
<td>Aug 24</td>
<td>0</td>
<td>22h 6.61m</td>
<td>-23° -46.8’</td>
<td>22h 8.65m</td>
</tr>
</tbody>
</table>

(29) AMPHITRITE - Opposition Aug. 31

EPOCH | HR | EQUINOX & EQUATER 1950.0 | EQUINOX & EQUATER 1986.5 | V |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MONTH</td>
<td>DAY</td>
<td>RT. ASC.</td>
<td>DECLINATION</td>
<td>RT. ASC.</td>
</tr>
<tr>
<td>Jul 20</td>
<td>0</td>
<td>23h 4.97m</td>
<td>-10° -41.7’</td>
<td>23h 6.88m</td>
</tr>
<tr>
<td>Jul 27</td>
<td>0</td>
<td>23h 3.20m</td>
<td>-10° -47.7’</td>
<td>23h 5.11m</td>
</tr>
<tr>
<td>Aug 3</td>
<td>0</td>
<td>23h 8.12m</td>
<td>-10° -59.5’</td>
<td>23h 2.04m</td>
</tr>
<tr>
<td>Aug 10</td>
<td>0</td>
<td>22h 55.83m</td>
<td>-11° -16.1’</td>
<td>22h 57.75m</td>
</tr>
<tr>
<td>Aug 17</td>
<td>0</td>
<td>22h 50.49m</td>
<td>-11° -36.1’</td>
<td>22h 52.42m</td>
</tr>
<tr>
<td>Aug 24</td>
<td>0</td>
<td>22h 44.37m</td>
<td>-11° -57.8’</td>
<td>22h 46.30m</td>
</tr>
</tbody>
</table>

(4) VESTA - Opposition Oct. 7

EPOCH | HR | EQUINOX & EQUATER 1950.0 | EQUINOX & EQUATER 1986.5 | V |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MONTH</td>
<td>DAY</td>
<td>RT. ASC.</td>
<td>DECLINATION</td>
<td>RT. ASC.</td>
</tr>
<tr>
<td>Jul 20</td>
<td>0</td>
<td>1h 5.45m</td>
<td>-1° -40.9’</td>
<td>1h 7.32m</td>
</tr>
<tr>
<td>Jul 27</td>
<td>0</td>
<td>1h 18.00m</td>
<td>-1° -40.8’</td>
<td>1h 12.17m</td>
</tr>
<tr>
<td>Aug 3</td>
<td>0</td>
<td>1h 14.06m</td>
<td>-1° -48.7’</td>
<td>1h 15.93m</td>
</tr>
<tr>
<td>Aug 10</td>
<td>0</td>
<td>1h 16.62m</td>
<td>-2° -5.0’</td>
<td>1h 18.49m</td>
</tr>
<tr>
<td>Aug 17</td>
<td>0</td>
<td>1h 17.87m</td>
<td>-5° -29.4’</td>
<td>1h 19.74m</td>
</tr>
<tr>
<td>Aug 24</td>
<td>0</td>
<td>1h 17.75m</td>
<td>-3° -1.5’</td>
<td>1h 19.61m</td>
</tr>
</tbody>
</table>

SOURCE: 1986 EMP
The following table contains occultation predictions for the month of August. The longitude and latitude for these predictions are W 83 44 37.7, +42 42 17.6. The elevation is +305 Meters. On the chart below the PA stands for position angle, Per. SNLT is percentage the moon is lit by the sun, where + is increasing illumination (from new moon to full) and is decreasing illumination (full moon to new moon). (P) is the phenomena happening, D - disappearance, R - reappearance.

The events were picked based on magnitude and the percent illumination of the moon. If the stellar mag. was marginal (about 6.0 mag. or dimmer) and the illumination percentage greater than 50 percent, the event is either negated or only the half of the event on the dark limb is included.

|----------|---------------|---|---------------|-----------|------------|--------|-----------------|
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MEMBERSHIP APPLICATION

NAME: ____________________________________________

ADDRESS: ____________________________________________

CITY & ZIP CODE: ____________________________________________

PHONE NUMBER: ____________________________________________

MEMBERSHIP CATEGORY & AMOUNT: ____________________________________________

You will receive a membership card.