HORIZONS Web-Interface

This tool provides a web-based *limited* interface to JPL's HORIZONS system which can be used to generate ephemerides for solar-system bodies. Full access to HORIZONS features is available via the primary telnet interface. HORIZONS system news shows recent changes and improvements. A web-interface tutorial is available to assist new users.

Current Settings

Ephemeris Type [change] : **OBSERVER**
Target Body [change] : **Moon [Luna]** [301]
Observer Location [change] : **Oakland**, **CA** (122°15'54.0"W, 37°48'02.9"N)
Time Span [change] : Start=**2014-10-01**, Stop=**2014-11-30**, Step=**1 d**
Table Settings [change] : QUANTITIES=**1,7,9,29,33**
Display/Output [change] : *default* (formatted HTML)

Object Data Page

```
Revised: Mar 11, 1998              Moon / (Earth)                              301

PHYSICAL PROPERTIES:
 Radius, km             = 1737.53+-0.03   Mass, 10^20 kg         =  734.9
 Density, gm cm^-3      =    3.3437       Geometric albedo       =    0.12
 V(1,0)                 =   +0.21         GM, km^3/s^2           = 4902.798+-.005
 Earth/Moon mass ratio = 81.300587        Surface gravity        =    1.62 m s^-2
 Nearside crust. thick.= 58+-8 km         Farside crust. thick.  = ~80 - 90 km
 Heat flow, Apollo 15  = 3.1+-.6 mW/m^2   Heat flow, Apollo 17   = 2.2+-.5 mW/m^2
 Mean crustal density  = 2.97+-.07g/cm^3  k2                     = 0.0302+-.0012
 Induced magnetic mom. = 4.23x10^22Gcm^3  Magnetometer moment    = 435+-15

DYNAMICAL CHARACTERISTICS:
 Mean angular diameter = 31'05.2"         Orbit period           = 27.321582 d
 Obliquity to orbit    = 6.67 deg         Eccentricity           = 0.05490
 Semi-major axis, a    = 384400 km        Inclination            = 5.145 deg
 Mean motion, rad/s    = 2.6616995x10^-6  Nodal period           = 6798.38 d
 Apsidal period        = 3231.50 d        Mom. of inertia C/MR^2= 0.3935+-.0011
 beta (C-A/B), x10^-4  = 6.31(72+-15)     gamma (B-A/C), x10^-4 = 2.278(8+-2)
```

Results

```
*******************************************************************************
Ephemeris / WWW_USER Mon Oct  6 07:41:36 2014 Pasadena, USA      / Horizons
*******************************************************************************
Target body name: Moon (301)                     {source: DE-0431LE-0431}
Center body name: Earth (399)                    {source: DE-0431LE-0431}
Center-site name: (user defined site below)
*******************************************************************************
Start time      : A.D. 2014-Oct-01 00:00:00.0000 UT
Stop  time      : A.D. 2014-Nov-30 00:00:00.0000 UT
Step-size       : 1440 minutes
*******************************************************************************
Target pole/equ : IAU_MOON                       {East-longitude +}
Target radii    : 1737.4 x 1737.4 x 1737.4 km    {Equator, meridian, pole}
Center geodetic : 237.735000,37.8008000,0.0000000 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindric: 237.735000,5046.01136,3887.9973 {E-lon(deg),Dxy(km),Dz(km)}
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```
Center pole/equ : High-precision EOP model        {East-longitude +}
Center radii    : 6378.1 x 6378.1 x 6356.8 km     {Equator, meridian, pole}
Target primary  : Earth
Vis. interferer : MOON (R_eq= 1737.400) km        {source: DE-0431LE-0431}
Rel. light bend : Sun, EARTH                      {source: DE-0431LE-0431}
Rel. lght bnd GM: 1.3271E+11, 3.9860E+05 km^3/s^2
Atmos refraction: NO (AIRLESS)
RA format       : HMS
Time format     : CAL
EOP file        : eop.141003.p141225
EOP coverage    : DATA-BASED 1962-JAN-20 TO 2014-OCT-03. PREDICTS-> 2014-DEC-24
Units conversion: 1 au= 149597870.700 km, c= 299792.458 km/s, 1 day= 86400.0 s
Table cut-offs 1: Elevation (-90.0deg=NO ),Airmass (>38.000=NO), Daylight (NO )
Table cut-offs 2: Solar Elongation (  0.0,180.0=NO ),Local Hour Angle( 0.0=NO )
*****************************************************************************************************
 Date__(UT)__HR:MN     R.A._(ICRF/J2000.0)_DEC L_Ap_Sid_Time  APmag  S-brt Cnst     GlxLon     GlxLat
*****************************************************************************************************
$$SOE
 2014-Oct-01 00:00 *m  17 49 01.97 -19 18 04.5 16 29 32.3967  -9.78   5.41  Sgr   8.659355   4.312804
 2014-Oct-02 00:00 *m  18 47 31.59 -18 32 48.0 16 33 28.9536 -10.30   5.17  Sgr  15.896389  -7.506474
 2014-Oct-03 00:00 *m  19 46 19.92 -16 41 03.6 16 37 25.5096 -10.77   4.93  Sgr  23.662682 -19.461802
 2014-Oct-04 00:00 *m  20 44 49.43 -13 47 53.6 16 41 22.0633 -11.20   4.68  Aqr  32.799459 -31.275660
 2014-Oct-05 00:00 *m  21 42 36.98 -10 03 40.0 16 45 18.6139 -11.60   4.43  Cap  44.629464 -42.456164
 2014-Oct-06 00:00 *   22 39 36.33 -05 43 11.5 16 49 15.1615 -11.97   4.15  Aqr  61.281908 -52.046687
 2014-Oct-07 00:00 *   23 35 54.86 -01 04 19.3 16 53 11.7071 -12.33   3.85  Psc  84.982337 -58.265268
 2014-Oct-08 00:00 *   00 31 46.73 +03 33 47.0 16 57 08.2522 -12.67   3.52  Psc 113.401452 -58.942591
 2014-Oct-09 00:00 *   01 27 25.18 +07 52 34.5 17 01 04.7987 -12.60   3.57  Psc 138.189956 -53.923410
 2014-Oct-10 00:00 *   02 22 56.05 +11 35 56.4 17 05 01.3476 -12.23   3.88  Ari 155.752273 -45.359175
 2014-Oct-11 00:00 *   03 18 14.04 +14 31 39.1 17 08 57.8993 -11.86   4.16  Ari 168.001559 -35.192547
 2014-Oct-12 00:00 *   04 13 02.90 +16 32 10.3 17 12 54.4535 -11.49   4.40  Tau 177.175697 -24.454291
 2014-Oct-13 00:00 *   05 06 59.57 +17 34 40.4 17 16 51.0093 -11.13   4.63  Tau 184.675759 -13.630034
 2014-Oct-14 00:00 *   05 59 40.91 +17 40 22.7 17 20 47.5655 -10.75   4.84  Ori 191.342862  -2.946935
 2014-Oct-15 00:00 *   06 50 50.28 +16 53 26.3 17 24 44.1213 -10.36   5.04  Gem 197.745725   7.485442
 2014-Oct-16 00:00 *   07 40 21.74 +15 19 43.5 17 28 40.6758  -9.95   5.25  Gem 204.357230  17.601041
 2014-Oct-17 00:00 *   08 28 21.09 +13 05 50.4 17 32 37.2287  -9.50   5.45  Cnc 211.678009  27.325645
 2014-Oct-18 00:00 *   09 15 04.47 +10 18 31.0 17 36 33.7797  -9.00   5.67  Cnc 220.354918  36.522201
 2014-Oct-19 00:00 *   10 00 55.91 +07 04 25.1 17 40 30.3289  -8.43   5.89  Leo 231.311839  44.909277
 2014-Oct-20 00:00 *   10 46 24.83 +03 30 15.9 17 44 26.8765  -7.78   6.11  Sex 245.797101  51.928880
 2014-Oct-21 00:00 *   11 32 03.87 -00 16 49.9 17 48 23.4232  -7.01   6.30  Leo 264.845924  56.604960
 2014-Oct-22 00:00 *m  12 18 27.00 -04 08 56.9 17 52 19.9697  -6.11   6.36  Vir 287.382266  57.724832
 2014-Oct-23 00:00 *m  13 06 07.39 -07 56 58.3 17 56 16.5169  -5.04   5.93  Vir 309.230623  54.744928
 2014-Oct-24 00:00 *m  13 55 34.40 -11 30 22.9 18 00 13.0656  -3.91   1.07  Vir 326.958152  48.353737
 2014-Oct-25 00:00 *m  14 47 09.39 -14 37 23.1 18 04 09.6166  -5.24   6.05  Lib 340.389046  39.690488
 2014-Oct-26 00:00 *m  15 41 00.32 -17 05 32.7 18 08 06.1702  -6.40   6.37  Lib 350.770307  29.624693
 2014-Oct-27 00:00 *m  16 36 56.85 -18 43 00.9 18 12 02.7263  -7.40   6.25  Oph 359.292531  18.692415
 2014-Oct-28 00:00 *m  17 34 28.75 -19 20 14.9 18 15 59.2841  -8.26   6.01  Oph   6.828117   7.226517
 2014-Oct-29 00:00 *m  18 32 50.80 -18 51 45.0 18 19 55.8425  -9.00   5.74  Sgr  14.043350  -4.538686
 2014-Oct-30 00:00 *m  19 31 14.03 -17 17 14.3 18 23 52.4003  -9.64   5.48  Sgr  21.553803 -16.397250
 2014-Oct-31 00:00 *m  20 28 58.90 -14 41 47.7 18 27 48.9561 -10.18   5.23  Cap  30.093563 -28.106668
 2014-Nov-01 00:00 *m  21 25 44.50 -11 15 04.3 18 31 45.5092 -10.66   4.98  Aqr  40.746913 -39.291273
 2014-Nov-02 00:00 *m  22 21 30.21 -07 10 05.9 18 35 42.0594 -11.09   4.74  Aqr  55.261452 -49.255111
 2014-Nov-03 00:00 *m  23 16 31.33 -02 42 08.1 18 39 38.6075 -11.48   4.49  Psc  75.951470 -56.652169
 2014-Nov-04 00:00 *m  00 11 11.39 +01 52 16.4 18 43 35.1546 -11.84   4.23  Psc 102.864582 -59.422114
 2014-Nov-05 00:00 *m  01 05 53.85 +06 16 12.2 18 47 31.7025 -12.18   3.95  Psc 129.446245 -56.416501
 2014-Nov-06 00:00 *   02 00 54.40 +10 13 25.7 18 51 28.2524 -12.49   3.65  Psc 149.552219 -49.020948
 2014-Nov-07 00:00 *   02 56 15.05 +13 29 45.7 18 55 24.8051 -12.69   3.44  Ari 163.575160 -39.326522
 2014-Nov-08 00:00 *   03 51 41.58 +15 54 27.2 18 59 21.3606 -12.37   3.71  Tau 173.814328 -28.652216
 2014-Nov-09 00:00 *   04 46 45.84 +17 21 16.5 19 03 17.9182 -12.03   3.99  Tau 181.934293 -17.671635
 2014-Nov-10 00:00 *   05 40 53.24 +17 48 51.0 19 07 14.4769 -11.68   4.24  Tau 188.941450  -6.728414
 2014-Nov-11 00:00 *   06 33 32.49 +17 20 03.5 19 11 11.0355 -11.34   4.46  Gem 195.484785   3.993591
 2014-Nov-12 00:00 *   07 24 23.95 +16 00 45.9 19 15 07.5932 -11.00   4.67  Gem 202.062131  14.384987
 2014-Nov-13 00:00 *   08 13 23.51 +13 58 20.5 19 19 04.1493 -10.65   4.87  Cnc 209.155631  24.357087
 2014-Nov-14 00:00 *   09 00 42.14 +11 20 29.3 19 23 00.7035 -10.27   5.07  Cnc 217.347455  33.791503
 2014-Nov-15 00:00 *   09 46 42.81 +08 14 33.6 19 26 57.2558  -9.88   5.26  Leo 227.445103  42.471197
 2014-Nov-16 00:00 *   10 31 56.88 +04 47 25.2 19 30 53.8065  -9.44   5.47  Sex 240.577946  49.968771
 2014-Nov-17 00:00 *   11 17 00.97 +01 05 41.5 19 34 50.3561  -8.94   5.69  Leo 257.955159  55.495135
 2014-Nov-18 00:00 *   12 02 34.64 -02 43 44.2 19 38 46.9052  -8.36   5.91  Vir 279.488857  57.902534
 2014-Nov-19 00:00 *   12 49 18.14 -06 33 04.8 19 42 43.4547  -7.68   6.14  Vir 301.968525  56.318090
 2014-Nov-20 00:00 *   13 37 49.68 -10 13 03.6 19 46 40.0055  -6.87   6.32  Vir 321.247766  50.999340
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 2014-Nov-21 00:00 *   14 28 40.97 -13 32 31.9 19 50 36.5584  -5.89   6.30  Lib 336.094602  42.984028
 2014-Nov-22 00:00 *m  15 22 10.75 -16 18 38.8 19 54 33.1139  -4.72   5.41  Lib 347.464823  33.228382
 2014-Nov-23 00:00 *m  16 18 17.06 -18 17 52.1 19 58 29.6721  -4.64   5.20  Sco 356.616096  22.364137
 2014-Nov-24 00:00 *m  17 16 31.58 -19 17 58.6 20 02 26.2325  -5.92   6.29  Oph   4.521688  10.799678
 2014-Nov-25 00:00 *m  18 16 01.55 -19 10 40.8 20 06 22.7940  -7.05   6.31  Sgr  11.907995  -1.165993
 2014-Nov-26 00:00 *m  19 15 42.08 -17 53 49.0 20 10 19.3551  -8.00   6.09  Sgr  19.403426 -13.271193
 2014-Nov-27 00:00 *m  20 14 34.78 -15 32 02.6 20 14 15.9144  -8.81   5.82  Cap  27.700669 -25.237301
 2014-Nov-28 00:00 *m  21 12 03.38 -12 15 44.6 20 18 12.4709  -9.48   5.55  Aqr  37.762404 -36.696348
 2014-Nov-29 00:00 *m  22 07 59.09 -08 18 54.8 20 22 09.0245 -10.05   5.29  Aqr  51.104911 -47.048885
 2014-Nov-30 00:00 *m  23 02 36.33 -03 57 08.1 20 26 05.5757 -10.53   5.04  Aqr  69.893195 -55.191076
$$EOE
*******************************************************************************************
Column meaning:

TIME

  Prior to 1962, times are UT1. Dates thereafter are UTC. Any 'b' symbol in
the 1st-column denotes a B.C. date. First-column blank (" ") denotes an A.D.
date. Calendar dates prior to 1582-Oct-15 are in the Julian calendar system.
Later calendar dates are in the Gregorian system.

  Time tags refer to the same instant throughout the universe, regardless of
where the observer is located.

  The dynamical Coordinate Time scale is used internally. It is equivalent to
the current IAU definition of "TDB". Conversion between CT and the selected
non-uniform UT output scale has not been determined for UTC times after the
next July or January 1st.  The last known leap-second is used over any future
interval.

  NOTE: "n.a." in output means quantity "not available" at the print-time.

SOLAR PRESENCE (OBSERVING SITE)
  Time tag is followed by a blank, then a solar-presence symbol:


        '*'  Daylight (refracted solar upper-limb on or above apparent horizon)
        'C'  Civil twilight/dawn
        'N'  Nautical twilight/dawn
        'A'  Astronomical twilight/dawn
        ' '  Night OR geocentric ephemeris

LUNAR PRESENCE (OBSERVING SITE)
  The solar-presence symbol is immediately followed by a lunar-presence symbol:

        'm'  Refracted upper-limb of Moon on or above apparent horizon
        ' '  Refracted upper-limb of Moon below apparent horizon OR geocentric
             ephemeris

 R.A._(ICRF/J2000.0)_DEC =
   J2000.0 astrometric right ascension and declination of target center.
Adjusted for light-time. Units: HMS (HH MM SS.ff) and DMS (DD MM SS.f)

 L_Ap_Sid_Time =
   Local Apparent Sidereal Time. The angle measured westward in the body
true-equator of-date plane from the meridian containing the body-fixed
observer to the meridian containing the true Earth equinox (defined by
intersection of the true Earth equator of date with the ecliptic of date).
TOPOCENTRIC ONLY. Units: HH MM SS.ffff.

 APmag S-brt =
   Moon's approximate apparent visual magnitude & surface brightness. When
phase angle < 7 deg (within ~ 1 day of full Moon), computed magnitude tends to
be about 0.12 too small.
   Units: MAGNITUDE & VISUAL MAGNITUDES PER SQUARE ARCSECOND

 Cnst =
   Constellation ID; the 3-letter abbreviation for the name of the
constellation containing the target center's astrometric position,
as defined by IAU (1930) boundary delineation.  See documentation
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for list of abbreviations.

 GlxLon GlxLat =
   Observer-centered Galactic System II (post WW II) longitude and latitude
of the target center's apparent position. Adjusted for light-time,
gravitational deflection of light, and stellar aberration. Units: DEG DEG



 Computations by ...
     Solar System Dynamics Group, Horizons On-Line Ephemeris System
     4800 Oak Grove Drive, Jet Propulsion Laboratory
     Pasadena, CA  91109   USA
     Information: http://ssd.jpl.nasa.gov/
     Connect    : telnet://ssd.jpl.nasa.gov:6775  (via browser)
                  telnet ssd.jpl.nasa.gov 6775    (via command-line)
     Author     : Jon.Giorgini@jpl.nasa.gov

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