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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 [\[change\]](#) : **1 Ceres**
Observer Location [\[change\]](#) : **Palomar Mountain--ZTF [I41]** (243°08'24.8"E, 33°21'26.4"N, 1686.9 m)
Time Span [\[change\]](#) : Start=**2019-04-26**, Stop=**2019-04-28**, Step=**12 h**
Table Settings [\[change\]](#) : QUANTITIES=**1,3,18-20**; date/time format=**BOTH**; angle format=**DEG**; output units=**AU-D**
Display/Output [\[change\]](#) : *default* (formatted HTML)

Object Data Page

```
JPL/HORIZONS                      1 Ceres                      2020-Feb-05 17:38:05
Rec #:      1 (+COV) Soln.date: 2019-Jun-05_16:22:15  # obs: 1002 (1995-2019)

IAU76/J2000 helio. ecliptic osc. elements (au, days, deg., period=Julian yrs):

EPOCH= 2454033.5 ! 2006-Oct-25.00 (TDB)          Residual RMS= .22345
EC= .07987906346370539  QR= 2.544709153978707    TP= 2453193.6614275328
OM= 80.40846590069125   W= 73.1893463033331      IN= 10.58671483589909
A= 2.76562466186023     MA= 179.9741090118086     ADIST= 2.986540169741752
PER= 4.59937            N= .214296068           ANGOMOM= .028515965
DAN= 2.68593           DDN= 2.81296             L= 153.3235262
B= 10.1294158          MOID= 1.57962            TP= 2004-Jul-07.1614275328

Asteroid physical parameters (km, seconds, rotational period in hours):
GM= 62.6284            RAD= 469.7              ROTPER= 9.07417
H= 3.4                 G= .120                B-V= .713
                        ALBEDO= .090           STYP= C

ASTEROID comments:
1: soln ref.= JPL#46, OCC=0          radar(60 delay, 0 Dop.)
2: source=ORB
```

Results

```
*****
Ephemeris / WWW_USER Wed Feb  5 17:38:05 2020 Pasadena, USA    / Horizons
*****
Target body name: 1 Ceres                      {source: JPL#46}
Center body name: Earth (399)                  {source: DE431}
Center-site name: Palomar Mountain--PTF
*****
Start time      : A.D. 2019-Apr-26 00:00:00.0000 UT
Stop time       : A.D. 2019-Apr-28 00:00:00.0000 UT
Step-size       : 720 minutes
*****
Target pole/equ : IAU                          {West-longitude positive}
Target radii    : 487.3 x 487.3 x 454.7 km      {Equator, meridian, pole}
Center geodetic : 243.140200,33.3573140,1.6862396 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindric: 243.140200,5334.19632,3488.0539 {E-lon(deg),Dxy(km),Dz(km)}
Center pole/equ : High-precision EOP model     {East-longitude positive}
Center radii    : 6378.1 x 6378.1 x 6356.8 km   {Equator, meridian, pole}
Target primary  : Sun
Vis. interferer : MOON (R_eq= 1737.400) km      {source: DE431}
Rel. light bend : Sun, EARTH                   {source: DE431}
Rel. lght bnd GM: 1.3271E+11, 3.9860E+05 km^3/s^2
Small-body perts: Yes                          {source: SB431-N16}
Atmos refraction: NO (AIRLESS)
RA format       : DEG
Time format     : BOTH
EOP file        : eop.200204.p200427
EOP coverage    : DATA-BASED 1962-JAN-20 TO 2020-FEB-04. PREDICTS-> 2020-APR-26
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 )
Table cut-offs 3: RA/DEC angular rate ( 0.0=NO )
```

```

*****
Initial IAU76/J2000 heliocentric ecliptic osculating elements (au, days, deg.):
EPOCH= 2454033.5 ! 2006-Oct-25.00 (TDB) Residual RMS= .22345
EC= .07987906346370539 QR= 2.544709153978707 TP= 2453193.6614275328
OM= 80.40846590069125 W= 73.1893463033331 IN= 10.58671483589909
Equivalent ICRF heliocentric equatorial cartesian coordinates (au, au/d):
X= 2.626536679271237E+00 Y=-1.003038764756320E+00 Z=-1.007293591158815E+00
VX= 4.202952273775981E-03 VY= 8.054172339518143E-03 VZ= 2.938175156440994E-03
Asteroid physical parameters (km, seconds, rotational period in hours):
GM= 62.6284 RAD= 469.7 ROTPER= 9.07417
H= 3.4 G= .120 B-V= .713
ALBEDO= .090 STYP= C
*****
Date__ (UT) __HR:MN Date_____JDUT R.A.__(ICRF)____DEC dRA*cosD d(DEC)/dt hEcl-Lon hEcl-Lat r rdot delta de
*****
$$SOE
2019-Apr-26 00:00 2458599.500000000 * 252.36966 -16.99178 -15.6786 -2.87218 240.0238 3.7095 2.737918940866 1.3606980 1.87558207044490 -13.379
2019-Apr-26 12:00 2458600.000000000 Am 252.30996 -17.00142 -18.0184 -2.62893 240.1315 3.6907 2.738311922560 1.3609033 1.87172532240217 -12.899
2019-Apr-27 00:00 2458600.500000000 * 252.25056 -17.00993 -16.6064 -2.89111 240.2391 3.6719 2.738704962045 1.3611037 1.86804229725787 -13.040
2019-Apr-27 12:00 2458601.000000000 Am 252.18761 -17.01962 -18.9313 -2.63638 240.3467 3.6531 2.739098059042 1.3612993 1.86428641303370 -12.543
2019-Apr-28 00:00 2458601.500000000 * 252.12506 -17.02817 -17.5233 -2.91089 240.4543 3.6342 2.739491211037 1.3614900 1.86070416639636 -12.693
$$EOE
*****
Column meaning:

TIME

Times PRIOR to 1962 are UT1, a mean-solar time closely related to the
prior but now-deprecated GMT. Times AFTER 1962 are in UTC, the current
civil or "wall-clock" time-scale. UTC is kept within 0.9 seconds of UT1
using integer leap-seconds for 1972 and later years.

Conversion from the internal Barycentric Dynamical Time (TDB) of solar
system dynamics to the non-uniform civil UT time-scale requested for output
has not been determined for UTC times after the next July or January 1st.
Therefore, the last known leap-second is used as a constant over future
intervals.

Time tags refer to the UT time-scale conversion on Earth regardless of
observer location within the solar system, where clock rates may differ
due to the local gravity field and there is no precisely defined or adopted
"UT" analog timescale.

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.

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)____DEC =
Astrometric right ascension and declination of the target center with
respect to the observing site (coordinate origin) in the reference frame of
the planetary ephemeris (ICRF). Compensated for down-leg light-time delay
aberration.

Units: RA in decimal degrees (ddd.fyyyy)
DEC in decimal degrees (sdd.fyyyy)

dRA*cosD d(DEC)/dt =
The angular rate of change in apparent RA and DEC (airless) of target center.
d(RA)/dt is multiplied by the cosine of declination to provide a linear rate.
Units: ARCSECONDS PER HOUR

hEcl-Lon hEcl-Lat =
Geometric heliocentric J2000 ecliptic longitude and latitude of target
center at the instant light leaves it to be observed at print time (print time
minus 1-way light-time). Units: DEGREES

r rdot =
Heliocentric range ("r", light-time corrected) and range-rate ("rdot")
of the target center at the instant light seen by the observer at print-time
would have left the target center (print-time minus down-leg light-time).
The Sun-to-target distance traveled by a ray of light emanating from the
center of the Sun that reaches the target center point at some instant and
is recordable by the observer one down-leg light-time later at print-time.
Units: AU and KM/S

delta deldot =
Range ("delta") and range-rate ("delta-dot") of target center with respect
to the observer at the instant light seen by the observer at print-time would
have left the target center (print-time minus down-leg light-time); the
distance traveled by a light ray emanating from the center of the target and

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recorded by the observer at print-time. "deldot" is a projection of the velocity vector along this ray, the light-time-corrected line-of-sight from the coordinate center, and indicates relative motion. A positive "deldot" means the target center is moving away from the observer (coordinate center). A negative "deldot" means the target center is moving toward the observer. Units: AU and KM/S

Computations by ...

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2020-Feb-06 01:38 UT
(server date/time)



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