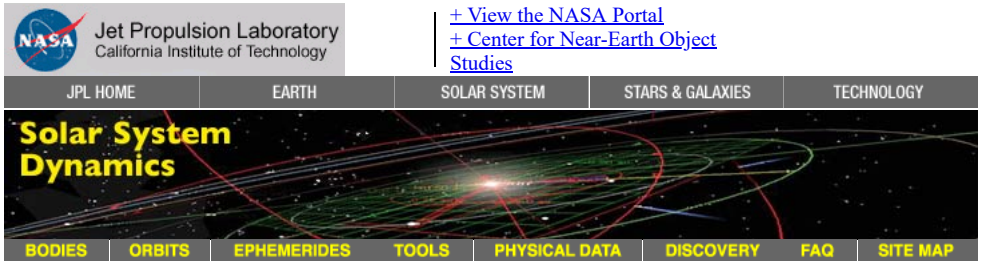

HORIZONS Web-Interface
This tool provides a web-based *limited* interface to JPL's HORIZONS system which can be used to generate ephemerides for solar-system bodies. Full access to HORIZONS features is available via the primary telnet interface. HORIZONS system news shows recent changes and improvements.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

Current Settings

Ephemeris Type [change] : **OBSERVER**
Target Body [change] : **1 Ceres**
Observer Location [change] : **Geocentric** [500]
Time Span [change] : Start=**2019-04-26**, Stop=**2019-04-28**, Step=**12 h**
Table Settings [change] : QUANTITIES=**1,3,18-20,31**; 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-06 08:17:18
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           ANGMOM= .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 Thu Feb  6 08:17:18 2020 Pasadena, USA      / Horizons
*******************************************************************************
Target body name: 1 Ceres                         {source: JPL#46}
Center body name: Earth (399)                     {source: DE431}
Center-site name: GEOCENTRIC
*******************************************************************************
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 : 0.00000000,0.00000000,0.0000000 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindric: 0.00000000,0.00000000,0.0000000 {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
*******************************************************************************************************************************************************
$$SOE
 2019-Apr-26 00:00 2458599.500000000     252.36919 -16.99138 -16.6181  -2.74844 240.0238   3.7095  2.737918941039   1.3606980 1.87554414727414 -13.226
 2019-Apr-26 12:00 2458600.000000000     252.31044 -17.00045 -17.0811  -2.75483 240.1315   3.6907  2.738311922451   1.3609033 1.87174945293421 -13.054
 2019-Apr-27 00:00 2458600.500000000     252.25008 -17.00954 -17.5414  -2.76144 240.2391   3.6719  2.738704962216   1.3611037 1.86800464519883 -12.881
 2019-Apr-27 12:00 2458601.000000000     252.18811 -17.01864 -17.9988  -2.76825 240.3467   3.6531  2.739098058934   1.3612993 1.86431025157426 -12.705
 2019-Apr-28 00:00 2458601.500000000     252.12455 -17.02777 -18.4532  -2.77526 240.4543   3.6342  2.739491211206   1.3614900 1.86066679853072 -12.528
$$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.

 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.fffff)
         DEC in decimal degrees (sdd.fffff)

 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
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

 ObsEcLon    ObsEcLat =
   Observer-centered Earth ecliptic-of-date longitude and latitude of the
target center's apparent position, adjusted for light-time, the gravitational
deflection of light and stellar aberration. Although centered on the observer,
the values are expressed relative to coordinate basis directions defined by
the Earth's true equator-plane, equinox direction, and mean ecliptic plane at
print time.  Units: DEGREES
```

```
 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.D.Giorgini@jpl.nasa.gov

*******************************************************************************************************************************************************
```