

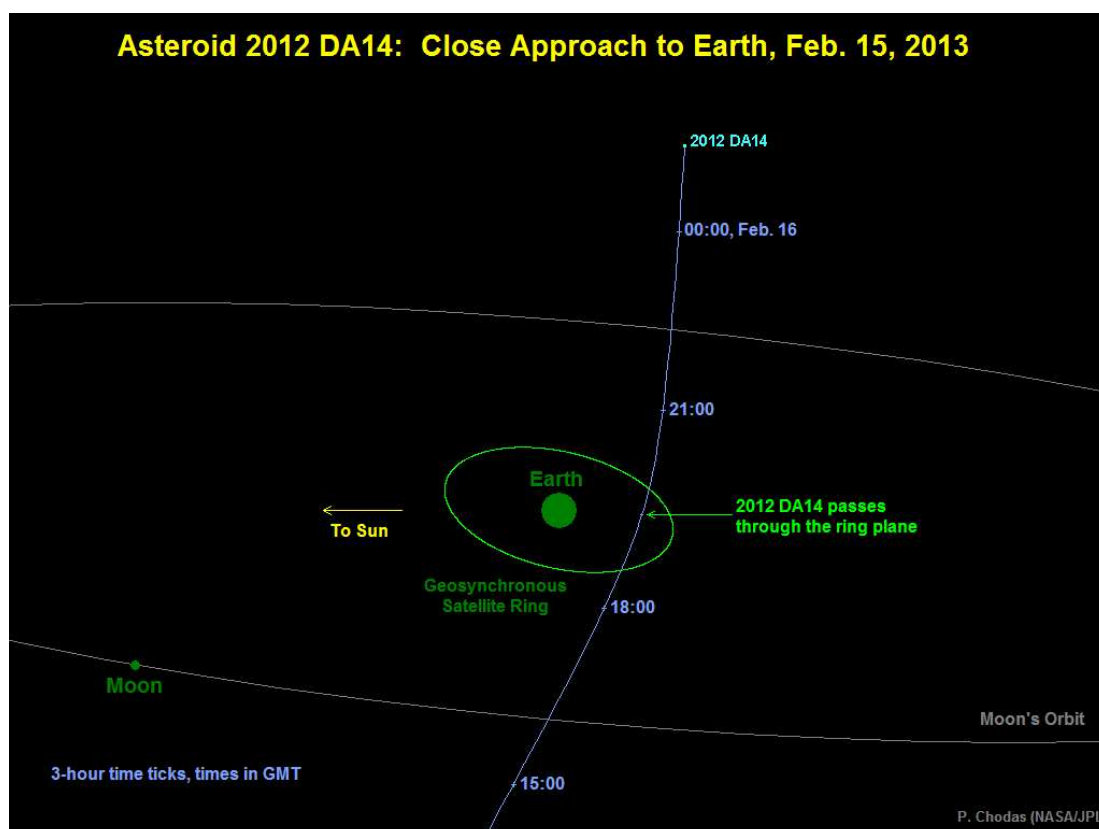
# ASSOCIAZIONE ASTROFILI SEGUSINI

10059 SUSA (TO)

Circolare interna n. 162

Febbraio 2013

## TRANSITO DELL'ASTEROIDE 2012 DA14



Transito dell'asteroide 2012 DA14 attraverso il sistema Terra-Luna il 15 febbraio 2013. Credit: NASA/JPL-Caltech

[...] non ut effugiamus ictus rerum (undique enim in nos tela iaciuntur), sed ut fortiter constanterque patiamur. Invicti esse possumus, inconcussi non possumus

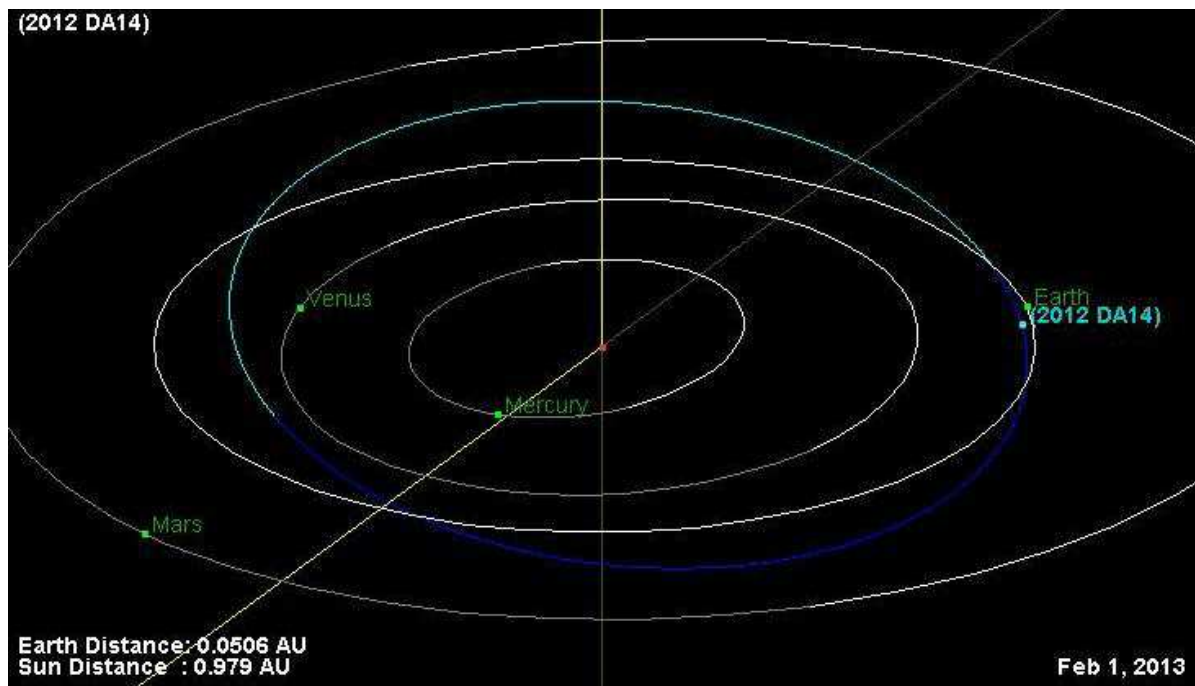
*La scienza deve servire non ad evitare i colpi della natura (perché da ogni parte vengono scagliati dardi su di noi), bensì a sopportarli con coraggio e fermezza.*

*Noi possiamo essere invincibili, inattaccabili no, non possiamo esserlo*

**Lucius Annaeus Seneca** (4 a.C.-65)

*Naturales quaestiones*, Liber II, 59, 2-3

(da Seneca, *Questioni Naturali*, a cura di Dionigi Vottero, UTET, Torino 1989, pp. 370-371)



Orbita attuale dell'asteroide 2012 DA14 (Credit: NASA/JPL)

<http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2012%20DA14>

## TRANSITO DELL'ASTEROIDE 2012 DA14

Il 15 febbraio 2013, alle 20:24 circa (ora italiana; 19:24 GMT), l'asteroide 2012 DA14 transiterà a soli 27700 km dalla superficie terrestre, al di sotto dell'orbita dei satelliti geostazionari che sono a circa 35800 km sopra la superficie terrestre.

Scoperto nel corso del precedente avvicinamento alla Terra - era allora sette volte più lontano della Luna - la notte tra il 22 e il 23 febbraio 2012 da telescopi robotizzati, nel sud della Spagna, nell'ambito del *La Sagra Sky Survey* (LSSS) program, l'asteroide 2012 DA14 è una roccia di 40-50 m di diametro (mezzo campo sportivo da calcio, più o meno) con una massa stimata di circa 130.000 tonnellate.

Il periodo orbitale, attualmente di circa 368 giorni, molto simile a quello terrestre, si ridurrà - dopo l'attuale passaggio - a circa 317 giorni: 2012 DA14 cambierà la sua classe orbitale passando da asteroide di tipo Apollo ad asteroide di tipo Aten e per almeno tre decenni non ci saranno altri incontri ravvicinati.

Un transito a così breve distanza è un record, anche se altri asteroidi sono passati ancora più vicini alla Terra, ma erano di dimensioni più piccole. In media ci aspetta un oggetto di queste dimensioni in transito ogni 40 anni e in collisione col nostro pianeta una volta ogni 1200 anni in media.

Donald K. Yeomans, del NEOP (NEAR Earth Object Program) della NASA dice che "dagli anni '90, cioè da quando sono iniziate le analisi regolari dello spazio attorno alla Terra, non avevamo mai osservato un oggetto così grande e così vicino".

Il rischio di impatto in questo transito, in base agli elementi orbitali finora raccolti, è zero (v. tabella a pagina 5). Ricordiamo però che un oggetto di pari dimensioni, esploso nell'atmosfera il 30 giugno 1908 in Siberia ha causato danni su una superficie, per fortuna disabitata, estesa quanto l'intera città di Roma (v. *Circolare interna* n. 123 del giugno 2008, pp. 3-7). Un altro oggetto di pari dimensioni, anche se prevalentemente composto di ferro, 50000 anni fa ha causato il Meteor crater in Arizona.



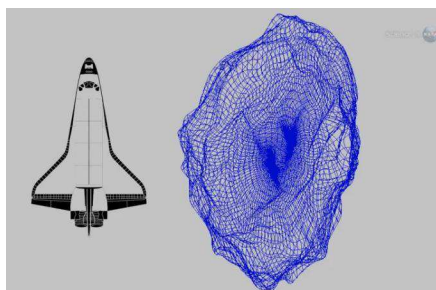
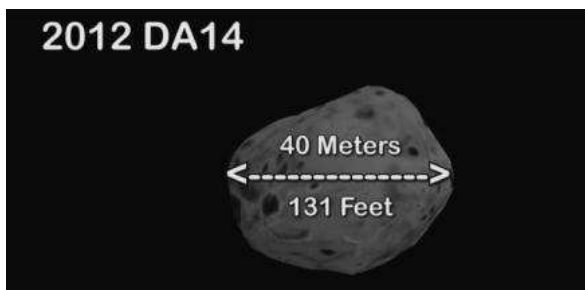
L'asteroide 2012 DA14 transiterà a 0.09 LD (distanze lunari), sotto le orbite dei satelliti geostazionari (da un video su <http://www.space.com/19432-close-approach-of-asteroid-2012-da14-fear-vs-fact-video.html>)

L'asteroide si avvicinerà al nostro pianeta alla velocità di 12.73 km/s. Al momento del massimo avvicinamento - l'area di migliore visibilità sarà l'Australia del Nord e l'Indonesia - la velocità diminuirà a circa 8 km/s:

l'asteroide sarà molto basso sull'orizzonte, diretto da sud a nord con un spostamento apparente tra le stelle di  $0.8^\circ$  al minuto (una distanza pari a circa due volte il diametro della Luna piena).

Sarà sempre invisibile ad occhio nudo, anche se la sua magnitudine - abitualmente 24.4 - scenderà a 7.6 per risalire a oltre 11 in poche ore.

Dalle nostre latitudini dovrebbe essere possibile fotografarlo la sera del 15, alle 21:45 ora italiana, nell'Orsa Maggiore, quando sarà di 8<sup>a</sup> magnitudine.



Dimensioni di 2012 DA14 (da [www.space.com](http://www.space.com), a sinistra, e da <http://science.nasa.gov/science-news/>, a destra)

### **Per approfondimenti:**

[http://www.oam.es/Asteroide\\_2012DA14.htm](http://www.oam.es/Asteroide_2012DA14.htm)

[http://www.oam.es/Asteroid\\_2012DA14.htm](http://www.oam.es/Asteroid_2012DA14.htm)

<http://www.lasagraskysurvey.org/index.html>

<http://newton.dm.unipi.it/neodyd/index.php?pc=1.1.0&n=2012DA14>

<http://www.minorplanetcenter.net/mpec/K12/K12D51.html>

<http://neo.jpl.nasa.gov/risk/2012da14.html>

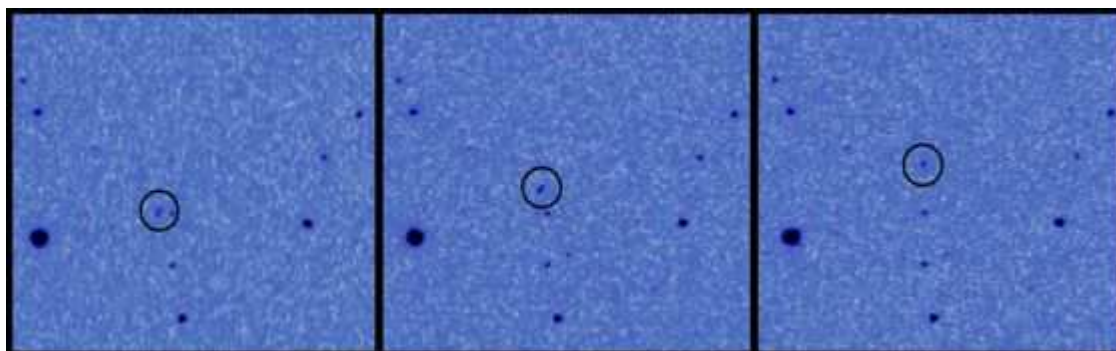
<http://neo.jpl.nasa.gov/news/news177.html>

<http://www.jpl.nasa.gov/news/news.php?release=2013-041>

[http://science.nasa.gov/science-news/science-at-nasa/2013/28jan\\_2012da/](http://science.nasa.gov/science-news/science-at-nasa/2013/28jan_2012da/)

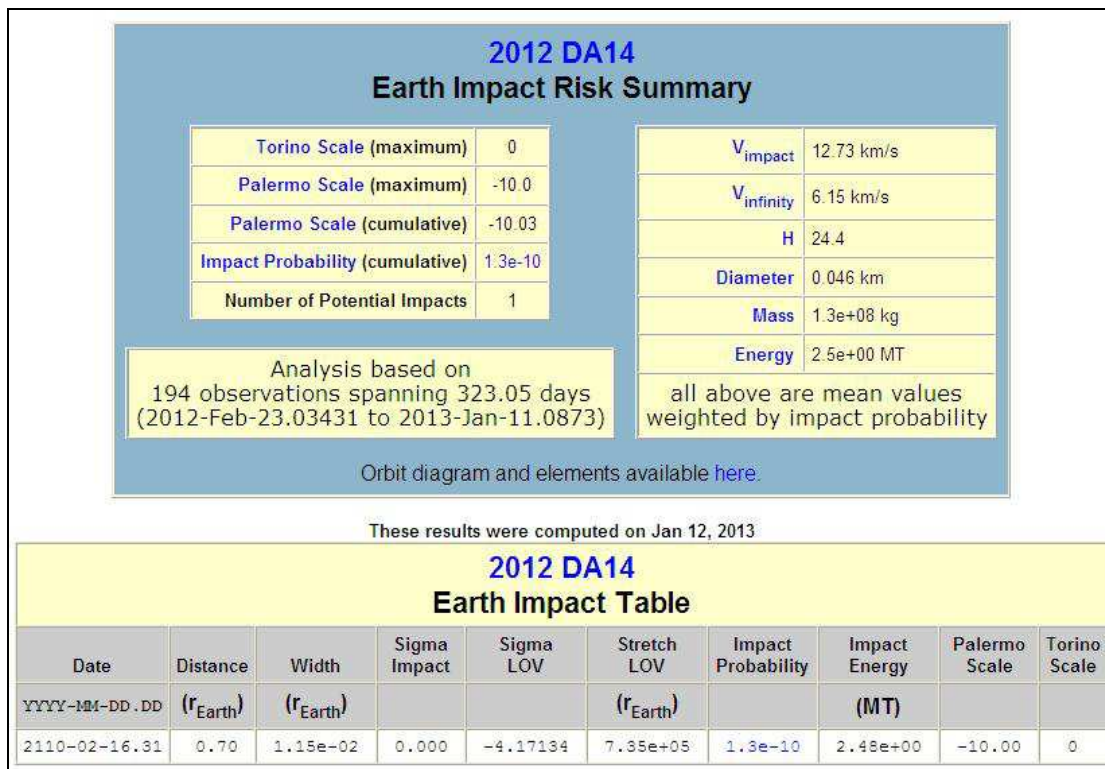
<http://www.media.inaf.it/2013/01/31/un-asteroide-sfiorera-la-terra/>

[http://divulgazione.uai.it/index.php/Cielo\\_di\\_Febbraio\\_2013#ASTEROIDI](http://divulgazione.uai.it/index.php/Cielo_di_Febbraio_2013#ASTEROIDI)



Tre immagini consecutive dell'asteroide 2012 DA14 riprese la notte tra il 22 e il 23 febbraio 2012.

Credit: OAM - Observatorio Astronómico de Mallorca



#### Summary Table Description

The Summary Table includes basic information about the hazard for this object. The maximum Torino and Palermo Scale values are listed, as well as the number of tabulated potential impacts and their corresponding cumulative Palermo Scale value and cumulative impact probability. The observation set used for the analysis is also listed. Certain parameter values depend upon the specific impact event in question, but they change little among the various table entries. For this reason we tabulate only mean values for these parameters:

- **V<sub>impact</sub>** - Velocity at atmospheric entry.
- **V<sub>infinity</sub>** - Relative velocity at atmospheric entry neglecting the acceleration caused by the Earth's gravity field, often called the hyperbolic excess velocity. ( $V_{infinity}^2 = V_{impact}^2 - V_{escape}^2$ , where  $V_{escape} = \sim 11.2$  km/s is the Earth escape velocity.)
- **H** - Absolute Magnitude, a measure of the intrinsic brightness of the object.
- **Diameter** - This is an estimate based on the absolute magnitude, usually assuming a uniform spherical body with visual albedo  $p_v = 0.154$  (in accordance with the Palermo Scale) but sometimes using actual measured values if these are available. Since the albedo is rarely measured, the diameter estimate should be considered only approximate, but in most cases will be accurate to within a factor of two.
- **Mass** - This estimate assumes a uniform spherical body with the computed diameter and a mass density of  $2.6$  g/cm<sup>3</sup>. The mass estimate is somewhat more rough than the diameter estimate, but generally will be accurate to within a factor of three.
- **Energy** - The kinetic energy at impact:  $0.5 * Mass * V_{impact}^2$ . Measured in Megatons of TNT.

#### Impact Table Legend

**Date** The calendar date (UTC) of the potential impact.

**Distance** The minimum distance on the target plane (scaled *b*-plane) from the LOV to the geocenter, measured in Earth radii. For these purposes the radius of the Earth, 6420 km, includes some allowance for the thickness of the atmosphere.

**Width** The one-sigma semi-width of the LOV uncertainty region, measured in Earth radii.

**Sigma Impact** The lateral distance in sigmas from the LOV to the Earth's atmosphere. Zero indicates that the LOV intersects the Earth. It is computed from (Distance - 1)/Width.

**Sigma LOV** The coordinate along the Line Of Variations (LOV). This value is a measure of how well the impacting orbit fits the available observations. Zero indicates the best-fitting, central (nominal) orbit and the further from zero, the less likely the event: Roughly 99% of all the uncertainty region lies between -3 and +3. Sentry explores out to Sigma LOV = +/-5.

**Stretch LOV** The stretching is the semimajor axis of the local linear uncertainty region. It describes how fast one moves across the target plane as Sigma LOV changes, and is measured in Earth radii per sigma. The local probability density varies inversely with the stretching, and thus larger stretching values will generally lead to lower impact probabilities.

**Impact Probability** The probability that the tabulated impact will occur. The probability computation is complex and depends on a number of assumptions that are difficult to verify. For these reasons the stated probability can easily be inaccurate by a factor of a few, and occasionally by a factor of ten or more.

**Impact Energy** The kinetic energy at impact, based upon the computed absolute magnitude and impact velocity for the particular case, and computed in accordance with the guidelines stated for the Palermo Technical Scale. Uncertainty in this value is dominated by mass uncertainty and the stated value will generally be good to within a factor of three.

**Palermo Scale** The hazard rating according to the Palermo Technical Impact Hazard Scale, based on the tabulated impact date, impact probability and impact energy.

**Torino Scale** The hazard rating according to the Torino Impact Hazard Scale, based on the tabulated impact probability and impact energy. The Torino Scale is defined only for potential impacts less than 100 years in the future.

da <http://neo.jpl.nasa.gov/risk/2012da14.html>



## EFFEMERIDI DI 2012 DA14

Riportiamo le effemeridi del transito di 2012 DA14, elaborate dal JPL/HORIZONS per il nostro Grange Observatory, con due scale temporali: ogni ora nei giorni dal 12 al 17, e ogni minuto, dalle ore 18:00 alle 23:30 GMT, del giorno 15 (v. <http://ssd.jpl.nasa.gov/horizons.cgi>).

Ecco le effemeridi dal 12 al 17 febbraio: i tempi sono in GMT (GMT + 1 h = ora solare italiana).

```

*****
Ephemeris / WWW_USER Sun Feb  3 02:17:00 2013 Pasadena, USA      / Horizons
*****
Target body name: (2012 DA14)                                {source: JPL#37}
Center body name: Earth (399)                                {source: DE405}
Center-site name: Grange Observatory, Bussoleno
*****
Start time          : A.D. 2013-Feb-12 00:00:00.0000 UT
Stop time           : A.D. 2013-Feb-18 00:00:00.0000 UT
Step-size           : 60 minutes
*****

Target pole/equ : No model available
Target radii    : (unavailable)
Center geodetic : 7.14040000,45.1422031,0.4951559 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindric: 7.14040000,4506.75553,4498.8568 {E-lon(deg),Dxy(km),Dz(km)}
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   : Sun                            {source: DE405}
Vis. interferer  : MOON (R_eq= 1737.400) km       {source: DE405}
Rel. light bend  : Sun, EARTH                     {source: DE405}
Rel. lght bnd GM: 1.3271E+11, 3.9860E+05 km^3/s^2
Small perturbers: Ceres, Pallas, Vesta            {source: SB405-CPV-2}
Small body GMs   : 6.32E+01, 1.43E+01, 1.78E+01 km^3/s^2
Atmos refraction: NO (AIRLESS)
RA format        : HMS
Time format      : CAL
EOP file         : eop.130201.p130425
EOP coverage     : DATA-BASED 1962-JAN-20 TO 2013-FEB-01. PREDICTS-> 2013-APR-24
Units conversion: 1 AU= 149597870.691 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)
*****
Initial FK5/J2000.0 heliocentric ecliptic osculating elements (AU, DAYS, DEG):
EPOCH= 2456014.5 ! 2012-Mar-28.00 (CT)           Residual RMS= .30806
EC= .1082238272885815 QR= .8933178241759214 TP= 2455895.3533163699
OM= 147.2857081305732 W= 271.0846959522515 IN= 10.33896985713762
Asteroid physical parameters (KM, SEC, rotational period in hours):
GM= n.a.          RAD= n.a.          ROTPER= n.a.
H= 24.357         G= .150           B-V= n.a.
                  ALBEDO= n.a.       STYP= n.a.

*****
Date__(UT)__HR:MN  R.A.__(ICRF/J2000.0)_DEC  Apmag      delta      deldot      S-O-T /r      S-T-O
*****
2013-Feb-12 00:00  00 23 49.33 -71 09 52.4  19.63 0.01379445482774 -6.1005737 62.3442 /T 116.9411
2013-Feb-12 01:00  00 24 12.68 -71 09 42.4  19.61 0.01364735615035 -6.1252214 62.3684 /T 116.9244
2013-Feb-12 02:00  00 24 38.96 -71 09 59.6  19.58 0.01349962886557 -6.1525214 62.4008 /T 116.8995
2013-Feb-12 03:00  00 25 06.61 -71 10 46.9  19.56 0.01335123101638 -6.1806369 62.4404 /T 116.8674
2013-Feb-12 04:00  00 25 33.99 -71 12 05.1  19.53 0.01320216573156 -6.2076791 62.4857 /T 116.8295
2013-Feb-12 05:00  00 25 59.41 -71 13 53.2  19.50 0.01305248093210 -6.2318353 62.5350 /T 116.7877
2013-Feb-12 06:00  00 26 21.30 -71 16 08.3  19.48 0.01290226599354 -6.2514927 62.5861 /T 116.7441
2013-Feb-12 07:00  * 00 26 38.24 -71 18 45.4  19.45 0.01275164559243 -6.2653471 62.6369 /T 116.7010
2013-Feb-12 08:00  *m 00 26 49.12 -71 21 38.3  19.42 0.01260077115188 -6.2724923 62.6849 /T 116.6605
2013-Feb-12 09:00  *m 00 26 53.22 -71 24 39.4  19.39 0.01244981046323 -6.2724822 62.7282 /T 116.6249
2013-Feb-12 10:00  *m 00 26 50.22 -71 27 40.4  19.36 0.01229893618537 -6.2653607 62.7648 /T 116.5959
2013-Feb-12 11:00  *m 00 26 40.33 -71 30 32.9  19.33 0.01214831400361 -6.2516600 62.7934 /T 116.5749

```



```

*****
Date__(UT)__HR:MN    R.A.__(ICRF/J2000.0)_DEC    Apmag    delta    deldot    S-O-T /r    S-T-O
*****
2013-Feb-12 12:00 *m 00 26 24.24 -71 33 08.9  19.31 0.01199809125916  -6.2323638  62.8132 /T 116.5629
2013-Feb-12 13:00 *m 00 26 03.09 -71 35 21.5  19.28 0.01184838683292  -6.2088399  62.8240 /T 116.5599
2013-Feb-12 14:00 *m 00 25 38.45 -71 37 05.2  19.25 0.01169928298718  -6.1827461  62.8260 /T 116.5657
2013-Feb-12 15:00 *m 00 25 12.19 -71 38 16.5  19.22 0.01155081973529  -6.1559156  62.8203 /T 116.5791
2013-Feb-12 16:00 *m 00 24 46.36 -71 38 54.4  19.20 0.01140299213477  -6.1302296  62.8087 /T 116.5986
2013-Feb-12 17:00 Cm 00 24 23.02 -71 39 00.2  19.17 0.01125575069332  -6.1074878  62.7930 /T 116.6220
2013-Feb-12 18:00 Am 00 24 04.14 -71 38 37.6  19.15 0.01110900485576  -6.0892835  62.7759 /T 116.6468
2013-Feb-12 19:00 m 00 23 51.39 -71 37 52.5  19.12 0.01096262932194  -6.0768944  62.7600 /T 116.6705
2013-Feb-12 20:00 00 23 46.07 -71 36 52.8  19.09 0.01081647274395  -6.0711953  62.7478 /T 116.6903
2013-Feb-12 21:00 00 23 48.97 -71 35 47.4  19.06 0.01067036818631  -6.0725997  62.7421 /T 116.7037
2013-Feb-12 22:00 00 24 00.36 -71 34 46.3  19.03 0.01052414461372  -6.0810334  62.7449 /T 116.7085
2013-Feb-12 23:00 00 24 19.94 -71 33 59.1  19.00 0.01037763860610  -6.0959417  62.7580 /T 116.7030
2013-Feb-13 00:00 00 24 46.84 -71 33 35.2  18.97 0.01023070549429  -6.1163302  62.7825 /T 116.6861
2013-Feb-13 01:00 00 25 19.75 -71 33 42.7  18.94 0.01008322915943  -6.1408346  62.8187 /T 116.6574
2013-Feb-13 02:00 00 25 56.89 -71 34 27.8  18.90 0.00993512983843  -6.1678153  62.8663 /T 116.6173
2013-Feb-13 03:00 00 26 36.22 -71 35 54.8  18.87 0.00978636942011  -6.1954702  62.9243 /T 116.5668
2013-Feb-13 04:00 00 27 15.48 -71 38 05.4  18.83 0.00963695388840  -6.2219577  62.9907 /T 116.5078
2013-Feb-13 05:00 A 00 27 52.33 -71 40 58.6  18.79 0.00948693276213  -6.2455219  63.0634 /T 116.4427
2013-Feb-13 06:00 N 00 28 24.54 -71 44 30.9  18.75 0.00933639557866  -6.2646117  63.1394 /T 116.3742
2013-Feb-13 07:00 * 00 28 50.08 -71 48 36.1  18.71 0.00918546566368  -6.2779861  63.2157 /T 116.3054
2013-Feb-13 08:00 *m 00 29 07.26 -71 53 06.0  18.67 0.00903429160952  -6.2847982  63.2892 /T 116.2395
2013-Feb-13 09:00 *m 00 29 14.91 -71 57 50.3  18.63 0.00888303703563  -6.2846532  63.3569 /T 116.1795
2013-Feb-13 10:00 *m 00 29 12.44 -72 02 37.7  18.59 0.00873186932395  -6.2776349  63.4162 /T 116.1279
2013-Feb-13 11:00 *m 00 28 59.95 -72 07 16.7  18.55 0.00858094809553  -6.2643008  63.4649 /T 116.0869
2013-Feb-13 12:00 *m 00 28 38.24 -72 11 35.6  18.51 0.00843041421909  -6.2456428  63.5017 /T 116.0578
2013-Feb-13 13:00 *m 00 28 08.88 -72 15 24.3  18.47 0.0082838011320  -6.2230196  63.5262 /T 116.0411
2013-Feb-13 14:00 *m 00 27 34.04 -72 18 34.7  18.43 0.00813092202034  -6.1980614  63.5386 /T 116.0365
2013-Feb-13 15:00 *m 00 26 56.43 -72 21 01.3  18.39 0.00798207479797  -6.1725573  63.5402 /T 116.0427
2013-Feb-13 16:00 *m 00 26 19.12 -72 22 41.8  18.35 0.00783382959569  -6.1483295  63.5332 /T 116.0575
2013-Feb-13 17:00 Cm 00 25 45.26 -72 23 37.6  18.31 0.00768613458187  -6.1271068  63.5204 /T 116.0780
2013-Feb-13 18:00 Nm 00 25 17.93 -72 23 53.7  18.27 0.00753889866274  -6.1104045  63.5055 /T 116.1007
2013-Feb-13 19:00 m 00 24 59.84 -72 23 38.5  18.23 0.00739199792035  -6.0994196  63.4922 /T 116.1217
2013-Feb-13 20:00 m 00 24 53.14 -72 23 03.1  18.19 0.00724528429990  -6.0949498  63.4847 /T 116.1369
2013-Feb-13 21:00 00 24 59.31 -72 22 21.0  18.14 0.00709859591777  -6.0973406  63.4868 /T 116.1425
2013-Feb-13 22:00 00 25 18.99 -72 21 46.9  18.10 0.00695176825266  -6.1064651  63.5022 /T 116.1347
2013-Feb-13 23:00 00 25 51.98 -72 21 36.1  18.05 0.00680464542914  -6.1217365  63.5337 /T 116.1107
2013-Feb-14 00:00 00 26 37.26 -72 22 03.1  18.00 0.00665709080823  -6.1421528  63.5836 /T 116.0684
2013-Feb-14 01:00 00 27 33.03 -72 23 21.2  17.95 0.00650899616165  -6.1663692  63.6529 /T 116.0067
2013-Feb-14 02:00 00 28 36.79 -72 25 41.5  17.89 0.00636028881566  -6.1927931  63.7417 /T 115.9254
2013-Feb-14 03:00 00 29 45.52 -72 29 12.1  17.83 0.00621093629755  -6.2196955  63.8489 /T 115.8258
2013-Feb-14 04:00 00 30 55.77 -72 33 57.7  17.77 0.00606094819345  -6.2453302  63.9722 /T 115.7100
2013-Feb-14 05:00 A 00 32 03.87 -72 39 59.2  17.71 0.00591037511276  -6.2680536  64.1084 /T 115.5813
2013-Feb-14 06:00 N 00 33 06.07 -72 47 13.6  17.64 0.00575930484752  -6.2864369  64.2537 /T 115.4436
2013-Feb-14 07:00 * 00 33 58.79 -72 55 33.9  17.57 0.00560785599761  -6.2993632  64.4034 /T 115.3015
2013-Feb-14 08:00 * 00 34 38.78 -73 04 49.4  17.51 0.00545616949825  -6.3061036  64.5526 /T 115.1598
2013-Feb-14 09:00 *m 00 35 03.40 -73 14 45.8  17.44 0.00530439862651  -6.3063672  64.6966 /T 115.0235
2013-Feb-14 10:00 *m 00 35 10.84 -73 25 06.6  17.36 0.00515269816813  -6.3003202  64.8309 /T 114.8969
2013-Feb-14 11:00 *m 00 35 00.34 -73 35 33.5  17.29 0.005001213488920  -6.2885744  64.9518 /T 114.7837
2013-Feb-14 12:00 *m 00 34 32.41 -73 45 47.8  17.22 0.00485007027408  -6.2721440  65.0566 /T 114.6867
2013-Feb-14 13:00 *m 00 33 48.94 -73 55 31.7  17.15 0.00469936565560  -6.2523735  65.1438 /T 114.6073
2013-Feb-14 14:00 *m 00 32 53.25 -74 04 30.0  17.07 0.00454916137551  -6.2308419  65.2134 /T 114.5455
2013-Feb-14 15:00 *m 00 31 50.02 -74 12 31.6  17.00 0.00439947947704  -6.2092494  65.2671 /T 114.4996
2013-Feb-14 16:00 *m 00 30 45.05 -74 19 30.7  16.92 0.0042350085146  -6.1892951  65.3082 /T 114.4663
2013-Feb-14 17:00 Cm 00 29 44.92 -74 25 27.8  16.84 0.00410156675168  -6.1725542  65.3417 /T 114.4407
2013-Feb-14 18:00 Nm 00 28 56.56 -74 30 30.9  16.76 0.00395318316330  -6.1603647  65.3739 /T 114.4162
2013-Feb-14 19:00 m 00 28 26.76 -74 34 54.8  16.67 0.00380502770566  -6.1537321  65.4127 /T 114.3852
2013-Feb-14 20:00 m 00 28 21.73 -74 39 01.3  16.58 0.00365695854341  -6.1532585  65.4665 /T 114.3391
2013-Feb-14 21:00 m 00 28 46.77 -74 43 18.1  16.49 0.00350882463813  -6.1591026  65.5447 /T 114.2687
2013-Feb-14 22:00 m 00 29 46.00 -74 48 17.8  16.39 0.00336047657444  -6.1709724  65.6568 /T 114.1643
2013-Feb-14 23:00 00 31 22.31 -74 54 36.8  16.28 0.00321177716219  -6.1881510  65.8120 /T 114.0168
2013-Feb-15 00:00 00 33 37.43 -75 02 53.6  16.17 0.00306261104586  -6.2095524  66.0192 /T 113.8172
2013-Feb-15 01:00 00 36 32.14 -75 13 48.3  16.04 0.00291289263994  -6.2338041  66.2864 /T 113.5577
2013-Feb-15 02:00 00 40 06.54 -75 28 01.5  15.90 0.00276257184359  -6.2593480  66.6206 /T 113.2311
2013-Feb-15 03:00 00 44 20.54 -75 46 14.1  15.76 0.00261163715824  -6.2845536  67.0277 /T 112.8316
2013-Feb-15 04:00 00 49 14.37 -76 09 07.1  15.60 0.00246011602350  -6.3078348  67.5129 /T 112.3541
2013-Feb-15 05:00 A 00 54 49.43 -76 37 22.4  15.42 0.00230807239122  -6.3277612  68.0804 /T 111.7942
2013-Feb-15 06:00 N 01 01 09.53 -77 11 43.7  15.23 0.00215560176555  -6.3431559  68.7347 /T 111.1476
2013-Feb-15 07:00 * 01 08 22.96 -77 52 58.6  15.03 0.00200282414912  -6.3531702  69.4812 /T 110.4089
2013-Feb-15 08:00 * 01 16 46.37 -78 42 01.6  14.81 0.00184987556182  -6.3573257  70.3274 /T 109.5704
2013-Feb-15 09:00 *m 01 26 52.65 -79 39 57.1  14.56 0.00169689906784  -6.3555104  71.2858 /T 108.6199
2013-Feb-15 10:00 *m 01 39 48.89 -80 48 03.3  14.30 0.00154403663225  -6.3479093  72.3762 /T 107.5373
2013-Feb-15 11:00 *m 01 58 02.83 -82 07 48.2  14.00 0.00139142379919  -6.3348307  73.6317 /T 106.2897
2013-Feb-15 12:00 *m 02 27 45.98 -83 40 08.3  13.67 0.00123919056328  -6.3163449  75.1071 /T 104.8223
2013-Feb-15 13:00 *m 03 27 43.72 -85 21 03.8  13.29 0.00108747499511  -6.2915346  76.8942 /T 103.0433
2013-Feb-15 14:00 *m 05 54 20.16 -86 33 45.2  12.85 0.00093646431680  -6.2568236  79.1512 /T 100.7943
2013-Feb-15 15:00 *m 09 16 37.91 -85 13 16.8  12.33 0.00078650102719  -6.2018126  82.1641 /T 97.7896
2013-Feb-15 16:00 *m 10 52 12.56 -80 43 16.0  11.68 0.00063836406109  -6.0973943  86.4855 /L 93.4764

```



```

*****
Date__(UT)__HR:MN   R.A.__(ICRF/J2000.0)_DEC  Apmag      delta      deldot     S-O-T /r     S-T-O
*****
2013-Feb-15 17:00 Cm  11 31 47.47 -72 47 47.2  10.84 0.00049409768913 -5.8560247  93.2848 /L  86.6855
2013-Feb-15 18:00 Nm  11 51 47.35 -58 29 36.5   9.72 0.00035985936548 -5.1765458 105.2459 /L  74.7328
2013-Feb-15 19:00 m  12 04 18.50 -30 24 35.6   8.31 0.00025661141023 -2.9937636 127.3170 /L  52.6702
2013-Feb-15 20:00 m  12 15 26.86 +13 35 20.8   7.62 0.00023849503303  1.6877459 146.3583 /L  33.6343
2013-Feb-15 21:00 m  12 27 35.76 +46 52 07.2   8.64 0.00032278198631  4.8101858 133.3780 /L  46.6095
2013-Feb-15 22:00 m  12 40 41.52 +63 34 59.7   9.72 0.00045310366906  5.8271634 121.4674 /L  58.5114
2013-Feb-15 23:00 m  12 54 48.79 +72 23 48.5  10.52 0.00059803235203  6.1611040 114.6251 /L  65.3447
2013-Feb-16 00:00 m  13 10 20.20 +77 35 20.3  11.14 0.00074800570376  6.2837661 110.4963 /L  69.4643
2013-Feb-16 01:00 m  13 27 51.25 +80 53 51.1  11.63 0.00089986477618  6.3294909 107.8323 /L  72.1193
2013-Feb-16 02:00 m  13 48 08.12 +83 06 24.7  12.03 0.00105238669595  6.3431560 106.0208 /L  73.9217
2013-Feb-16 03:00 m  14 12 00.69 +84 36 48.8  12.36 0.00120504159939  6.3423671 104.7360 /L  75.1976
2013-Feb-16 04:00 m  14 40 04.70 +85 38 14.2  12.65 0.00135758815533  6.3350200 103.7889 /L  76.1359
2013-Feb-16 05:00 A  15 12 12.05 +86 18 33.1  12.91 0.00150992104321  6.3250629 103.0617 /L  76.8542
2013-Feb-16 06:00 N  15 47 04.46 +86 42 53.0  13.14 0.00166200563007  6.3146349 102.4773 /L  77.4298
2013-Feb-16 07:00 *  16 22 22.14 +86 54 57.8  13.35 0.00181384638827  6.3049377 101.9833 /L  77.9151
2013-Feb-16 08:00 *  16 55 38.76 +86 57 47.6  13.53 0.00196546957015  6.2966212 101.5435 /L  78.3461
2013-Feb-16 09:00 *  17 25 20.81 +86 53 50.9  13.71 0.00211691241255  6.2899695 101.1334 /L  78.7474
2013-Feb-16 10:00 *m  17 51 04.26 +86 45 06.6  13.87 0.00226821564830  6.2850015 100.7370 /L  79.1351
2013-Feb-16 11:00 *m  18 13 12.67 +86 33 06.3  14.03 0.00241941796723  6.2815375 100.3446 /L  79.5186
2013-Feb-16 12:00 *m  18 32 28.07 +86 18 59.9  14.17 0.00257055187941  6.2792516  99.9518 /L  79.9026
2013-Feb-16 13:00 *m  18 49 32.22 +86 03 41.1  14.31 0.00272164078529  6.2777202  99.5581 /L  80.2876
2013-Feb-16 14:00 *m  19 04 58.86 +85 47 52.5  14.44 0.00287269719459  6.2764693  99.1656 /L  80.6713
2013-Feb-16 15:00 *m  19 19 12.36 +85 32 08.4  14.57 0.00302372206668  6.2750202  98.7787 /L  81.0493
2013-Feb-16 16:00 *m  19 32 28.98 +85 16 57.0  14.69 0.00317470522388  6.2729327  98.4030 /L  81.4162
2013-Feb-16 17:00 *m  19 44 58.63 +85 02 41.1  14.80 0.00332562674242  6.2698428  98.0447 /L  81.7657
2013-Feb-16 18:00 Nm  19 56 46.63 +84 49 38.8  14.91 0.00347645917285  6.2654935  97.7098 /L  82.0917
2013-Feb-16 19:00 m  20 07 54.96 +84 38 03.8  15.01 0.00362717039154  6.2597560  97.4038 /L  82.3890
2013-Feb-16 20:00 m  20 18 23.29 +84 28 05.4  15.11 0.00377772684635  6.2526414  97.1311 /L  82.6529
2013-Feb-16 21:00 m  20 28 09.63 +84 19 48.6  15.20 0.00392809693576  6.2442999  96.8948 /L  82.8804
2013-Feb-16 22:00 m  20 37 10.92 +84 13 14.5  15.29 0.00407825425502  6.2350106  96.6964 /L  83.0700
2013-Feb-16 23:00 m  20 45 23.38 +84 08 20.2  15.38 0.00422818045506  6.2251598  96.5360 /L  83.2218
2013-Feb-17 00:00 m  20 52 42.97 +84 04 58.7  15.46 0.00437786749038  6.2152122  96.4117 /L  83.3373
2013-Feb-17 01:00 m  20 59 05.71 +84 02 59.7  15.53 0.00452731907713  6.2056744  96.3206 /L  83.4199
2013-Feb-17 02:00 m  21 04 28.14 +84 02 09.5  15.60 0.00467655124108  6.1970560  96.2580 /L  83.4738
2013-Feb-17 03:00 m  21 08 47.79 +84 02 11.8  15.67 0.00482559190162  6.1898295  96.2185 /L  83.5047
2013-Feb-17 04:00 m  21 12 03.67 +84 02 48.2  15.74 0.00497447950927  6.1843918  96.1960 /L  83.5186
2013-Feb-17 05:00 A  21 14 16.86 +84 03 39.1  15.80 0.00512326082448  6.1810316  96.1842 /L  83.5219
2013-Feb-17 06:00 C  21 15 30.90 +84 04 24.9  15.87 0.00527198799053  6.1799041  96.1765 /L  83.5210
2013-Feb-17 07:00 *  21 15 52.13 +84 04 47.1  15.93 0.00542071510838  6.1810151  96.1670 /L  83.5219
2013-Feb-17 08:00 *  21 15 29.60 +84 04 29.6  15.99 0.00556949456115  6.1842160  96.1505 /L  83.5298
2013-Feb-17 09:00 *  21 14 34.73 +84 03 19.9  16.04 0.00571837335892  6.1892108  96.1228 /L  83.5489
2013-Feb-17 10:00 *m  21 13 20.44 +84 01 10.3  16.10 0.00586738977656  6.1955734  96.0807 /L  83.5824
2013-Feb-17 11:00 *m  21 12 00.10 +83 57 58.2  16.16 0.00601657053975  6.2027752  96.0225 /L  83.6320
2013-Feb-17 12:00 *m  21 10 46.32 +83 53 46.0  16.21 0.00616592877674  6.2102212  95.9478 /L  83.6980
2013-Feb-17 13:00 *m  21 09 49.86 +83 48 41.2  16.27 0.00631546289934  6.2172903  95.8575 /L  83.7797
2013-Feb-17 14:00 *m  21 09 18.86 +83 42 54.9  16.32 0.00646515650960  6.2233799  95.7535 /L  83.8750
2013-Feb-17 15:00 *m  21 09 18.50 +83 36 40.9  16.38 0.00661497935439  6.2279482  95.6389 /L  83.9809
2013-Feb-17 16:00 *m  21 09 50.99 +83 30 14.4  16.43 0.00676488927345  6.2305533  95.5173 /L  84.0938
2013-Feb-17 17:00 *m  21 10 55.85 +83 23 50.9  16.48 0.00691483501423  6.2308860  95.3929 /L  84.2095
2013-Feb-17 18:00 Nm  21 12 30.39 +83 17 45.1  16.53 0.00706475972349  6.2287932  95.2699 /L  84.3238
2013-Feb-17 19:00 m  21 14 30.21 +83 12 09.9  16.58 0.00721460487609  6.2242902  95.1525 /L  84.4324
2013-Feb-17 20:00 m  21 16 49.71 +83 07 16.0  16.63 0.00736431436914  6.2175621  95.0444 /L  84.5318
2013-Feb-17 21:00 m  21 19 22.56 +83 03 11.3  16.68 0.00751383849626  6.2089528  94.9487 /L  84.6188
2013-Feb-17 22:00 m  21 22 02.02 +83 00 00.9  16.72 0.00766313752346  6.1989427  94.8677 /L  84.6912
2013-Feb-17 23:00 m  21 24 41.33 +82 57 46.7  16.77 0.00781218461366  6.1881173  94.8026 /L  84.7476
2013-Feb-18 00:00 m  21 27 13.93 +82 56 27.4  16.81 0.00796096789038  6.1771274  94.7538 /L  84.7878
*****

```

Column meaning a pag. 14

**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





Ed ecco le effemeridi del transito di 2012 DA14 del 15 febbraio 2013, dalle ore 18:00 alle 23:30 GMT, calcolate di minuto in minuto.

```

*****
Ephemeris / WWW_USER Sun Feb 3 02:25:47 2013 Pasadena, USA / Horizons
*****
Target body name: (2012 DA14) {source: JPL#37}
Center body name: Earth (399) {source: DE405}
Center-site name: Grange Observatory, Bussoleno
*****
Start time : A.D. 2013-Feb-15 18:00.0000 UT
Stop time : A.D. 2013-Feb-16 23:30.0000 UT
Step-size : 1 minutes
*****

Target pole/equ : No model available
Target radii : (unavailable)
Center geodetic : 7.14040000,45.1422031,0.4951559 {E-lon(deg),Lat(deg),Alt(km)}
Center cylindrical: 7.14040000,4506.75553,4498.8568 {E-lon(deg),Dxy(km),Dz(km)}
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 : Sun {source: DE405}
Vis. interferer : MOON (R_eq= 1737.400) km {source: DE405}
Rel. light bend : Sun, EARTH {source: DE405}
Rel. lght bnd GM: 1.3271E+11, 3.9860E+05 km^3/s^2
Small perturbers: Ceres, Pallas, Vesta {source: SB405-CPV-2}
Small body GMS : 6.32E+01, 1.43E+01, 1.78E+01 km^3/s^2
Atmos refraction: NO (AIRLESS)
RA format : HMS
Time format : CAL
RTS-only print : NO
EOP file : eop.130201.p130425
EOP coverage : DATA-BASED 1962-JAN-20 TO 2013-FEB-01. PREDICTS-> 2013-APR-24
Units conversion: 1 AU= 149597870.691 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)
*****
Initial FK5/J2000.0 heliocentric ecliptic osculating elements (AU, DAYS, DEG):
EPOCH= 2456014.5 ! 2012-Mar-28.00 (CT) Residual RMS= .30806
EC= .1082238272885815 QR= .8933178241759214 TP= 2455895.3533163699
OM= 147.2857081305732 W= 271.0846959522515 IN= 10.33896985713762
Asteroid physical parameters (KM, SEC, rotational period in hours):
GM= n.a. RAD= n.a. ROTPER= n.a.
H= 24.357 G= .150 B-V= n.a.
ALBEDO= n.a. STYP= n.a.

*****
Date__(UT)__HR:MN R.A.__(ICRF/J2000.0)_DEC Apmag delta deldot S-O-T /r S-T-O
*****
2013-Feb-15 18:00 Nm 11 51 47.35 -58 29 36.5 9.72 0.00035985936545 -5.1765458 105.2459 /L 74.7328
2013-Feb-15 18:01 Nm 11 52 02.29 -58 09 58.7 9.70 0.00035778710650 -5.1573154 105.5162 /L 74.4626
2013-Feb-15 18:02 Nm 11 52 17.11 -57 50 07.2 9.68 0.00035572263785 -5.1376986 105.7895 /L 74.1895
2013-Feb-15 18:03 Nm 11 52 31.81 -57 30 01.9 9.66 0.00035366611616 -5.1176871 106.0657 /L 73.9135
2013-Feb-15 18:04 Am 11 52 46.41 -57 09 42.6 9.64 0.00035161770135 -5.0972724 106.3449 /L 73.6344
2013-Feb-15 18:05 Am 11 53 00.89 -56 49 09.0 9.61 0.00034957755690 -5.0764460 106.6271 /L 73.3523
2013-Feb-15 18:06 Am 11 53 15.26 -56 28 21.1 9.59 0.00034754584973 -5.0551990 106.9124 /L 73.0671
2013-Feb-15 18:07 Am 11 53 29.52 -56 07 18.6 9.57 0.00034552275019 -5.0335225 107.2009 /L 72.7788
2013-Feb-15 18:08 Am 11 53 43.68 -55 46 01.3 9.55 0.00034350843243 -5.0114074 107.4924 /L 72.4874
2013-Feb-15 18:09 Am 11 53 57.73 -55 24 29.0 9.52 0.00034150307421 -4.9888445 107.7872 /L 72.1928
2013-Feb-15 18:10 Am 11 54 11.69 -55 02 41.6 9.50 0.00033950685691 -4.9658244 108.0851 /L 71.8950
2013-Feb-15 18:11 Am 11 54 25.54 -54 40 38.9 9.48 0.00033751996592 -4.9423374 108.3862 /L 71.5940
2013-Feb-15 18:12 Am 11 54 39.30 -54 18 20.6 9.46 0.00033554259040 -4.9183739 108.6906 /L 71.2898
2013-Feb-15 18:13 Am 11 54 52.96 -53 55 46.5 9.43 0.00033357492334 -4.8939240 108.9983 /L 70.9822
2013-Feb-15 18:14 Am 11 55 06.52 -53 32 56.6 9.41 0.00033161716197 -4.8689777 109.3093 /L 70.6714
2013-Feb-15 18:15 Am 11 55 20.00 -53 09 50.5 9.39 0.00032966950726 -4.8435247 109.6236 /L 70.3572
2013-Feb-15 18:16 Am 11 55 33.38 -52 46 28.0 9.37 0.00032773216460 -4.8175548 109.9413 /L 70.0397
2013-Feb-15 18:17 Am 11 55 46.67 -52 22 49.1 9.34 0.00032580534341 -4.7910574 110.2624 /L 69.7187
2013-Feb-15 18:18 Am 11 55 59.88 -51 58 53.4 9.32 0.00032388925722 -4.7640220 110.5869 /L 69.3944
2013-Feb-15 18:19 Am 11 56 13.00 -51 34 40.8 9.30 0.00032198412409 -4.7364377 110.9148 /L 69.0666
2013-Feb-15 18:20 Am 11 56 26.04 -51 10 11.1 9.27 0.00032009016632 -4.7082937 111.2462 /L 68.7353
2013-Feb-15 18:21 Am 11 56 39.00 -50 45 24.1 9.25 0.00031820761046 -4.6795790 111.5811 /L 68.4006
2013-Feb-15 18:22 Am 11 56 51.87 -50 20 19.6 9.23 0.00031633668774 -4.6502825 111.9195 /L 68.0623
2013-Feb-15 18:23 Am 11 57 04.67 -49 54 57.3 9.20 0.00031447763380 -4.6203927 112.2614 /L 67.7206
2013-Feb-15 18:24 Am 11 57 17.39 -49 29 17.2 9.18 0.00031263068864 -4.5898985 112.6068 /L 67.3753
2013-Feb-15 18:25 Am 11 57 30.04 -49 03 19.0 9.16 0.00031079609711 -4.5587884 112.9558 /L 67.0264
2013-Feb-15 18:26 Am 11 57 42.61 -48 37 02.5 9.13 0.00030897410858 -4.5270507 113.3084 /L 66.6740
2013-Feb-15 18:27 Am 11 57 55.12 -48 10 27.5 9.11 0.00030716497687 -4.4946739 113.6645 /L 66.3180
2013-Feb-15 18:28 Am 11 58 07.55 -47 43 33.9 9.08 0.00030536896081 -4.4616463 114.0242 /L 65.9585

```



```

*****
Date__(UT)__HR:MN      R.A.__(ICRF/J2000.0)_DEC  Apmag      delta      deldot      S-O-T /r      S-T-O
*****
2013-Feb-15 18:29 Am 11 58 19.91 -47 16 21.5  9.06 0.00030358632377 -4.4279560 114.3875 /L 65.5953
2013-Feb-15 18:30 Am 11 58 32.21 -46 48 50.0  9.04 0.00030181733371 -4.3935913 114.7544 /L 65.2285
2013-Feb-15 18:31 Am 11 58 44.45 -46 20 59.4  9.01 0.00030006226363 -4.3585404 115.1250 /L 64.8581
2013-Feb-15 18:32 Am 11 58 56.62 -45 52 49.4  8.99 0.00029832139114 -4.3227912 115.4991 /L 64.4842
2013-Feb-15 18:33 Am 11 59 08.73 -45 24 19.8  8.96 0.00029659499845 -4.2863321 115.8768 /L 64.1066
2013-Feb-15 18:34 Am 11 59 20.78 -44 55 30.5  8.94 0.00029488337284 -4.2491511 116.2581 /L 63.7254
2013-Feb-15 18:35 Am 11 59 32.77 -44 26 21.4  8.92 0.00029318680616 -4.2112365 116.6430 /L 63.3406
2013-Feb-15 18:36 Am 11 59 44.71 -43 56 52.3  8.89 0.00029150559490 -4.1725763 117.0315 /L 62.9523
2013-Feb-15 18:37 Am 11 59 56.59 -43 27 02.9  8.87 0.00028984004050 -4.1331590 117.4235 /L 62.5604
2013-Feb-15 18:38 Am 12 00 08.42 -42 56 53.3  8.84 0.00028819044898 -4.0929728 117.8191 /L 62.1650
2013-Feb-15 18:39 m 12 00 20.20 -42 26 23.2  8.82 0.00028655713080 -4.0520064 118.2182 /L 61.7660
2013-Feb-15 18:40 m 12 00 31.93 -41 55 32.5  8.79 0.00028494040136 -4.0102482 118.6208 /L 61.3636
2013-Feb-15 18:41 m 12 00 43.61 -41 24 21.1  8.77 0.00028334058040 -3.9676872 119.0268 /L 60.9577
2013-Feb-15 18:42 m 12 00 55.24 -40 52 48.9  8.75 0.00028175799197 -3.9243122 119.4363 /L 60.5483
2013-Feb-15 18:43 m 12 01 06.83 -40 20 55.8  8.72 0.00028019296484 -3.8801125 119.8492 /L 60.1356
2013-Feb-15 18:44 m 12 01 18.38 -39 48 41.6  8.70 0.00027864583188 -3.8350774 120.2653 /L 59.7196
2013-Feb-15 18:45 m 12 01 29.88 -39 16 06.3  8.67 0.00027711692997 -3.7891968 120.6848 /L 59.3002
2013-Feb-15 18:46 m 12 01 41.35 -38 43 09.7  8.65 0.00027560660043 -3.7424607 121.1075 /L 58.8777
2013-Feb-15 18:47 m 12 01 52.77 -38 09 51.9  8.62 0.00027411518830 -3.6948593 121.5334 /L 58.4520
2013-Feb-15 18:48 m 12 02 04.16 -37 36 12.8  8.60 0.00027264304228 -3.6463834 121.9623 /L 58.0231
2013-Feb-15 18:49 m 12 02 15.51 -37 02 12.3  8.58 0.00027119051502 -3.5970242 122.3943 /L 57.5913
2013-Feb-15 18:50 m 12 02 26.83 -36 27 50.4  8.55 0.00026975796250 -3.5467732 122.8292 /L 57.1565
2013-Feb-15 18:51 m 12 02 38.12 -35 53 07.0  8.53 0.00026834574377 -3.4956225 123.2670 /L 56.7189
2013-Feb-15 18:52 m 12 02 49.38 -35 18 02.2  8.50 0.00026695422139 -3.4435648 123.7075 /L 56.2785
2013-Feb-15 18:53 m 12 03 00.60 -34 42 36.0  8.48 0.00026558376024 -3.3905930 124.1507 /L 55.8354
2013-Feb-15 18:54 m 12 03 11.80 -34 06 48.3  8.45 0.00026423472835 -3.3367011 124.5964 /L 55.3899
2013-Feb-15 18:55 m 12 03 22.98 -33 30 39.2  8.43 0.00026290749590 -3.2818835 125.0446 /L 54.9418
2013-Feb-15 18:56 m 12 03 34.13 -32 54 08.9  8.41 0.00026160243490 -3.2261351 125.4950 /L 54.4915
2013-Feb-15 18:57 m 12 03 45.25 -32 17 17.2  8.38 0.00026031991971 -3.1694520 125.9477 /L 54.0391
2013-Feb-15 18:58 m 12 03 56.35 -31 40 04.4  8.36 0.00025906032593 -3.1118306 126.4023 /L 53.5846
2013-Feb-15 18:59 m 12 04 07.44 -31 02 30.5  8.34 0.00025782403012 -3.0532683 126.8588 /L 53.1282
2013-Feb-15 19:00 m 12 04 18.50 -30 24 35.6  8.31 0.00025661141020 -2.9937636 127.3170 /L 52.6702
2013-Feb-15 19:01 m 12 04 29.55 -29 46 20.0  8.29 0.00025542284434 -2.9333155 127.7767 /L 52.2106
2013-Feb-15 19:02 m 12 04 40.58 -29 07 43.6  8.27 0.00025425871061 -2.8719243 128.2377 /L 51.7497
2013-Feb-15 19:03 m 12 04 51.59 -28 28 46.8  8.24 0.00025311938730 -2.8095910 128.6999 /L 51.2876
2013-Feb-15 19:04 m 12 05 02.59 -27 49 29.7  8.22 0.00025200525179 -2.7463179 129.1631 /L 50.8246
2013-Feb-15 19:05 m 12 05 13.58 -27 09 52.6  8.20 0.00025091668013 -2.6821081 129.6269 /L 50.3608
2013-Feb-15 19:06 m 12 05 24.56 -26 29 55.6  8.18 0.00024985404734 -2.6169662 130.0913 /L 49.8966
2013-Feb-15 19:07 m 12 05 35.53 -25 49 39.0  8.16 0.00024881772620 -2.5508976 130.5560 /L 49.4321
2013-Feb-15 19:08 m 12 05 46.49 -25 09 03.2  8.13 0.00024780808676 -2.4839090 131.0206 /L 48.9676
2013-Feb-15 19:09 m 12 05 57.44 -24 28 08.4  8.11 0.00024682549669 -2.4160084 131.4850 /L 48.5033
2013-Feb-15 19:10 m 12 06 08.39 -23 46 55.0  8.09 0.00024587031989 -2.3472050 131.9489 /L 48.0395
2013-Feb-15 19:11 m 12 06 19.33 -23 05 23.3  8.07 0.00024494291613 -2.2775093 132.4120 /L 47.5765
2013-Feb-15 19:12 m 12 06 30.27 -22 23 33.6  8.05 0.00024404364116 -2.2069331 132.8741 /L 47.1146
2013-Feb-15 19:13 m 12 06 41.20 -21 41 26.5  8.03 0.00024317284546 -2.1354896 133.3347 /L 46.6541
2013-Feb-15 19:14 m 12 06 52.14 -20 59 02.2  8.01 0.00024233087380 -2.0631934 133.7936 /L 46.1954
2013-Feb-15 19:15 m 12 07 03.07 -20 16 21.3  7.99 0.00024151806531 -1.9900602 134.2504 /L 45.7387
2013-Feb-15 19:16 m 12 07 14.00 -19 33 24.2  7.97 0.00024073475188 -1.9161073 134.7048 /L 45.2843
2013-Feb-15 19:17 m 12 07 24.94 -18 50 11.4  7.95 0.00023998125877 -1.8413536 135.1565 /L 44.8328
2013-Feb-15 19:18 m 12 07 35.88 -18 06 43.4  7.93 0.00023925790320 -1.7658189 135.6051 /L 44.3843
2013-Feb-15 19:19 m 12 07 46.82 -17 23 00.7  7.91 0.00023856499384 -1.6895248 136.0502 /L 43.9393
2013-Feb-15 19:20 m 12 07 57.77 -16 39 03.9  7.89 0.00023790283103 -1.6124942 136.4914 /L 43.4982
2013-Feb-15 19:21 m 12 08 08.73 -15 54 53.6  7.87 0.00023727170498 -1.5347512 136.9284 /L 43.0614
2013-Feb-15 19:22 m 12 08 19.69 -15 10 30.4  7.86 0.00023667189655 -1.4563215 137.3606 /L 42.6292
2013-Feb-15 19:23 m 12 08 30.65 -14 25 54.9  7.84 0.00023610367580 -1.3772320 137.7878 /L 42.2022
2013-Feb-15 19:24 m 12 08 41.63 -13 41 07.7  7.82 0.00023556730146 -1.2975108 138.2095 /L 41.7806
2013-Feb-15 19:25 m 12 08 52.61 -12 56 09.4  7.81 0.00023506302130 -1.2171876 138.6252 /L 41.3650
2013-Feb-15 19:26 m 12 09 03.61 -12 11 00.9  7.79 0.00023459107027 -1.1362930 139.0345 /L 40.9558
2013-Feb-15 19:27 m 12 09 14.62 -11 25 42.6  7.78 0.00023415167146 -1.0548590 139.4370 /L 40.5534
2013-Feb-15 19:28 m 12 09 25.63 -10 40 15.5  7.76 0.00023374503458 -0.9729186 139.8322 /L 40.1583
2013-Feb-15 19:29 m 12 09 36.66 -09 54 40.1  7.75 0.00023337135565 -0.8905059 140.2197 /L 39.7709
2013-Feb-15 19:30 m 12 09 47.70 -09 08 57.3  7.73 0.00023303081741 -0.8076561 140.5991 /L 39.3917
2013-Feb-15 19:31 m 12 09 58.76 -08 23 07.7  7.72 0.000232723358754 -0.7244053 140.9698 /L 39.0211
2013-Feb-15 19:32 m 12 10 09.82 -07 37 12.2  7.71 0.00023244981978 -0.6407906 141.3314 /L 38.6596
2013-Feb-15 19:33 m 12 10 20.91 -06 51 11.6  7.69 0.00023220965254 -0.5568496 141.6835 /L 38.3076
2013-Feb-15 19:34 m 12 10 32.00 -06 05 06.5  7.68 0.00023200320869 -0.4726209 142.0256 /L 37.9655
2013-Feb-15 19:35 m 12 10 43.12 -05 18 57.8  7.67 0.00023183059602 -0.3881437 142.3573 /L 37.6339
2013-Feb-15 19:36 m 12 10 54.24 -04 32 46.3  7.66 0.00023169190623 -0.3034576 142.6782 /L 37.3131
2013-Feb-15 19:37 m 12 11 05.39 -03 46 32.9  7.65 0.00023158721494 -0.2186300 142.9879 /L 37.0036
2013-Feb-15 19:38 m 12 11 16.55 -03 00 18.3  7.64 0.00023151658171 -0.1336202 143.2858 /L 36.7057
2013-Feb-15 19:39 m 12 11 27.73 -02 14 03.3  7.64 0.00023148004972 -0.0485502 143.5718 /L 36.4198
2013-Feb-15 19:40 m 12 11 38.92 -01 27 48.7  7.63 0.00023147764567 0.0365660 143.8453 /L 36.1464
2013-Feb-15 19:41 m 12 11 50.14 -00 41 35.4  7.62 0.00023150938003 0.1216873 144.1060 /L 35.8857
2013-Feb-15 19:42 m 12 12 01.37 +00 04 35.8  7.61 0.00023157524648 0.2067727 144.3536 /L 35.6382
2013-Feb-15 19:43 m 12 12 12.62 +00 50 44.1  7.61 0.00023167522239 0.2917810 144.5879 /L 35.4040
2013-Feb-15 19:44 m 12 12 23.89 +01 36 48.7  7.60 0.00023180926865 0.3766715 144.8084 /L 35.1836
2013-Feb-15 19:45 m 12 12 35.18 +02 22 48.8  7.60 0.00023197733003 0.4614038 145.0149 /L 34.9771
2013-Feb-15 19:46 r 12 12 46.48 +03 08 43.6  7.60 0.00023217933488 0.5459376 145.2072 /L 34.7848

```





```

*****
Date__(UT)__HR:MN      R.A.__(ICRF/J2000.0)_DEC  Apmag      delta      deldot      S-O-T /r      S-T-O
*****
2013-Feb-15 21:06 m 12 28 51.89 +49 07 08.3  8.76 0.00033455767419  4.9736690 131.8922 /L  48.0945
2013-Feb-15 21:07 m 12 29 04.64 +49 28 42.1  8.78 0.00033655753092  4.9990649 131.6508 /L  48.3358
2013-Feb-15 21:08 m 12 29 17.39 +49 50 00.4  8.80 0.00033856747265  5.0239592 131.4111 /L  48.5753
2013-Feb-15 21:09 m 12 29 30.16 +50 11 03.4  8.82 0.00034058730027  5.0483618 131.1733 /L  48.8130
2013-Feb-15 21:10 m 12 29 42.95 +50 31 51.3  8.84 0.00034261681851  5.0722825 130.9374 /L  49.0488
2013-Feb-15 21:11 m 12 29 55.75 +50 52 24.1  8.86 0.00034465583612  5.0957311 130.7033 /L  49.2828
2013-Feb-15 21:12 m 12 30 08.56 +51 12 42.3  8.88 0.00034670416556  5.1187169 130.4711 /L  49.5148
2013-Feb-15 21:13 m 12 30 21.39 +51 32 45.8  8.90 0.00034876162318  5.1412494 130.2408 /L  49.7450
2013-Feb-15 21:14 m 12 30 34.24 +51 52 35.1  8.92 0.00035082802899  5.1633377 130.0124 /L  49.9732
2013-Feb-15 21:15 m 12 30 47.10 +52 12 10.1  8.94 0.00035290320664  5.1849909 129.7859 /L  50.1996
2013-Feb-15 21:16 m 12 30 59.97 +52 31 31.2  8.95 0.00035498698344  5.2062178 129.5613 /L  50.4241
2013-Feb-15 21:17 m 12 31 12.86 +52 50 38.5  8.97 0.00035707919016  5.2270272 129.3386 /L  50.6466
2013-Feb-15 21:18 m 12 31 25.77 +53 09 32.2  8.99 0.00035917966110  5.2474276 129.1178 /L  50.8672
2013-Feb-15 21:19 m 12 31 38.69 +53 28 12.5  9.01 0.00036128823392  5.2674275 128.8990 /L  51.0859
2013-Feb-15 21:20 m 12 31 51.62 +53 46 39.6  9.03 0.00036340474965  5.2870352 128.6820 /L  51.3027
2013-Feb-15 21:21 m 12 32 04.57 +54 04 53.6  9.05 0.00036552905260  5.3062587 128.4670 /L  51.5176
2013-Feb-15 21:22 m 12 32 17.53 +54 22 54.7  9.07 0.00036766099032  5.3251060 128.2539 /L  51.7306
2013-Feb-15 21:23 m 12 32 30.51 +54 40 43.2  9.09 0.00036980041349  5.3435850 128.0427 /L  51.9417
2013-Feb-15 21:24 m 12 32 43.51 +54 58 19.2  9.11 0.00037194717591  5.3617032 127.8333 /L  52.1508
2013-Feb-15 21:25 m 12 32 56.52 +55 15 42.8  9.12 0.00037410113444  5.3794683 127.6259 /L  52.3581
2013-Feb-15 21:26 m 12 33 09.54 +55 32 54.2  9.14 0.00037626214889  5.3968875 127.4204 /L  52.5635
2013-Feb-15 21:27 m 12 33 22.58 +55 49 53.7  9.16 0.00037843008203  5.4139682 127.2167 /L  52.7671
2013-Feb-15 21:28 m 12 33 35.63 +56 06 41.4  9.18 0.00038060479946  5.4307172 127.0149 /L  52.9687
2013-Feb-15 21:29 m 12 33 48.70 +56 23 17.3  9.20 0.00038278616962  5.4471417 126.8149 /L  53.1685
2013-Feb-15 21:30 m 12 34 01.79 +56 39 41.8  9.21 0.00038497406367  5.4632484 126.6168 /L  53.3665
2013-Feb-15 21:31 m 12 34 14.88 +56 55 55.0  9.23 0.00038716835552  5.4790439 126.4205 /L  53.5626
2013-Feb-15 21:32 m 12 34 28.00 +57 11 57.0  9.25 0.00038936892166  5.4945348 126.2261 /L  53.7569
2013-Feb-15 21:33 m 12 34 41.13 +57 27 48.0  9.27 0.00039157564120  5.5097275 126.0335 /L  53.9494
2013-Feb-15 21:34 m 12 34 54.27 +57 43 28.1  9.29 0.00039378839578  5.5246281 125.8426 /L  54.1401
2013-Feb-15 21:35 m 12 35 07.43 +57 58 57.5  9.30 0.00039600706951  5.5392428 125.6536 /L  54.3290
2013-Feb-15 21:36 m 12 35 20.61 +58 14 16.3  9.32 0.00039823154894  5.5535777 125.4663 /L  54.5161
2013-Feb-15 21:37 m 12 35 33.80 +58 29 24.8  9.34 0.00040046172298  5.5676385 125.2808 /L  54.7015
2013-Feb-15 21:38 m 12 35 47.00 +58 44 23.0  9.36 0.00040269748289  5.5814310 125.0970 /L  54.8851
2013-Feb-15 21:39 m 12 36 00.23 +58 59 11.0  9.37 0.00040493872219  5.5949608 124.9150 /L  55.0669
2013-Feb-15 21:40 m 12 36 13.46 +59 13 49.2  9.39 0.00040718533662  5.6082334 124.7347 /L  55.2471
2013-Feb-15 21:41 m 12 36 26.71 +59 28 17.4  9.41 0.00040943722413  5.6212543 124.5561 /L  55.4255
2013-Feb-15 21:42 m 12 36 39.98 +59 42 36.0  9.42 0.00041169428475  5.6340285 124.3792 /L  55.6023
2013-Feb-15 21:43 m 12 36 53.27 +59 56 45.0  9.44 0.00041395642067  5.6465614 124.2040 /L  55.7774
2013-Feb-15 21:44 m 12 37 06.56 +60 10 44.6  9.46 0.00041622353606  5.6588579 124.0305 /L  55.9508
2013-Feb-15 21:45 m 12 37 19.88 +60 24 35.0  9.47 0.00041849553712  5.6709230 123.8585 /L  56.1225
2013-Feb-15 21:46 m 12 37 33.21 +60 38 16.1  9.49 0.00042077233198  5.6827614 123.6883 /L  56.2927
2013-Feb-15 21:47 m 12 37 46.56 +60 51 48.3  9.51 0.00042305383070  5.6943779 123.5196 /L  56.4612
2013-Feb-15 21:48 m 12 37 59.92 +61 05 11.5  9.52 0.00042533994522  5.7057772 123.3526 /L  56.6281
2013-Feb-15 21:49 m 12 38 13.30 +61 18 25.9  9.54 0.00042763058925  5.7169636 123.1871 /L  56.7934
2013-Feb-15 21:50 m 12 38 26.69 +61 31 31.8  9.56 0.00042992567837  5.7279416 123.0232 /L  56.9571
2013-Feb-15 21:51 m 12 38 40.10 +61 44 29.0  9.57 0.00043222512985  5.7387156 122.8609 /L  57.1193
2013-Feb-15 21:52 m 12 38 53.53 +61 57 17.9  9.59 0.00043452886269  5.7492896 122.7001 /L  57.2800
2013-Feb-15 21:53 m 12 39 06.97 +62 09 58.5  9.61 0.00043683679755  5.7596680 122.5408 /L  57.4391
2013-Feb-15 21:54 m 12 39 20.43 +62 22 30.9  9.62 0.00043914885675  5.7698546 122.3830 /L  57.5967
2013-Feb-15 21:55 m 12 39 33.90 +62 34 55.2  9.64 0.00044146496419  5.7798535 122.2268 /L  57.7528
2013-Feb-15 21:56 m 12 39 47.39 +62 47 11.6  9.65 0.00044378504533  5.7896685 122.0720 /L  57.9074
2013-Feb-15 21:57 m 12 40 00.90 +62 59 20.1  9.67 0.00044610902717  5.7993033 121.9187 /L  58.0606
2013-Feb-15 21:58 m 12 40 14.43 +63 11 20.9  9.69 0.00044843683819  5.8087617 121.7668 /L  58.2123
2013-Feb-15 21:59 m 12 40 27.97 +63 23 14.1  9.70 0.00045076840836  5.8180472 121.6164 /L  58.3626
2013-Feb-15 22:00 m 12 40 41.52 +63 34 59.7  9.72 0.00045310366905  5.8271634 121.4674 /L  58.5114
2013-Feb-15 22:01 m 12 40 55.10 +63 46 37.9  9.73 0.000455442255305  5.8361137 121.3198 /L  58.6589
2013-Feb-15 22:02 m 12 41 08.69 +63 58 08.9  9.75 0.00045778499449  5.8449015 121.1736 /L  58.8049
2013-Feb-15 22:03 m 12 41 22.30 +64 09 32.6  9.76 0.00046013092887  5.8535301 121.0288 /L  58.9496
2013-Feb-15 22:04 m 12 41 35.92 +64 20 49.2  9.78 0.00046248029296  5.8620027 120.8853 /L  59.0929
2013-Feb-15 22:05 m 12 41 49.56 +64 31 58.7  9.79 0.00046483302484  5.8703224 120.7432 /L  59.2349
2013-Feb-15 22:06 m 12 42 03.22 +64 43 01.4  9.81 0.00046718906382  5.8784924 120.6024 /L  59.3755
2013-Feb-15 22:07 m 12 42 16.90 +64 53 57.2  9.82 0.00046954835043  5.8865156 120.4630 /L  59.5148
2013-Feb-15 22:08 m 12 42 30.59 +65 04 46.3  9.84 0.00047191082642  5.8943950 120.3248 /L  59.6528
2013-Feb-15 22:09 m 12 42 44.30 +65 15 28.7  9.85 0.00047427643467  5.9021335 120.1879 /L  59.7895
2013-Feb-15 22:10 m 12 42 58.03 +65 26 04.6  9.87 0.00047664511922  5.9097339 120.0523 /L  59.9250
2013-Feb-15 22:11 m 12 43 11.77 +65 36 34.0  9.88 0.00047901682524  5.9171989 119.9180 /L  60.0592
2013-Feb-15 22:12 m 12 43 25.54 +65 46 57.0  9.90 0.00048139149897  5.9245312 119.7849 /L  60.1921
2013-Feb-15 22:13 m 12 43 39.32 +65 57 13.8  9.91 0.00048376908773  5.9317335 119.6531 /L  60.3238
2013-Feb-15 22:14 m 12 43 53.11 +66 07 24.3  9.93 0.00048614953989  5.9388083 119.5224 /L  60.4543
2013-Feb-15 22:15 m 12 44 06.93 +66 17 28.7  9.94 0.00048853280481  5.9457582 119.3930 /L  60.5836
2013-Feb-15 22:16 m 12 44 20.76 +66 27 27.1  9.96 0.00049091883289  5.9525855 119.2648 /L  60.7116
2013-Feb-15 22:17 m 12 44 34.62 +66 37 19.5  9.97 0.00049330757549  5.9592929 119.1377 /L  60.8385
2013-Feb-15 22:18 m 12 44 48.49 +66 47 06.0  9.98 0.00049569898491  5.9658825 119.0119 /L  60.9643
2013-Feb-15 22:19 m 12 45 02.38 +66 56 46.7  10.00 0.00049809301440  5.9723566 118.8871 /L  61.0888
2013-Feb-15 22:20 m 12 45 16.28 +67 06 21.7  10.01 0.00050048961813  5.9787177 118.7635 /L  61.2123
2013-Feb-15 22:21 m 12 45 30.21 +67 15 51.0  10.03 0.00050288875115  5.9849677 118.6411 /L  61.3346
2013-Feb-15 22:22 m 12 45 44.15 +67 25 14.8  10.04 0.00050529036938  5.9911090 118.5197 /L  61.4558
2013-Feb-15 22:23 m 12 45 58.11 +67 34 33.0  10.05 0.00050769442962  5.9971435 118.3995 /L  61.5758

```



```

*****
Date__(UT)__HR:MN      R.A.__(ICRF/J2000.0)_DEC  APmag      delta      deldot      S-O-T /r      S-T-O
*****
2013-Feb-15 22:24 m 12 46 12.10 +67 43 45.8 10.07 0.00051010088948 6.0030735 118.2804 /L 61.6948
2013-Feb-15 22:25 m 12 46 26.09 +67 52 53.2 10.08 0.00051250970741 6.0089008 118.1623 /L 61.8127
2013-Feb-15 22:26 m 12 46 40.11 +68 01 55.3 10.10 0.00051492084264 6.0146274 118.0453 /L 61.9296
2013-Feb-15 22:27 m 12 46 54.15 +68 10 52.2 10.11 0.00051733425519 6.0202554 117.9294 /L 62.0454
2013-Feb-15 22:28 m 12 47 08.21 +68 19 44.0 10.12 0.00051974990586 6.0257866 117.8145 /L 62.1601
2013-Feb-15 22:29 m 12 47 22.28 +68 28 30.6 10.14 0.00052216775617 6.0312227 117.7006 /L 62.2738
2013-Feb-15 22:30 m 12 47 36.38 +68 37 12.3 10.15 0.00052458776841 6.0365657 117.5878 /L 62.3865
2013-Feb-15 22:31 m 12 47 50.49 +68 45 48.9 10.16 0.00052700990556 6.0418174 117.4759 /L 62.4982
2013-Feb-15 22:32 m 12 48 04.63 +68 54 20.7 10.18 0.00052943413130 6.0469793 117.3651 /L 62.6089
2013-Feb-15 22:33 m 12 48 18.78 +69 02 47.6 10.19 0.00053186041003 6.0520533 117.2553 /L 62.7186
2013-Feb-15 22:34 m 12 48 32.96 +69 11 09.7 10.20 0.00053428870679 6.0570410 117.1464 /L 62.8273
2013-Feb-15 22:35 m 12 48 47.15 +69 19 27.1 10.22 0.00053671898728 6.0619440 117.0385 /L 62.9351
2013-Feb-15 22:36 m 12 49 01.36 +69 27 39.9 10.23 0.00053915121786 6.0667639 116.9315 /L 63.0419
2013-Feb-15 22:37 m 12 49 15.60 +69 35 48.1 10.24 0.00054158536552 6.0715022 116.8255 /L 63.1477
2013-Feb-15 22:38 m 12 49 29.85 +69 43 51.7 10.26 0.00054402139783 6.0761605 116.7204 /L 63.2527
2013-Feb-15 22:39 m 12 49 44.13 +69 51 50.8 10.27 0.00054645928302 6.0807403 116.6163 /L 63.3567
2013-Feb-15 22:40 m 12 49 58.42 +69 59 45.5 10.28 0.00054889898987 6.0852430 116.5130 /L 63.4597
2013-Feb-15 22:41 m 12 50 12.74 +70 07 35.9 10.29 0.00055134048775 6.0899670 116.4107 /L 63.5619
2013-Feb-15 22:42 m 12 50 27.07 +70 15 21.9 10.31 0.00055378374660 6.0940228 116.3092 /L 63.6632
2013-Feb-15 22:43 m 12 50 41.43 +70 23 03.6 10.32 0.00055622873691 6.0983027 116.2087 /L 63.7636
2013-Feb-15 22:44 m 12 50 55.81 +70 30 41.2 10.33 0.00055867542971 6.1025111 116.1090 /L 63.8632
2013-Feb-15 22:45 m 12 51 10.21 +70 38 14.6 10.34 0.00056112379657 6.1066492 116.0102 /L 63.9619
2013-Feb-15 22:46 m 12 51 24.63 +70 45 43.8 10.36 0.00056357380956 6.1107184 115.9122 /L 64.0597
2013-Feb-15 22:47 m 12 51 39.07 +70 53 09.0 10.37 0.00056602544129 6.1147198 115.8150 /L 64.1567
2013-Feb-15 22:48 m 12 51 53.53 +71 00 30.2 10.38 0.00056847866484 6.1186548 115.7187 /L 64.2528
2013-Feb-15 22:49 m 12 52 08.01 +71 07 47.4 10.39 0.00057093345381 6.1225245 115.6233 /L 64.3481
2013-Feb-15 22:50 m 12 52 22.52 +71 15 00.7 10.41 0.00057338978223 6.1263301 115.5286 /L 64.4426
2013-Feb-15 22:51 m 12 52 37.05 +71 22 10.2 10.42 0.00057584762463 6.1300728 115.4348 /L 64.5363
2013-Feb-15 22:52 m 12 52 51.59 +71 29 15.8 10.43 0.00057830695601 6.1337536 115.3417 /L 64.6292
2013-Feb-15 22:53 m 12 53 06.17 +71 36 17.6 10.44 0.00058076775179 6.1373738 115.2495 /L 64.7213
2013-Feb-15 22:54 m 12 53 20.76 +71 43 15.8 10.45 0.00058322998785 6.1409344 115.1580 /L 64.8127
2013-Feb-15 22:55 m 12 53 35.38 +71 50 10.2 10.47 0.00058569364049 6.1444364 115.0673 /L 64.9032
2013-Feb-15 22:56 m 12 53 50.01 +71 57 01.0 10.48 0.00058815868643 6.1478809 114.9773 /L 64.9930
2013-Feb-15 22:57 m 12 54 04.67 +72 03 48.1 10.49 0.00059062510281 6.1512689 114.8882 /L 65.0820
2013-Feb-15 22:58 m 12 54 19.36 +72 10 31.8 10.50 0.00059309286718 6.1546015 114.7997 /L 65.1703
2013-Feb-15 22:59 m 12 54 34.06 +72 17 11.9 10.51 0.00059556195748 6.1578795 114.7120 /L 65.2578
2013-Feb-15 23:00 m 12 54 48.79 +72 23 48.5 10.52 0.00059803235202 6.1611040 114.6251 /L 65.3447
2013-Feb-15 23:01 m 12 55 03.54 +72 30 21.7 10.54 0.00060050402953 6.1642758 114.5388 /L 65.4307
2013-Feb-15 23:02 m 12 55 18.32 +72 36 51.5 10.55 0.00060297696909 6.1673960 114.4533 /L 65.5161
2013-Feb-15 23:03 m 12 55 33.12 +72 43 17.9 10.56 0.00060545115014 6.1704654 114.3685 /L 65.6008
2013-Feb-15 23:04 m 12 55 47.94 +72 49 41.1 10.57 0.00060792655248 6.1734848 114.2844 /L 65.6847
2013-Feb-15 23:05 m 12 56 02.79 +72 56 00.9 10.58 0.00061040315627 6.1764552 114.2010 /L 65.7680
2013-Feb-15 23:06 m 12 56 17.66 +73 02 17.5 10.59 0.00061288094202 6.1793775 114.1182 /L 65.8506
2013-Feb-15 23:07 m 12 56 32.55 +73 08 30.9 10.60 0.00061535989056 6.1822524 114.0362 /L 65.9325
2013-Feb-15 23:08 m 12 56 47.47 +73 14 41.2 10.62 0.00061783998305 6.1850807 113.9548 /L 66.0137
2013-Feb-15 23:09 m 12 57 02.41 +73 20 48.3 10.63 0.00062032120100 6.1878633 113.8741 /L 66.0943
2013-Feb-15 23:10 m 12 57 17.38 +73 26 52.3 10.64 0.00062280352620 6.1906009 113.7940 /L 66.1742
2013-Feb-15 23:11 m 12 57 32.37 +73 32 53.2 10.65 0.00062528694078 6.1932943 113.7146 /L 66.2535
2013-Feb-15 23:12 m 12 57 47.38 +73 38 51.2 10.66 0.00062777142717 6.1959443 113.6358 /L 66.3321
2013-Feb-15 23:13 m 12 58 02.42 +73 44 46.1 10.67 0.00063025696808 6.1985516 113.5577 /L 66.4101
2013-Feb-15 23:14 m 12 58 17.49 +73 50 38.1 10.68 0.00063274354654 6.2011169 113.4802 /L 66.4874
2013-Feb-15 23:15 m 12 58 32.58 +73 56 27.1 10.69 0.00063523114584 6.2036410 113.4033 /L 66.5641
2013-Feb-15 23:16 m 12 58 47.69 +74 02 13.3 10.70 0.00063771974958 6.2061244 113.3270 /L 66.6402
2013-Feb-15 23:17 m 12 59 02.83 +74 07 56.5 10.72 0.00064020934162 6.2085680 113.2514 /L 66.7157
2013-Feb-15 23:18 m 12 59 18.00 +74 13 37.0 10.73 0.00064269990609 6.2109724 113.1764 /L 66.7906
2013-Feb-15 23:19 m 12 59 33.19 +74 19 14.7 10.74 0.00064519142738 6.2133382 113.1019 /L 66.8649
2013-Feb-15 23:20 m 12 59 48.41 +74 24 49.6 10.75 0.00064768389017 6.2156660 113.0280 /L 66.9386
2013-Feb-15 23:21 m 13 00 03.65 +74 30 21.7 10.76 0.00065017727936 6.2179566 112.9548 /L 67.0118
2013-Feb-15 23:22 m 13 00 18.92 +74 35 51.2 10.77 0.00065267158013 6.2202105 112.8821 /L 67.0843
2013-Feb-15 23:23 m 13 00 34.22 +74 41 17.9 10.78 0.00065516677788 6.2224283 112.8100 /L 67.1563
2013-Feb-15 23:24 m 13 00 49.54 +74 46 42.1 10.79 0.00065766285826 6.2246107 112.7384 /L 67.2277
2013-Feb-15 23:25 m 13 01 04.89 +74 52 03.5 10.80 0.00066015980717 6.2267582 112.6674 /L 67.2985
2013-Feb-15 23:26 m 13 01 20.27 +74 57 22.5 10.81 0.00066265761073 6.2288713 112.5970 /L 67.3688
2013-Feb-15 23:27 m 13 01 35.67 +75 02 38.8 10.82 0.00066515625528 6.2309508 112.5271 /L 67.4385
2013-Feb-15 23:28 m 13 01 51.10 +75 07 52.6 10.83 0.00066765572740 6.2329970 112.4578 /L 67.5077
2013-Feb-15 23:29 m 13 02 06.56 +75 13 03.9 10.84 0.00067015601388 6.2350105 112.3890 /L 67.5764
2013-Feb-15 23:30 m 13 02 22.04 +75 18 12.7 10.85 0.00067265710172 6.2369919 112.3207 /L 67.6445
*****

```

Column meaning a pag. 14

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



## 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 uniform 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 WITH TARGET RISE/TRANSIT/SET MARKER (OBSERVING SITE)

The solar-presence symbol is immediately followed by another marker symbol:

'm' Refracted upper-limb of Moon on or above apparent horizon  
' ' Refracted upper-limb of Moon below apparent horizon OR geocentric  
'r' Rise (target body on or above cut-off RTS elevation)  
't' Transit (target body at or past local maximum RTS elevation)  
's' Set (target body on or below cut-off RTS elevation)

### RTS MARKERS (TVH)

Rise and set are with respect to the reference ellipsoid true visual horizon defined by the elevation cut-off angle. Horizon dip and yellow-light refraction (Earth only) are considered. Accuracy is < or = to twice the requested search step-size.

### R.A.\_(ICRF/J2000.0)\_DEC =

J2000.0 astrometric right ascension and declination of target center. Corrected for light-time. Units: HMS (HH MM SS.ff) and DMS (DD MM SS.f)

### APmag =

Asteroid's approximate apparent visual magnitude by following definition:  
 $APmag = H + 5 \cdot \log_{10}(\delta) + 5 \cdot \log_{10}(r) - 2.5 \cdot \log_{10}((1-G) \cdot \phi_{11} + G \cdot \phi_{12})$ .  
In principle, accurate to ~ +/- 0.1 magnitude. For solar phase angles > 90 deg, the error could exceed 1 magnitude. No values are output for phase angles greater than 120 degrees, since the extrapolation error could be large and unknown. Units: NONE

### 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

### S-O-T /r =

Sun-Observer-Target angle; target's apparent solar elongation seen from observer location at print-time. If negative, the target center is behind the Sun. Angular units: DEGREES.

The '/r' column is a Sun-relative code, output for observing sites with defined rotation models only.

/T indicates target trails Sun (evening sky)

/L indicates target leads Sun (morning sky)

NOTE: The S-O-T solar elongation angle is the total separation in any direction. It does not indicate the angle of Sun leading or trailing.

### S-T-O =

Sun-Target-Observer (~ PHASE ANGLE) angle: the vertex angle at target center formed by a vector to the apparent center of the Sun and a vector intersecting the observer at print-time. This measurable angle is within 20 arcseconds (0.006 deg) of the reduced PHASE ANGLE at observer's location at print time. The difference is due to down-leg stellar aberration affecting measured target position but not apparent solar illumination direction. When computing phase, Horizons uses the true phase angle, not S-T-O, but the resulting difference in illuminated fraction is less than 0.001%. Units: DEGREES

Solar System Dynamics Group, Horizons On-Line Ephemeris System 4800 Oak Grove Drive, JPL - Pasadena, CA 91109 USA



Riprendiamo infine da **HEAVENS ABOVE** ([www.heavens-above.com](http://www.heavens-above.com)) i dati del passaggio di 2012 DA14 sopra la nostra postazione (SPE.S.-Specola Segusina) e, nelle pagine seguenti, la carta generale del transito nelle ore di visibilità e il dettaglio del momento del transito nell'Orsa Maggiore alle ore 22:30 (tempi in ora solare italiana = GMT + 1 h).

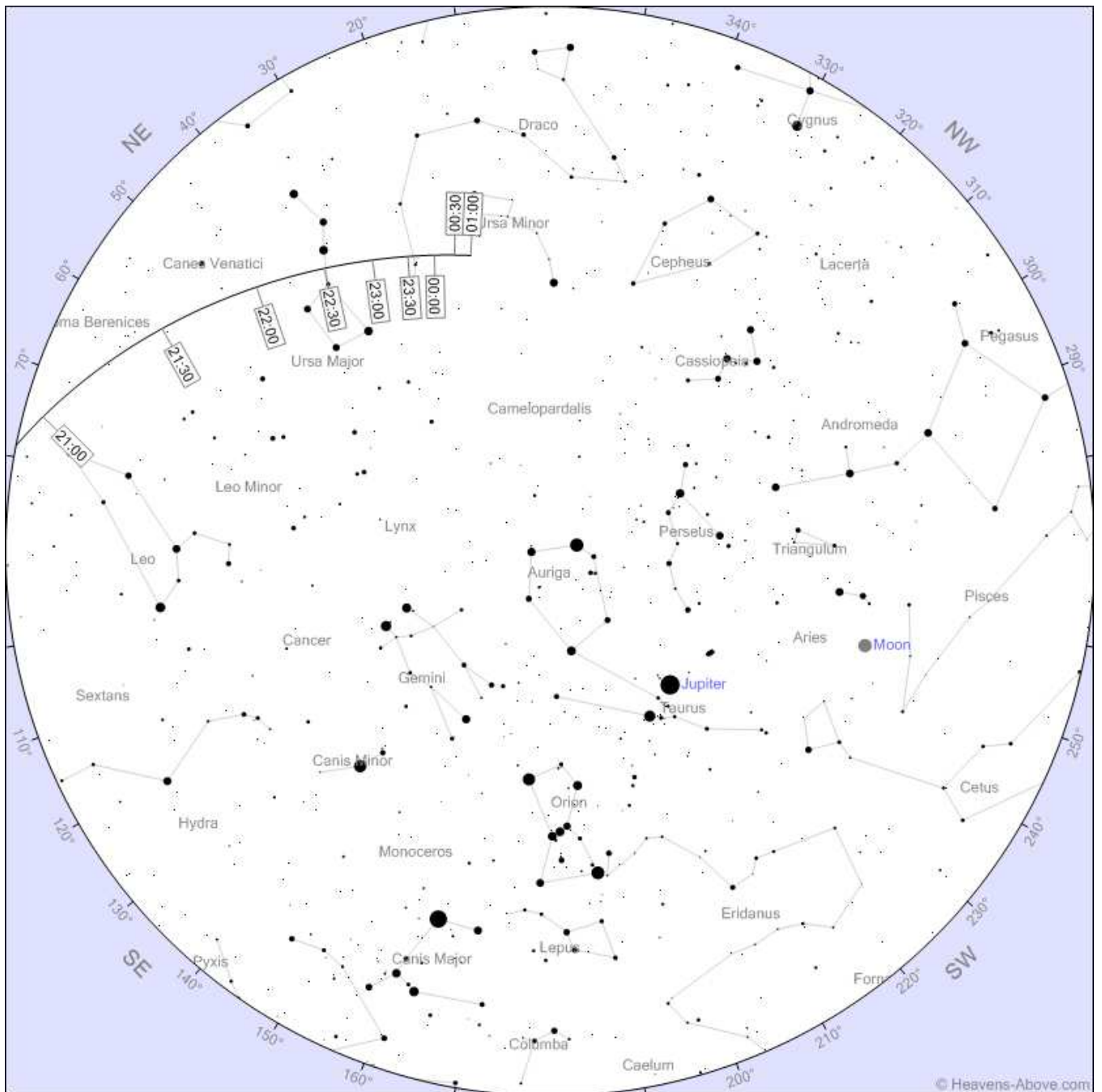
**Posizione di 2012 DA14 rispetto alla nostra postazione (SPE.S.-Specola Segusina)**

Time	Distance (km)	Brightness	Altitude	Right ascension	Declination	Constellation
16:00:00	117,677	11.8	-47.5°	09 <sup>h</sup> 17 <sup>m</sup>	-85° 14'	Octans
16:30:00	106,550	11.6	-49.0°	10 <sup>h</sup> 16 <sup>m</sup>	-83° 20'	Octans
17:00:00	95,515	11.2	-50.6°	10 <sup>h</sup> 52 <sup>m</sup>	-80° 44'	Chamaeleon
17:30:00	84,616	10.9	-52.0°	11 <sup>h</sup> 16 <sup>m</sup>	-77° 18'	Chamaeleon
18:00:00	73,930	10.4	-52.8°	11 <sup>h</sup> 32 <sup>m</sup>	-72° 48'	Musca
18:30:00	63,590	10.0	-52.4°	11 <sup>h</sup> 43 <sup>m</sup>	-66° 48'	Musca
19:00:00	53,843	9.4	-49.5°	11 <sup>h</sup> 52 <sup>m</sup>	-58° 31'	Centaurus
19:30:00	45,155	8.8	-42.5°	11 <sup>h</sup> 59 <sup>m</sup>	-46° 50'	Centaurus
20:00:00	38,387	8.1	-29.8°	12 <sup>h</sup> 04 <sup>m</sup>	-30° 26'	Hydra
20:30:00	34,853	7.7	-11.4°	12 <sup>h</sup> 10 <sup>m</sup>	-9° 11'	Virgo
21:00:00	35,665	7.8	9.0°	12 <sup>h</sup> 15 <sup>m</sup>	13° 34'	Coma Berenices
21:30:00	40,573	8.4	26.0°	12 <sup>h</sup> 21 <sup>m</sup>	32° 50'	Coma Berenices
22:00:00	48,273	9.0	37.6°	12 <sup>h</sup> 28 <sup>m</sup>	46° 52'	Canes Venatici
22:30:00	57,578	9.6	44.9°	12 <sup>h</sup> 34 <sup>m</sup>	56° 40'	Ursa Major
23:00:00	67,771	10.1	49.2°	12 <sup>h</sup> 41 <sup>m</sup>	63° 35'	Draco
23:30:00	78,466	10.6	51.6°	12 <sup>h</sup> 48 <sup>m</sup>	68° 37'	Draco
00:00:00	89,454	11.0	52.8°	12 <sup>h</sup> 55 <sup>m</sup>	72° 24'	Draco
00:30:00	100,619	11.3	53.2°	13 <sup>h</sup> 02 <sup>m</sup>	75° 18'	Draco
01:00:00	111,892	11.6	53.2°	13 <sup>h</sup> 10 <sup>m</sup>	77° 35'	Camelopardalis

Flyby data (relative to centre of Earth)	
Time of closest approach	15/02/2013 20:25:49
Distance of closest approach	34,100km
Speed at closest approach	7.818km/s
Speed at infinity	6.143km/s

<http://www.heavens-above.com/2012da14.aspx?lat=45.136&lng=7.043&loc=SPES+-+Specola+Segusina&alt=535&tz=CET>



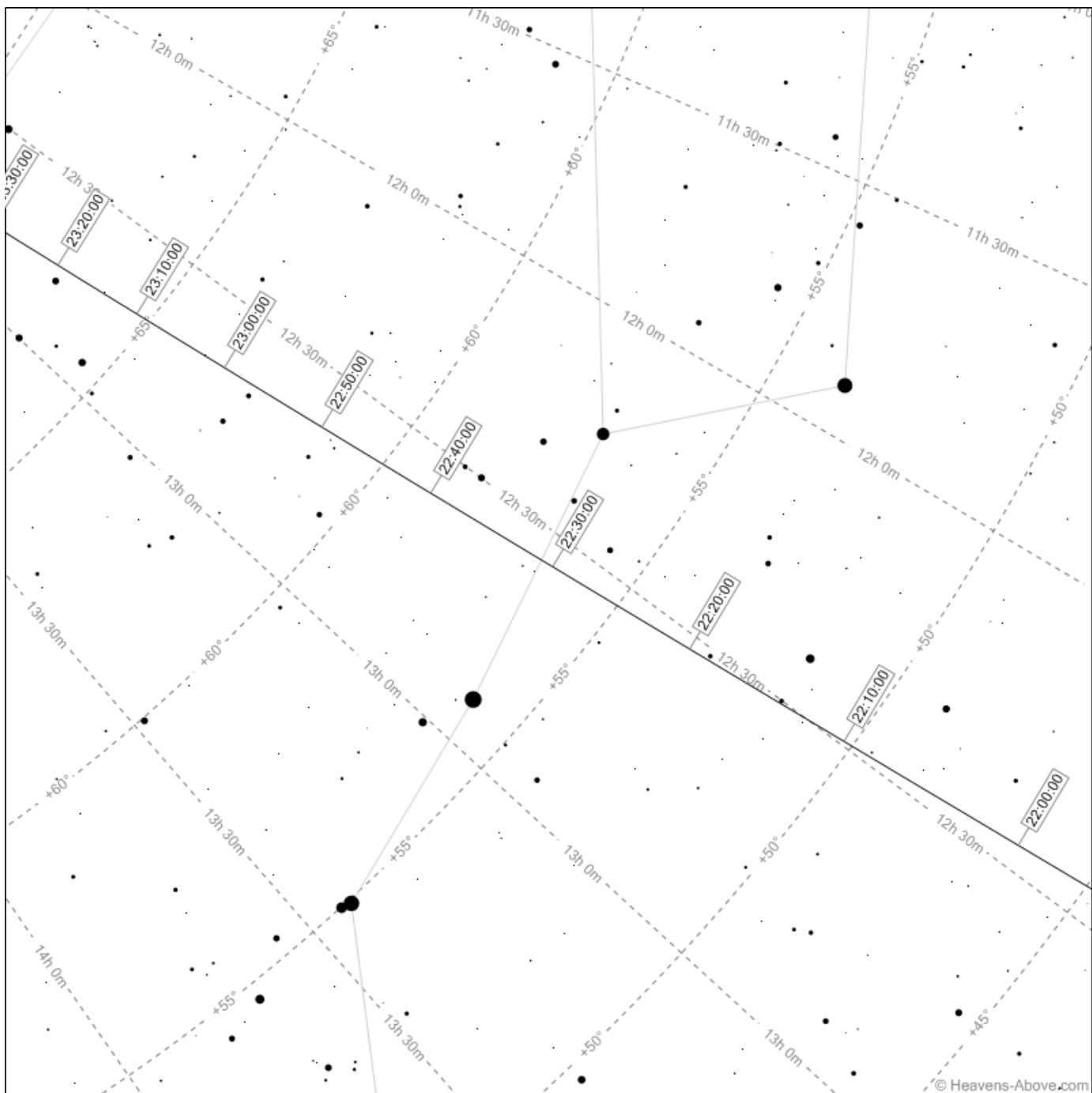


Il percorso e i tempi (in ora solare italiana) del transito di 2012 DA14, visto da Susa (da *Heavens-Above.com*)

<http://www.heavens-above.com/2012da14.aspx?lat=45.136&lng=7.043&loc=SPES+-+Specola+Segusina&alt=535&tz=CET>







Transito di 2012 DA14 attraverso la costellazione dell'Orsa Maggiore, visto da Susa; tempi in ora solare italiana  
(da Heavens-Above.com)

<http://www.heavens-above.com/2012da14.aspx?lat=45.136&lng=7.043&loc=SPES+-+Specola+Segusina&alt=535&tz=CET>





## ASSOCIAZIONE ASTROFILI SEGUSINI

dal 1973 l'associazione degli astrofili della Valle di Susa

**Sito Internet:** [www.astrofilisusa.it](http://www.astrofilisusa.it)

**E-mail:** [info@astrofilisusa.it](mailto:info@astrofilisusa.it)

**Telefoni:** +39.0122.622766 +39.0122.32516 Fax +39.0122.628462

**Recapito postale:** c/o Dott. Andrea Ainardi - Corso Couvert, 5 - 10059 SUSA (TO) - E-mail [ainardi@tin.it](mailto:ainardi@tin.it)

**Sede Sociale:** Castello della Contessa Adelaide - Via Impero Romano, 2 - 10059 SUSA (TO)

Riunione: primo martedì e terzo venerdì del mese, ore 21:15, eccetto agosto

**"SPE.S. - Specola Segusina":** Lat. 45° 08' 09.7" N - Long. 07° 02' 35.9" E - H 535 m (WGS 84)

Castello della Contessa Adelaide - 10059 SUSA (TO) - Tel. +39.331.838.939.1 (*esclusivamente negli orari di apertura*)

**"Grange Observatory" - Centro di calcolo AAS:** Lat. 45° 08' 31.7" N - Long. 07° 08' 25.6" E - H 495 m (WGS 84)

Codice MPC 476 International Astronomical Union

c/o Ing. Paolo Pognant - Via Massimo D'Azeglio, 34 - 10053 BUSSOLENO (TO) - Tel. / Fax +39.0122.640797

E-mail: [grangeobs@yahoo.com](mailto:grangeobs@yahoo.com) - Sito Internet: <http://grangeobs.net>

**Sede Osservativa:** *Arena Romana* di SUSA (TO)

**Sede Operativa:** Corso Trieste, 15 - 10059 SUSA (TO) (*Ingresso da Via Ponsero, 1*)

**Planetario:** Via General Cantore angolo Via Ex Combattenti - 10050 CHIUSA DI SAN MICHELE (TO)

L'AAS ha la disponibilità del *Planetario* di Chiusa di San Michele (TO) e ne è referente scientifico.

**Quote di iscrizione 2013:** soci ordinari: € 30.00; soci juniores (*fino a 18 anni*): € 10.00

**Coordinate bancarie IBAN:** IT 40 V 02008 31060 000100930791 UNICREDIT BANCA SpA - Agenzia di SUSA (TO)

**Codice fiscale dell'AAS:** 96020930010 (*per eventuale destinazione del 5 per mille nella dichiarazione dei redditi*)

**Tutela assicurativa AAS** (RC, Incendio e Rischi accessori) offerta da FONDIARIA-SAI SpA, Divisione Fondiaria - Agenzia Generale di Bussoleno (TO), [www.rosso.piemonte.it](http://www.rosso.piemonte.it)

### **Responsabili per il triennio 2012-2014:**

Presidente: Andrea Ainardi

Vicepresidenti: Luca Giunti e Paolo Pognant

Segretario: Andrea Bologna

Tesoriere: Roberto Perdoncin

Consiglieri: Giuliano Favro e Gino Zanella

Revisori: Oreste Bertoli, Valter Crespi e Aldo Ivot

### **Direzione "SPE.S. - Specola Segusina":**

Direttore: Paolo Pognant Vicedirettore: Alessio Gagnor

**L'AAS è Delegazione Territoriale UAI - Unione Astrofili Italiani (codice DELTO02)**

**L'AAS è iscritta al Registro Regionale delle Associazioni di Promozione Sociale - Sez. Provincia di Torino (n. 44/TO)**

**AAS** – Associazione Astrofili Segusini: fondata nel 1973, opera da allora, con continuità, in Valle di Susa per la ricerca e la divulgazione astronomica.

**AAS** – Astronomical Association of Susa, Italy: since 1973 continuously performs astronomical research, publishes Susa Valley (Turin area) local ephemerides and organizes star parties and public conferences.

### **Circolare interna n. 162 - Febbraio 2013 - Anno XLI**

*Pubblicazione riservata a Soci, Simpatizzanti e a Richiedenti privati. Stampata in proprio o trasmessa tramite posta elettronica. La Circolare interna è anche disponibile, a colori, in formato pdf sul sito Internet dell'AAS.*

*Hanno collaborato a questo numero speciale:* Roberto Perdoncin, Paolo Pognant, Andrea Ainardi