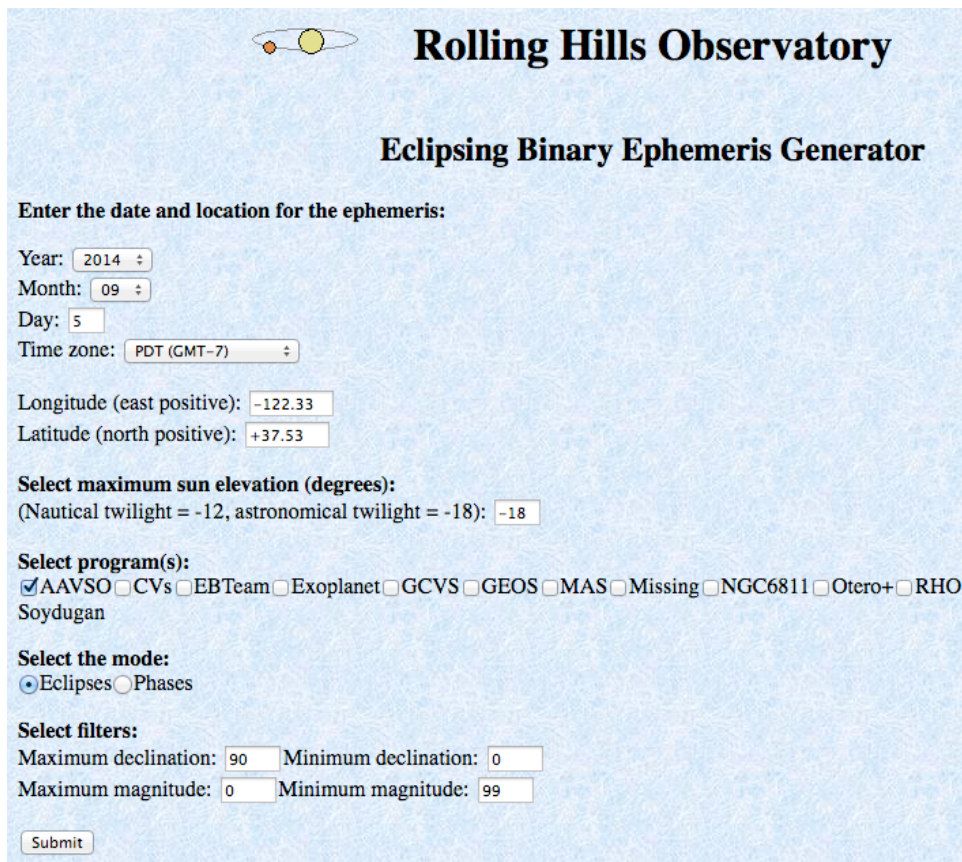


Lab 6 - Eclipsing Binaries

Before further exploring eclipsing binary stars, we need to locate potential EB targets using the ephemeris <http://en.wikipedia.org/wiki/Ephemeris> on Rolling Hills Observatory website. We'll then determine the exact times of these events at Mt. Suhora Observatory website. The search is based on date, time, and exact sky position of the target during lab.

Locating Eclipsing Binaries

Go to Rolling Hills Observatory website <http://www.rollinghillsobs.org/> and choose **Ephem Generator > EB Ephem Generator**, to bring up the Eclipsing Binary Ephemeris Generator window:



The screenshot shows the 'Rolling Hills Observatory Eclipsing Binary Ephemeris Generator' web form. It includes a logo of a planet with a ring and a yellow sun. The form has several sections: 'Enter the date and location for the ephemeris:' with fields for Year (2014), Month (09), Day (5), and Time zone (PDT (GMT-7)); 'Longitude (east positive): -122.33' and 'Latitude (north positive): +37.53'; 'Select maximum sun elevation (degrees):' with a note '(Nautical twilight = -12, astronomical twilight = -18): -18'; 'Select program(s):' with checkboxes for AAVSO (checked), CVs, EBTeam, Exoplanet, GCVS, GEOS, MAS, Missing, NGC6811, Otero+, RHO, and Soydugan; 'Select the mode:' with radio buttons for Eclipses (selected) and Phases; and 'Select filters:' with fields for Maximum declination (90), Minimum declination (0), Maximum magnitude (0), and Minimum magnitude (99). A 'Submit' button is at the bottom.

Rolling Hills Observatory website

Enter today's **Date** (YMD), and the **time zone**, either PST-8 or PDT-7. Enter Longitude (-122.33) and Latitude (+37.53) for CSM observatory. Choose **Astronomical Twilight** (sun 18° below horizon), **AAVSO program**, (American Association of Variable Star Observers) and **Eclipses**.

Hit the **Submit** button to generate a list of tonight's eclipsing binaries for our CSM Observatory location. This will include star names, altitude, min. and max. magnitudes, and duration. Earlier events appear at top, later events near the bottom.

Star	Date/Time	Altitude	Azimuth	Max Mag	Min Mag	Duration
AB And(S)	2014-09-05 23:10 PDT	64	81	9.5	10.3	3
SW Lac(S)	2014-09-05 23:10 PDT	68	80	8.5	9.4	3
U Sge	2014-09-05 23:20 PDT	60	242	6.5	9.3	6
U Peg	2014-09-06 00:00 PDT	55	120	9.2	10.1	3
OO Aql	2014-09-06 00:05 PDT	50	234	9.2	9.9	3
BU Vul	2014-09-06 00:05 PDT	73	243	10.6	11.4	3
AB Cas	2014-09-06 01:00 PDT	46	23	10.1	11.8	4
YY Del	2014-09-06 01:25 PDT	47	249	11.3	12.0	4
SW Lac	2014-09-06 03:00 PDT	66	280	8.5	9.4	3
AB And	2014-09-06 03:10 PDT	68	277	9.5	10.3	3
EQ Tau	2014-09-06 03:20 PDT	54	104	10.5	11.0	3
ZZ Cyg	2014-09-06 03:25 PDT	37	305	10.6	11.7	4
U Peg(S)	2014-09-06 03:35 PDT	61	229	9.2	10.1	3

Rolling Hills Observatory website

Write down the names of tonight's eclipsing binaries (i.e. AB And, SW Lac) with durations of 3 or 4 hours, to create a short list of 2-5 stars. Next, you will choose one of these targets to image, using the ephemeris at Mt. Suhora Observatory website.

Go to Mt. Suhora Observatory. <http://www.as.up.krakow.pl/main/index.php?lang=en>
Under **Eclipsing Binaries**, choose **Linear Ephemerides**. From the menu at top, choose the constellation of the first target on your list. (for AB Andromeda, choose **And**.) Scroll down and click on your target star (AB And) to find tonight's eclipse times. Be careful to choose correctly, or you may photograph a non-event !

STAR Name	Typ	Mo HJD)	(ERR)	Period (Days)
AND RT	all	2452500.3511	(1)	0.62892857
AND SY	pri	2452530.4	(4)	34.9089
AND TT	pri	2452501.1106	(7)	2.765108
AND TW	all	2452501.866	(1)	4.122750
AND UU	pri	2452500.389	(4)	1.486290
AND WW	all	2452501.244	(9)	23.28525
AND WX	pri	2452502.377	(4)	3.001179
AND WZ	all	2452500.2323	(6)	0.6956643
AND XZ	all	2452500.559	(1)	1.3572795
AND AA	pri	2452500.7302	(8)	0.9350953
AND AB	all	2452500.0645	(4)	0.33189015
AND AD	all	2452500.367	(4)	0.9862210
AND AM	pri	2452504.11	(1)	8.850546
AND AN	all	2452502.621	(4)	3.219562

Mt. Suhora website

Choose **AND AB** from the list above, to see the following window:

Current primary (pri) and secondary (sec) AB And eclipses are now displayed in bold. Greyed entries are events already past.

Computed Times of Minima, (ToM) are shown in local time, 24 hour format. ToM is when the stars are at mid-eclipse. Imaging runs are centered around ToMs.

Computed times of minima :			
Date:	Time:	Type:	HJD:
05-09-2014	10:42	pri	2456906.23813
05-09-2014	14:41	sec	2456906.40408
05-09-2014	18:40	pri	2456906.57002
05-09-2014	22:39	sec	2456906.73597

Mt. Suhora website

In our AB And example above we see:

05-09-2014	18:40	pri	2456906.57002
05-09-2014	22:39	sec	2456906.73597

AB And has a primary eclipse with ToM at 18:40 or 6:40 pm (in daylight).
AB And has a secondary eclipse with ToM at 22:39 or 10:39 pm (nighttime).
The last number in the row is Julian Date. JD converter: <http://ssd.jpl.nasa.gov/tc.cgi>

Follow the same procedure with each star created in your list on page 23.

Confirm which targets have eclipses at favorable times:

Using the Sky6 on observatory computers, determine which of your stars is in good position during the predicted ToMs. Targets should not cross the meridian during eclipse, and be ~ 30 degrees above the horizon. This step determines your final target.

Mt. Suhora's ToM predictions are accurate to within ~ 4 minutes. Typically, you'll end up with 1-2 usable target EBs for a given night.

Follow instructions for EB imaging procedures in ASTR 203 p.26-28.