Final table of Kepler Objects of Interest that are transiting at about the same time as Venus on June 5/6, 2012.

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Summary: Based upon catalog of 1,235 Kuiper Objects of Interest (KOI) 126 were found to be transiting around the same time as Venus. The start and stop times for the KOI transits are shown in Columns 5, 6, 7 and 8 in the accompanying table, and are given as UT hours on the indicated date.

Approach

Each KOI represents an object that passes across the face of its star as viewed from Earth. The motion is represented by three quantities:

1) The orbital period of the object, P, given in days,

2) The duration of the transit across its star as viewed from Earth, T, given in hours, and

3) The exact time and date that the object began a previous transit. This is commonly given in terms of Julian Day number rather than a calendar date and time because it is easier to work with a continuous variable such as JD rather than months days and years, although it is easy to convert from JD to normal calendar date when needed.

Here are the Julian Day numbers for some sequential calendar dates.

June 1, 2012 at 00:00 UT is JD = 2456079.5
June 2, 2012 at 00:00 UT is JD = 2456080.5
June 3, 2012 at 00:00 UT is JD = 2456081.5
June 4, 2012 at 00:00 UT is JD = 2456082.5
June 5, 2012 at 00:00 UT is JD = 2456083.5
June 6, 2012 at 00:00 UT is JD = 2456084.5
June 7, 2012 at 00:00 UT is JD = 2456085.5
June 8, 2012 at 00:00 UT is JD = 2456086.5
June 9, 2012 at 00:00 UT is JD = 2456087.5

The JD numbers are based on Universal Time and on a 24-hr clock and are indicated in decimal fractions of a 24-hour day. For example, JD 2456083.5 is 00:00 UT on June 5. To find the JD number for 14:30 UT you calculate its

fraction of the day, 14.5/24 = 0.6042 and add it to JD = 2456083.5 to get JD= 2456084.104.

Example.

Suppose a KOI was found to start its transit exactly on JD 2456080.5. It had a period of 3.0 days, and a transit duration of 4.5 decimal hours. We can predict all of its transit start times in the future just by adding '3.0' to the start JD of 2456080.5 and get the following sequence of future start times: 2456080.5, 2456083.5, 2456086.5, etc. To get the end times for each transit, we just add 4.5 hours to each of the predicted start times. Since 4.5/24.0 = 0.1875 we get
2456080.5 + 0.1875 = 2456080.6875
2456083.5 + 0.1875 = 2456083.6875
2456086.5 + 0.1875 = 2456086.6875

We can convert these Julian Day numbers back into a calendar day and UT time during that day as follows:

First Transit:
Start JD = 2456080.5 = June 2, 2012 at 00:00 UT
End JD = 2456080.6875 = June 2, 2012 at 00:00 UT + 0.1875x24.0
= 4.5 hours, which equals 04:30 UT

The Excel spreadsheet for the transit calculations is available at:

http://spacemath.gsfc.nasa.gov/SED12/KeplerVenus.xls

For additional Kepler-related math resources and problems, go to

http://spacemath.gsfc.nasa.gov/Transit2012.html.

The final table below was calculated as follows.

Step 1 - The spreadsheet of 1235 transit candidates available at the Kepler mission page
http://kepler.nasa.gov/Mission/discoveries/candidates/ was downloaded.

Step 2 - The Julian day offset for the start of the first transit of the KOI is given in the Kepler Archive in Column F. The 't0' dates begin with March 09, 2009 at 12:00 UT, which is JD 2454900.0. The actual JD for this fiducial transit, T1, was calculated by adding Column F to 2454900.0.

Example: KOI-8.01 has t0 = 55.90127 days, so T1 = 2454900.0 + 55.90127 = JD 2454955.90127

Step 3 – The transit of Venus(TOV) starts on JD 2456084.4234 which is June 5, at about 22:09:42 UT. It ends on June 6 at 04:49 UT. The time between the fiducial KOI transit and First Ingress of TOV is the difference, Td, between the JD calculated in Step-2 and JD 2456084.4234 This difference was calculated for all 1235 KOIs.

Example: KOI-8.01 has Td = 2456084.4234 - 2454955.90127 = 1128.52213 days that elapse between its fiducial transit start date and the start of the transit of Venus on June 5.

Step 4 – The number of transit, Nt, occurring in the time interval Td is simply Td divided by the orbital period, P, of the KOI provided in Column Q of the Archive.

Example: KOI-18.01 has P = 3.548461 so Nt = 1128.52213/3.548461 = 318.0314 orbits

Step 5 – The integer number of transits, Ni was found by truncating the remainder of Nt.

Example KOI-18.01 would have Ni =318 orbits.

Step 6 – The closest start of a KOI transit, Ts, to the start of the TOV in hours was found by calculating T = T1 + P*Ni

Example KOI-18.01 would have Ts = 2454955.90127 + 3.548461 x 318 so
Ts = 2456084.3119.
This Julian Day number is shown in the table below in column 5.

Step 7 – The duration of the KOI transit, Dt, is found in archive Column P, so the end of the KOI transit is just
Te =Ts + Dt/24.0 where Dt is in decimal hours.

Example KOI-18.01 would have Te = 2456084.3119 + 4.6271/24.0 = 2456084.5047 as the end JD of its transit

Step 8 – The JD numbers calculated in Step 6 and 7 are converted into calendar dates and UT times using June 5, 2012 00:00 UT which is JD 2456083.500.

Example KOI-18.01.
Ts = (2456084.3119 – 2456083.5)*24.0 = 19.4848 UT on June 5. Te = (2456084.5047 – 2456083.5)*24.0 = 0.1128 UT on June 6. These decimal-hour UT times can be converted into the usual hh:mm format to get Ts = 19:29 UT for the start of the KOI transit on June 5, and 00:07 UT for the end of the KOI transit, on June 6. These times are shown in the table below as columns 6 and 7.

Table of Exoplanet Transits during the 2012 Transit of Venus

KOI Name	Star Kepler Mag.	Star Class	Proposed Exoplanet Radius (Earth=1)	Proposed Exoplanet Temp. (K)	Proposed Exoplanet Transit Duration (Hrs)	Date and UT of Transit JD of Transit	June 5 Start (UT)	June 5 End (UT)	June 6 Start (UT)	June 6 End (UT)
						Venus =	**22:09**			**04:49**
5.01	11.7	G	7	1376	2.03	2456084.57			**01:40**	**03:42**
7.01	12.2	G	3.7	1290	3.62	2456084.61			**02:43**	**06:21**
18.01	13.4	G	8.2	1180	4.63	2456084.31	**19:29**			**00:07**
42.01	9.4	G	2.6	834	4.48	2456084.20	**16:52**	**21:21**		
70.03	12.5	G	2	333	7.24	2456084.25	**18:07**			**01:21**
72.01	11.0	G	1.3	1790	1.82	2456084.31	**19:19**	**21:09**	**15:25**	**17:15**
85.01	11.0	G	3.2	1318	4.07	2456084.29	**19:01**	**23:05**		
89.01	11.6	F	4.4	756	10.40	2456084.38	**21:05**			**07:30**
98.01	12.1	F	12.1	1528	6.86	2456084.67			**04:00**	**10:51**
107.01	12.7	G	2.1	943	4.87	2456084.60			**02:23**	**07:16**
117.02	12.5	G	2.4	729	4.09	2456084.21	**17:07**	**21:13**		
131.01	13.8	F	9	1181	4.67	2456084.34	**20:05**			**00:46**
135.01	14.0	F	8.3	1250	2.78	2456084.33	**19:59**	**22:46**		
137.03	13.5	G	2.3	1228	2.08	2456084.51			**00:18**	**02:22**
148.01	13.0	G	2.1	908	2.69	2456084.67			**03:58**	**06:40**
149.01	13.4	G	4.1	890	7.86	2456084.49	**23:48**			**07:39**
157.06	13.7	G	1.7	811	4.10	2456084.33	**19:51**	**23:57**		
159.01	13.4	G	3.1	963	4.11	2456084.61			**02:40**	**06:46**
167.01	13.3	F	1.8	1072	4.24	2456084.35	**20:23**			**00:37**
191.03	15.0	G	1.4	1839	1.49	2456083.86			**01:42**	**03:11**
202.01	14.3	G	11.5	1559	1.96	2456084.58			**01:55**	**03:53**
203.01	14.1	G	13.8	1518	2.28	2456084.53			**00:47**	**03:04**
220.02	14.2	G	0.7	822	2.87	2456084.55			**01:18**	**04:10**
226.01	14.8	G	1.6	595	3.03	2456084.50			**00:02**	**03:03**
241.01	14.1	G	1.7	516	3.52	2456084.33	**19:56**	**23:27**		
245.01	9.7	G	2.1	482	4.71	2456082.69				
248.03	15.3	K	2	825	1.64	2456084.70			**04:42**	**06:21**
250.01	15.5	K	3.6	491	2.82	2456084.25	**17:59**	**20:48**		
260.02	10.5	F	2.2	434	10.73	2456080.84				
285.01	11.6	G	2.1	757	5.84	2456084.68			**04:21**	**10:11**
295.01	12.3	G	2	1088	2.88	2456084.31	**19:26**	**22:19**		
299.01	12.9	G	3.6	2002	2.00	2456084.26	**18:12**	**20:11**		
313.02	13.0	G	2.2	852	3.22	2456084.30	**19:05**	**22:18**		
339.01	13.8	F	1.5	1319	2.42	2456084.41	**21:50**			**00:16**
343.01	13.2	G	2.2	1065	3.32	2456084.23	**17:35**	**20:54**		

343.02	13.2	G	1.6	1421	2.48	2456084.39	**21:15**	**23:44**		
355.01	13.2	F	2	1115	2.84	2456084.66			**03:45**	**06:35**
369.01	12.0	F	1.3	1073	1.87	2456084.42	**22:04**	**23:57**		
384.01	13.3	G	2	1143	5.07	2456084.34	**20:16**			**01:21**
410.01	14.5	G	12.4	1009	1.88	2456084.59			**02:11**	**04:03**
428.01	14.6	F	5.6	959	6.87	2456084.60			**02:30**	**09:22**
470.01	14.7	G	4	997	1.99	2456084.39	**21:24**	**23:24**		
472.01	15.0	G	3.2	1023	3.40	2456084.47	**23:24**			**02:47**
478.01	14.3	K	4.5	522	1.79	2456084.41	**21:54**	**23:42**		
481.02	14.7	G	1.7	1253	1.69	2456084.42	**22:08**	**23:50**		
496.01	14.4	G	2.7	1514	1.54	2456084.47	**23:21**			**00:53**
511.01	14.2	G	2.8	936	3.21	2456084.28	**18:38**	**21:50**		
524.01	14.9	G	2.3	838	2.37	2456084.24	**17:52**	**20:15**		
531.01	14.4	K	4.3	749	1.33	2456084.31	**19:21**	**20:41**		
547.01	14.8	G	3.5	489	4.50	2456083.78	**06:49**	**11:19**		
557.01	15.0	G	3.1	636	3.77	2456084.02	**12:24**	**16:10**		
593.01	15.0	G	2.1	760	3.27	2456084.53			**00:38**	**03:54**
598.01	14.8	G	1.7	644	2.96	2456084.22	**17:18**	**20:15**		
599.01	14.9	G	2.3	935	2.42	2456084.14	**15:24**	**17:50**		
614.01	14.5	G	4	587	1.87	2456084.50	**23:56**			**01:48**
626.01	13.5	F	2.2	817	3.90	2456084.61			**02:40**	**06:34**
665.03	13.2	G	0.8	1320	3.79	2456084.34	**20:11**	**23:58**		
688.01	14.0	F	2.5	1465	2.92	2456084.27	**18:31**	**21:27**		
697.01	13.7	G	4	1601	3.64	2456084.19	**16:34**	**20:12**		
710.01	13.3	F	1.7	1320	3.93	2456084.31	**19:31**	**23:27**		
721.01	13.6	G	2.3	942	6.83	2456084.14	**15:19**	**22:09**		
730.02	15.3	G	2.3	852	5.49	2456084.39	**21:14**			**02:44**
745.01	15.8	G	9.7	613	9.35	2456084.46				**08:27**
749.02	15.4	G	1.4	875	2.36	2456084.39	**21:15**	**23:36**		
780.01	15.3	K	2.2	995	1.99	2456084.67			**04:03**	**06:02**
786.01	15.2	G	1.8	980	2.32	2456084.51			**00:20**	**02:40**
794.01	15.0	G	2.1	1296	2.40	2456084.35	**20:25**	**22:49**		
799.01	15.3	G	4.5	1511	1.60	2456084.55			**01:07**	**02:44**
810.01	15.1	G	2.7	859	2.34	2456084.45	**22:55**			**01:15**
835.01	15.2	G	1.6	485	2.94	2456084.37	**20:46**	**23:42**		
844.01	15.6	G	2.8	878	3.03	2456084.56			**01:29**	**04:31**
851.01	15.3	G	5.5	989	2.72	2456084.69			**04:26**	**07:09**
852.01	15.3	G	2.4	1086	2.91	2456084.54			**00:54**	**03:49**
861.01	15.0	G	1.5	1090	1.86	2456084.56			**01:22**	**03:13**
864.01	15.6	G	2.2	846	2.75	2456084.52			**00:35**	**03:19**

864.03	15.6	G	1.8	648	1.40	2456084.23	**17:27**	**18:52**		
874.01	15.0	G	2.2	882	2.19	2456084.40	**21:41**	**23:52**		
892.01	15.2	G	2.8	654	2.89	2456084.28	**18:41**	**21:35**		
897.01	15.3	G	12	1417	2.15	2456084.48	**23:29**			**01:37**
904.01	15.8	K	2.1	960	1.85	2456084.37	**20:46**	**22:37**		
913.01	15.2	G	9.1	902	3.25	2456084.44				**01:48**
921.02	15.5	G	2.7	512	4.09	2456084.65			**03:32**	**07:37**
935.02	15.2	F	3.2	496	6.40	2456082.64		**In Transit**		
938.02	15.6	G	1.3	1525	1.79	2456084.67			**04:05**	**05:52**
939.01	15.1	G	1.6	1099	2.61	2456084.32	**19:43**	**22:20**		
952.01	15.8	K	2.3	575	2.18	2456084.34	**20:05**	**22:16**		
952.04	15.8	K	1.1	730	1.62	2456084.48				**01:07**
960.01	15.5	G	13.9	555	6.18	2456084.63			**03:04**	**09:15**
961.02	15.9	K	14.4	1524	0.55	2456084.68	**17:22**	**17:55**	**04:15**	**04:48**
986.01	14.1	G	1.3	626	3.11	2456084.56			**01:30**	**04:36**
1013.01	15.3	G	1.6	1641	0.77	2456084.57	**13:11**	**13:57**	**01:38**	**02:24**
1014.01	15.8	G	2.7	502	3.14	2456083.66	**3:54**	**07:02**		**00:00**
1019.01	10.3	G	1.2	1364	2.56	2456084.38	**21:01**	**23:35**		
1020.01	12.9	G	21.9	580	6.31	2456084.19	**16:36**	**22:54**		
1050.01	14.0	G	2.3	1462	1.50	2456084.41	**21:56**	**23:26**		
1053.01	15.4	G	1.9	1466	1.69	2456084.50			**00:00**	**01:36**
1078.01	15.4	K	1.9	660	1.50	2456084.65			**03:31**	**05:01**
1086.01	14.6	G	2.5	623	5.96	2456084.38	**21:03**			**03:00**
1150.01	13.3	G	0.7	1940	1.91	2456084.61			**02:44**	**04:39**
1151.01	13.4	G	1.2	989	3.32	2456084.44	**22:30**			**01:49**
1163.01	15.0	G	1.9	1153	1.81	2456084.61			**02:38**	**04:26**
1177.01	15.5	G	9.8	945	2.52	2456084.69			**04:39**	**07:10**
1187.01	14.5	G	2.5	1789	0.78	2456084.68	**19:30**	**20:17**	**04:24**	**05:10**
1202.01	15.9	K	1.5	1104	1.37	2456084.49	**01:23**	**02:45**		**01:02**
1273.01	14.9	G	2.8	460	5.39	2456084.51			**00:18**	**05:42**
1300.01	14.3	K	1.7	1485	1.14	2456084.40	**21:36**	**22:45**	**12:45**	**13:54**
1305.01	15.2	G	1.3	1020	2.21	2456084.33	**19:56**	**22:8**		
1306.03	15.6	G	1.8	956	3.75	2456084.38	**21:12**			**00:57**
1325.01	15.1	G	3.3	652	3.44	2456084.40	**21:34**	**25:1**		**01:01**
1337.01	14.8	G	1.4	1177	1.82	2456084.64			**03:26**	**05:15**
1338.01	14.6	G	1.7	1195	3.07	2456084.33	**19:50**	**22:54**		**00:00**
1367.01	15.1	G	1.2	1639	1.00	2456084.61	**12:59**	**13:58**	**02:36**	**03:36**
1391.01	14.4	F	8.3	921	1.94	2456084.17	**16:00**	**17:56**		
1413.01	14.4	G	1.5	730	7.99	2456084.39	**21:14**			**05:14**
1422.01	15.9	K	3.1	627	2.04	2456084.67			**04:07**	**06:09**
1427.01	15.8	K	1.5	830	1.78	2456084.48	**23:32**			**01:18**

1459.01	15.7	K	6.9	1435	1.07	2456084.42	**22:03**	**23:07**	**14:40**	**15:44**
1494.01	15.9	K	2.4	659	2.90	2456084.31	**19:27**	**22:21**		
1501.01	15.8	K	1.7	1003	2.17	2456084.52			**00:31**	**02:41**
1502.01	15.2	G	1.9	1131	1.51	2456084.47	**23:20**			**00:50**
1522.01	14.3	G	2.5	562	5.07	2456083.66	**03:46**	**08:50**		
1546.01	14.5	G	5.8	1309	1.72	2456084.52	**02:28**	**04:11**	**00:29**	**02:12**
1557.01	14.8	G	5.2	1123	1.98	2456084.21	**17:03**	**19:02**		
1601.01	14.7	G	1.5	726	6.21	2456084.59			**02:07**	**08:19**
1603.01	14.4	F	1.4	1146	2.77	2456084.45	**22:50**			**01:35**
1605.01	14.8	F	1.8	1126	1.45	2456084.30	**19:08**	**20:34**		
1606.01	14.0	G	1.2	908	1.98	2456084.38	**21:12**	**23:10**		

Note (January 1, 2012)

As more exoplanets are discovered by Kepler, this table will be re-calculated and expanded to include the candidates known by May, 2012.