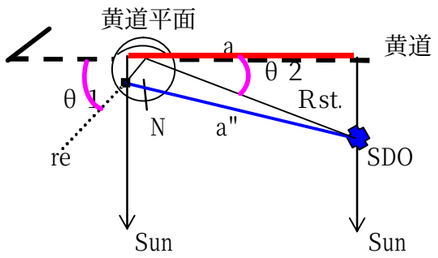
2012年 6月 6日　金星太陽面通過時の 1AU測量記録

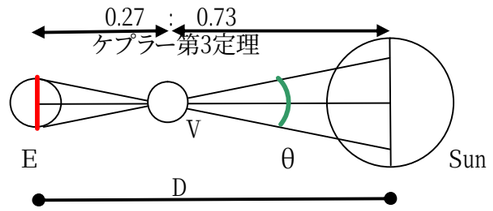
2012.6.20 by Ueno, Shigekazu

原文日本語
Original in Japanese

BASE LINE
a=re ･Cos θ 1+ R st ･Cos. θ 2



$$D = \frac{a}{2k \cdot \tan \theta/2} \Leftarrow D = \frac{a/2}{\mathrm{Tan}\,\theta/2 \cdot k}$$

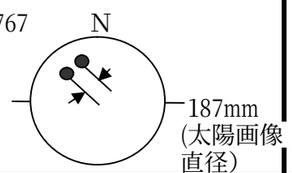
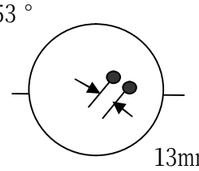


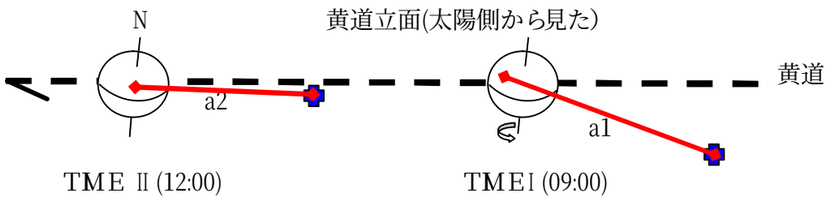
1AU算出概念： 大津ーSDO間の黄道立面上ベースライン長と2地点からの金星位置の視差を計算 ･測量する。三角関数表のTan値を応用すると地球 ･金星距離が求められる。 その値をケプラー第 3定理から導き出される地球 ･金星公転軌道半径の差／地球公転軌道半径の比で割ると地球 ･太陽距離が求められる。

SDO: 欧米共同太陽観測地球同期軌道衛星
R st. = 軌道半径 :42,164km
昇交点 :西経102 °　赤道傾斜 :28.5 °

SUN:
1AU = 149,597,870.700KM　　150 x 10^6km 理科年表）
視直径 :0.5254 °

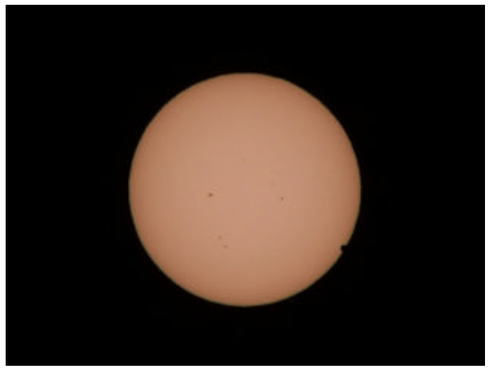
E＝Earth
re=半径 6,378km

	θ	D	D 平均値	結論と感想
	Solar apparent dia.=0.5254 °			
TIME Ⅰ 09:00 (JST)	OTSU N35. 16 ° E135. 93 ° θ 1= 48 ° re x Cos48 ° =6,378 x 0.66913 =4,268km SDO N 0.0 ° W 102 ° θ 2= 15 ° R st. x Cos15 ° =42,164 x 0.9659 =40,727km a1 = 44,995km	θ Ⅰ= 0.5254 ° x 16mm/187mm = 0.045 ° 2k = 2 x 0.2767 = 0.5534  187mm (太陽画像直径)	DⅠ = a/ 0.5534 x Tan0.0225 ° = 44,995/0.5534 x 3.927x10^{-4} = 207 x 10^6km	207x10^6KM	1. 大津市和邇浜の観測地点は、第1接触開始5分前から台風の雲が切れ、第4接触までほぼ晴れ渡った。余裕をもって観測 ･撮影そして、散歩の道すがらの人たちへも観望チャンスを提供出来た。 2. 観測機材 ･画像ソフトなどプロ級レベルに程遠くとも、地球の差し渡しの一万倍少し先の光源をわずかにさえぎる画像を見比べただけで、その距離を桁違いとならない精度で算出できたとは予想より出来すぎとも考えます。 3. 太陽観測衛星は地球から遠く月以遠の L1ポイントにずっと漂うSOHO画像を期待していたが、何らかの理由で日常観測の画像も開示されなくなっていた。 そのベースライン長に見劣りするとはいえ、SDO衛星との 4万KMベースライン長でも充分に一般天文ファンを満足できた。探求心だけでもおなかいっぱいと観測 ･計算にいそしむ昔の学者達の気分をいくらか味わえた。 今後は現代天文学 1AUﾃﾞｰﾀの 11桁精度と張り合っても意味がないので、別の課題の検証もいいのではと思う。 観望 ･撮影だけでなく、計算、検証など交えた楽しみ方も面白い。
TIME Ⅱ 12:00	OTSU θ 1 = 90 ° re x Cos90 ° =6,378 x 0 = 0km SDO N 15 ° W 102 ° θ 2= -30 ° R st. x Cos30 ° =42,164 x 0.8660 =36,515km a2 =36,515km	θ Ⅱ= 0.5254 ° x 13mm/187mm = 0.03653 °  13mm(金星2画像中心距離)	DⅡ = a/0.5534 x Tan0.0183 ° = 36,515/ 0.5534 x 3.194 x10^{-4} = 207 x 10^6km		



使用機材など
撮影光学系： Panasonic FZ50　光学 12倍ズーム。
55mmフィルター径にND400フィルター 2枚重ね、
2. 2倍コンバージョンレンズを付加。
RAWモードで撮影 (f5.6~11, スピード1/640~1,100)
画像編集ソフト： フォトショップ ･エレメンツ6
SILKYPIX Developer
SDO画像:　SDOサイトアーカイブ頁よりメガピクセルサイズをダウンロード
その他：
2地点黄道座標太陽経度差確認ソフト： VoyagerⅡ

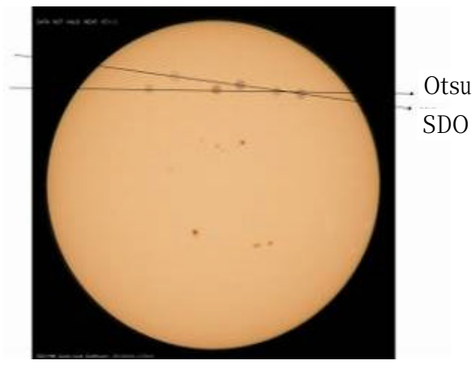
参考書類 ･サイト
長野高専 1AU測定教材化レポート
http://www2.nagano-nct.ac.jp/~ohnishi/SOHO_Mercury2006/1AUbyKoujiOHNISHI.pdf
Real Timme Satellite Tracking
http://www.n2yo.com/?s=36395
SOHOサイト
http://sohowww.nascom.nasa.gov/home.html



第 3-第 4接触途中。 ピエロの鼻のような？

09:00 二地点撮影合成画像 (TIME I)

09:00& 12:00 3時間後の二地点撮影合成画像を追加 (TIME I & Ⅱ)



09:00, 10:30 & 12:00 両地点金星画像軌跡は SDOのW102 ° 北上軌道を反映

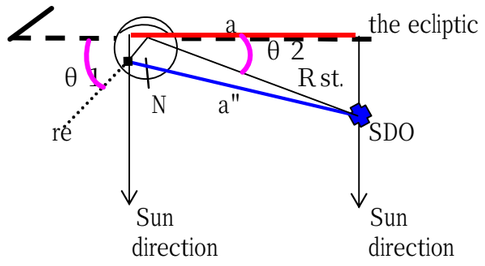
Measuring 1AU taking chance of Venus Transit June 6, 2012

reported by Ueno, Shigekazu (2012/06/20)

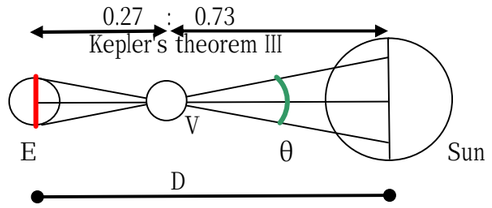
翻訳後英語
Translated into English

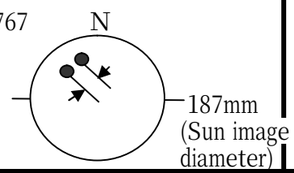
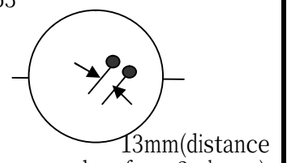
BASE LINE on the Ecliptic Plane

a=re ･Cos θ 1+ R st ･Cos θ 2



$$D = \frac{a}{2k \cdot \tan \theta/2} \Leftarrow D = \frac{a/2}{\tan \theta/2 \cdot k}$$



			θ Solar apparent diameter = 0.5254 °	D	D (average measured)
TIME I 00:00 (UTC)	OTSU N35. 16 ° E135. 93 ° θ 1= 48 ° re x Cos48 ° =6,378 x 0.66913 =4,268km	SDO N 0.0 ° W 102 ° θ 2= 15 ° R st. x Cos15 ° =42,164 x 0.9659 =40,727km	θ I= 0.5254 ° x 16mm/187mm = 0.045 ° 2k = 2 x 0.2767 = 0.5534  187mm (Sun image diameter)	DI = a/ 0.5534 x Tan0.0225 ° = 44,995/0.5534 x 3.927x10^{-4} = 207 x 10^{6}km	207x10^{6}KM
	a1 = 44,995km				
TIME II 03:00	OTSU θ 1 = 90 ° re x Cos90 ° =6,378 x 0 = 0km	SDO N 15 ° W 102 ° θ 2= -30 ° R st. x Cos30 ° =42,164 x 0.8660 =36,515km	θ II= 0.5254 ° x 13mm/187mm = 0.03653 °  13mm(distance of Venus images taken from 2 places)	DII = a/0.5534 x Tan0.0183 ° = 36,515/ 0.5534 x 3.194 x10^{-4} = 207 x 10^{6}km	
	a2 =36,515km				

Concept of measuring 1AU

(i) Measure and calculate Venus parallax (degree) based on the base line on the elevation view on the ecliptic at the earth center. Parallax between Venus views from Otsu and SDO at 00:00 and 03:00 UTC on the solar images (ii)Get distance between the earth and Venus utilizing trigonometric function Tan θ / 2 value. (iii) Divide the calculated value by the ratio induced from Kepler's theorem III to get the distance between the earth and the sun. (the ratio = orbit radius difference between the earth & Venus divided by the earth orbit radius)

SDO: on earth synchronized orbit radius of 42,164km at E102 ° with inclination of 28.5 °

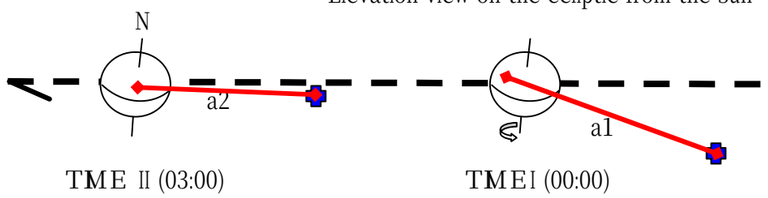
SUN:1AU = 149,597,870.700KM 150 x 10^{6}km
(the precisest and latest human knowledge)

E = Earth re= the earth radius = 6,378km

Conclusion and comments

1. I had a very good luck of very fine weather through the whole event from the 1st to the 4th contact of Venus. Out of 248pictures taken and developed/processed by photoshop elements6, a good number of fine images could show me not only the parallax but sun spot move by the sun's rotation on its axis as well photosphere surface minute structures including granules. Tools I used are only commercial level poor gadgets, but good seeing near Zenith and good location beside Lake Biwa was my another good luck, I guess.
2. Regret to say, my unskilful fingers to process digital images lost good chance to get accurate 1AU value, but I am happy to prove that the latest human knowledge of 1AU value in 11digits is not a fake built on the bricks called theories and accurate measuring piled up and up in wrong directions. My calculation and theory taken is very simple and basic but the result discrepancy was much less than a digit from 150x10^{6}km
3. I was also very happy to feel how the historical great astronomy scientists were full of strong quest spirit observing and calculating so many matters without taking a bite of sandwich all the day and night.

Elevation view on the ecliptic from the sun



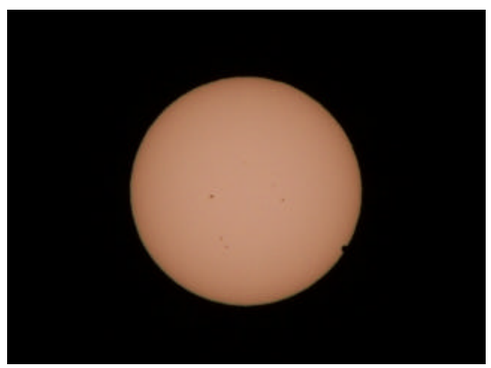
Tools used:
- Optical gadgets: Panasonic FZ50 x12 optical zoom + ND400 x 2 filters + x2.2 conversion lens RAW mode data (F5.6~ 11, shutter speed 1/640~ 1,100)
- Digital photo process soft: Photoshop Elements 6, Silkypix Developer
- SDO images: downloaded from SDO site images in mega pixel sized
- Other soft: Voyager II to know θ 1 & θ 2

Documents/Web sites for reference

*Determination of 1AU by Kouji Ohnishi, Nagano National College of Technology
http://www2.nagano-nct.ac.jp/~ohnishi/SOHO_Mercury2006/1AUbyKoujiOHNISHI.pdf

*Real Time Satellite Tracking
http://www.n2yo.com/?s=36395

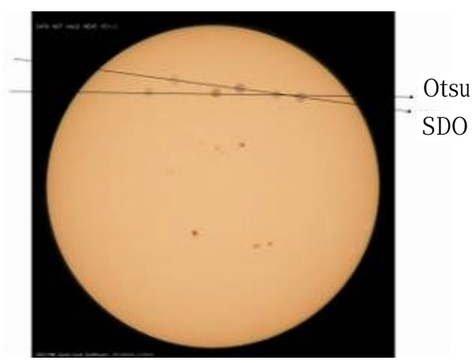
*SOHO
http://sohowww.nascom.nasa.gov/home.html



between the 3rd and 4th contacts

[TIME I] 00:00 Combined images taken in the two locations at 00:00 (UTC)

[TIME I & II] 00:00 & 03:00 Combined images taken after 3 hours in the two locations are added



00:00, 01:30 & 03:00 Combined images of these three different times reflect that SDO moved to north abovethe earth W102 °

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