

I                      II                      III                      IV  
 11:19:58            11:39:33            5:04:19            11:23:34

Predicted  
 Times  
 Athens, Greece

**Table 1**

Geocentric Phases of the 2004 Transit of Venus

Event	Universal Time	Description
Contact I	05:13:29	ingress begins
Contact II	05:32:55	ingress ends
Greatest	08:19:44	minimum angular distance
Contact III	11:06:33	egress begins
Contact IV	11:25:59	egress ends

National observatory of Greece  
 Penteli Observatory

38.05° N  
 +23.86° E

509 m above  
 Sea level

**Hotka, Michael**

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**From:** Kostas Lagouvardos [lagouvar@meteo.noa.gr]  
**Sent:** Tuesday, June 08, 2004 5:56 AM  
**To:** Hotka, Michael  
**Subject:** Re: Just saw the webcast from your observatory

Hi Mike

Longitude +23.86 deg, Latitude +38.05 deg, Height above sea level 509 m  
Please conver to arcmin.

Kind regards from cloudy (now) Athens

Kostas

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National Observatory of Athens  
Institute for Environmental Research  
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Weather forecasts: <http://www.noa.gr/forecast> (in english)  
or <http://www.forecasts.gr> (in greek)  
Weather forecasts for Europe: <http://www.eurometeo.gr> (in english)

----- Original Message -----

**From:** Hotka, Michael  
**To:** [lagouvar@meteo.noa.gr](mailto:lagouvar@meteo.noa.gr)  
**Sent:** Tuesday, June 08, 2004 2:38 PM  
**Subject:** Just saw the webcast from your observatory

Hello...

Great job in broadcasting the Transit of Venus from your observatory.

What is the latitude and longitude of this observatory so that I can use my timing measurements of the 4 contacts to calculate the AU?

Thank you for an opportunity that I would not have had from my home here in Colorado.

Mike

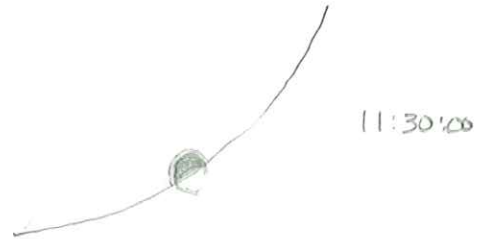
My Data

I 11:20:05 H $\alpha$   
11:21:55 white  
Light

II 11:38:35 H $\alpha$   
11:40:43 white  
light

H $\alpha$  definitely looked inside  
Sun by the time white  
light 2nd Contact  
occurred

Beautiful prominences  
on each side of  
Venus on Sun's Disk.



June 7, 2004

Live Webcast

From Athens, Greece

My Data

III 5:04:38 H $\alpha$

white light already there  
at 5:04:50

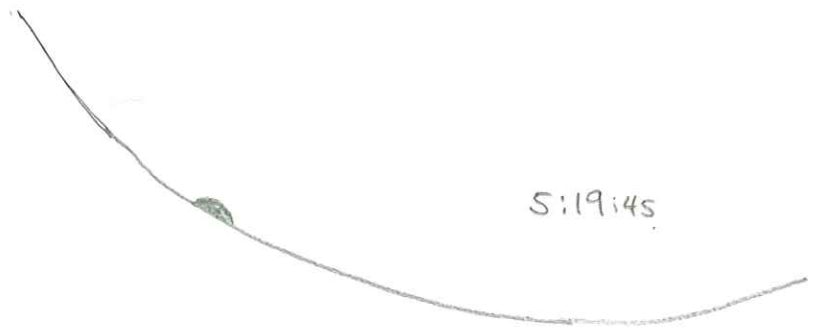
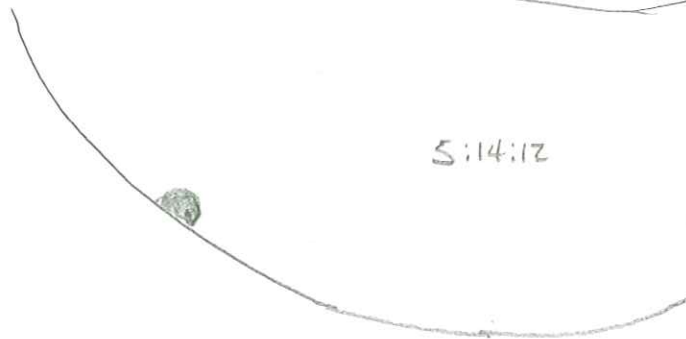
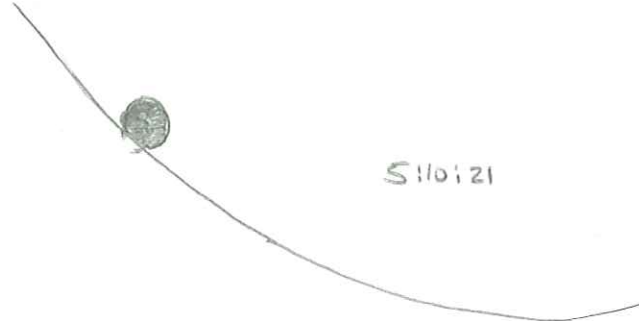
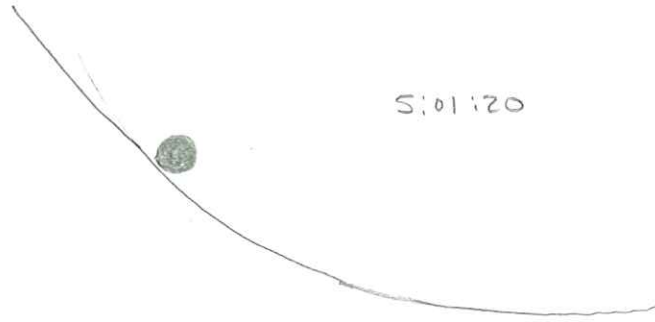
IV 5:23:03 H $\alpha$

white light gone  
for over 30 seconds

June 8, 2004

Live webcast  
on NASA TV  
from Athens, Greece.

Got lucky on 4<sup>th</sup> contact  
image. P/c & clouds were  
blocking the sun at times.



Already there  
 1st 11:20:14 white light  
 Actual  
 → 11:19:54 Ha derived  
 Video 37:48  
 Limb darkening  
 Says Limb  
 Tape 38:17 "Limb"  
 10 15  
 Tape leads  
 Δ 29 sec  
 From Video  
 2nd 37:25 Ha  
 38:44 white light

Actual  
 Better (11:38:04 Ha  
 11:39:13 white light)

From Video

Times in MDT  
 June 7, 2004

21:52 23:03  
 19:45  
 Δ 3:18  
 Same image size  
 From III-TV  
 contact

Ha  
 22:43  
 - 3:18  
 19:25

1st & 2nd Contact  
 by rewatching  
 video & syncing  
 audio tape time  
 with video tape time.

derived  
 1st contact  
 11:19:25 - derived  
 + Δ 00:00:29  
 11:19:54 - actual

3rd & 4th Contact  
 by rewatching  
 video & syncing  
 audio tape time  
 with video tape time.

so what we do is use  
 Kepler's law  
 ↑ 5:02:30  
 "tape"  
 video time = 3:23

3rd Contact:

Video: 5:19  
 Actual: 5:03:26 H<sub>a</sub>

2nd  
 task  
 Best → Video: 6:01  
 Actual: 5:04:07

3rd Contact

5:10 → 5:19  
 5:29

times in MDT

4th Contact:

Video White: 23:01  
 H<sub>a</sub>: 24:06  
 Actual 5:22:59

4th  
 calc  
 24:06  
 3:23  
 20:29

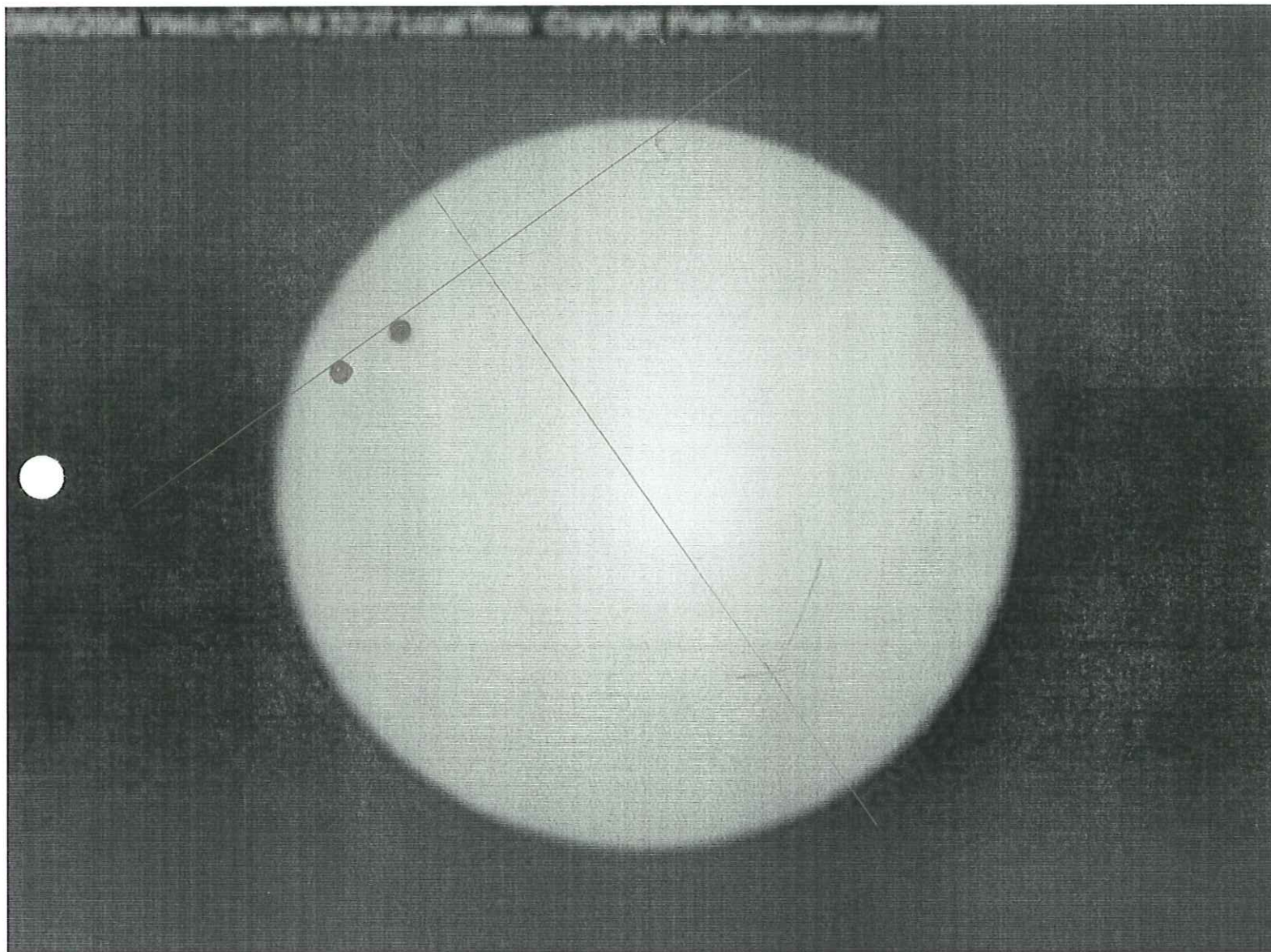
5:19  
 3:23  
 Δ → 1:56  
 3rd  
 contact of video  
 Actual time  
 5:02:30  
 1:56  
 5:03:26

5:02:30	03:26
20:29	00:41
<hr/>	<hr/>
5:22:59	4:07

C

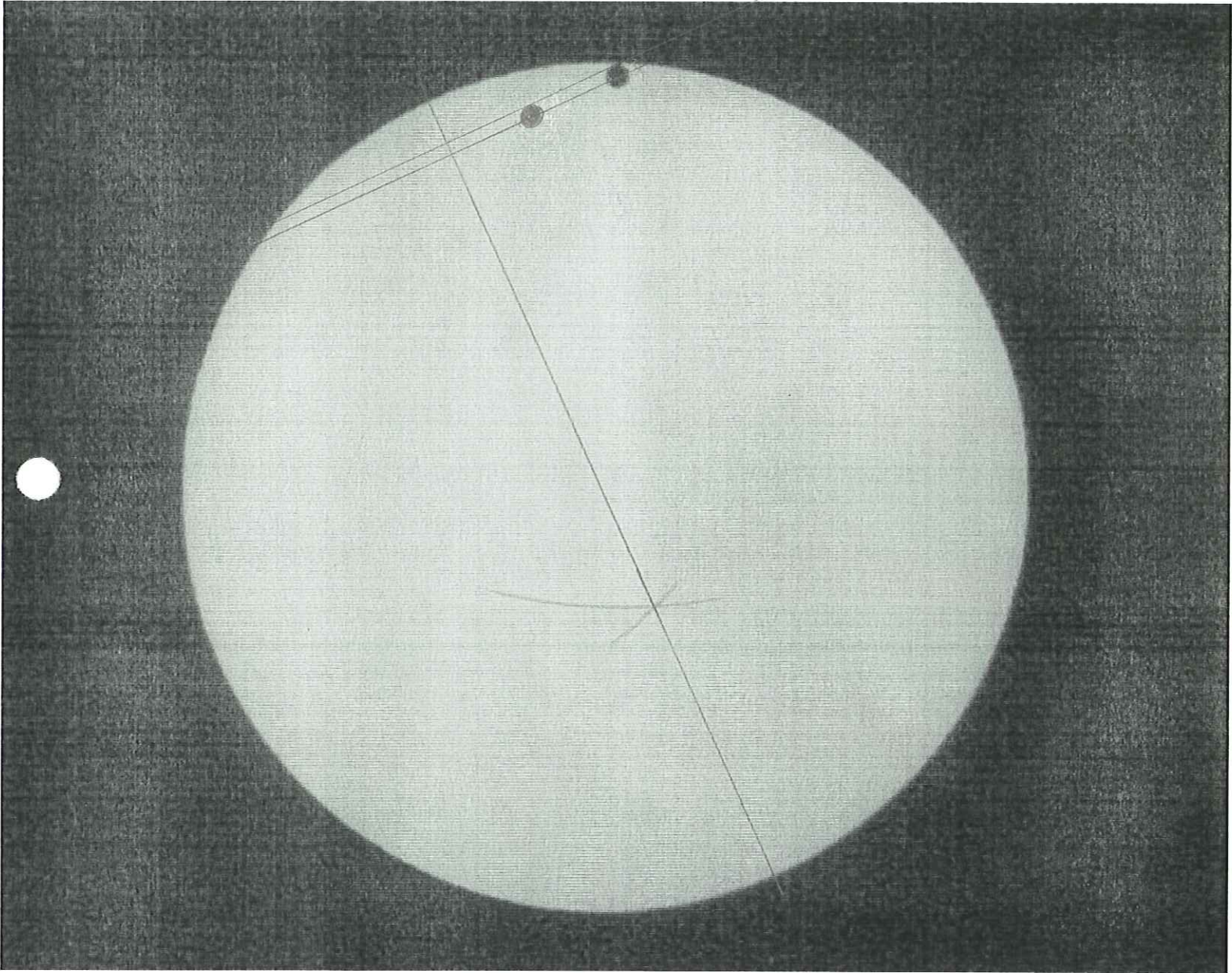


Australia



C

Howard University





1) Howard Sun 5.667"      Howard sun 1.1981 x bigger  
 Australia Sun 4.730"      than Australia Sun

Howard to edge = .329"      .329"

Australia to Edge = .593" x 1.1981 = .710"

Howard Latitude 39 19 05 N = 39.318°

Australia Latitude 32.008° S

∠ btw observers = 71.326

Earth diameter 12,756 km

$$\frac{12756}{180} = \frac{d}{71.326}$$

$$d = 5054.6359 \text{ km}$$

$$.710 - .329 = .381$$

$$\frac{.381''}{5.667''} = \frac{\alpha}{.5^\circ} \quad \text{or } \alpha = .0336157^\circ$$

$$\alpha = .0005867 \text{ Radians}$$

$$L = \frac{\frac{d}{2}}{\tan\left(\frac{\alpha}{2}\right)} = \frac{\left(\frac{5054.6359}{2}\right)}{\tan\left(\frac{.0005867}{2}\right)} = \frac{2527.318}{.0000051} = 4.955 \times 10^8 \text{ km}$$

Actual value = 41,400,000 km

error = 91% error

magnitude = 17% error

$$2) \quad \begin{aligned} \text{Total path} &= 2.848'' \\ \text{Venus moved} &= .649'' \end{aligned} \quad \frac{.649}{2.848} = \frac{t}{21600 \text{ sec}}$$

$$t = 4922.19 \text{ sec}$$

$$\Delta x = .1145$$

$$\text{Angular displacement} = .1145 \times .5 = .05726 = a$$

$$\text{Angular Velocity } \omega = \frac{a}{t} = \frac{.05726^\circ}{4922.19} = 1.16 \times 10^{-5} \text{ deg/sec}$$

$$\begin{aligned} \text{Orbital Velocity } v &= \frac{D \times \tan(a)}{\Delta t} = \\ &= \frac{1.496 \times 10^8 \times \tan(.05726)}{4922.19} \end{aligned}$$

$$= 30,374 \text{ km/sec}$$

$$\text{Actual Value} = 35.0 \text{ km/sec}$$

$$\text{error} = 13.2\%$$

$$4) \quad M_{\text{sun}} = \frac{(4\pi^2 \cdot A_V^3)}{G \cdot P^2} = \frac{4\pi^2 \cdot (1.082 \times 10^{11} \text{ m})^3}{6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2} \cdot (224.7 \text{ days})^2} \quad 1 \text{ N} = \frac{\text{kg} \cdot \text{m}}{\text{sec}^2}$$

$$= \frac{5.0008 \times 10^{34}}{2.514 \times 10^4}$$

$$\frac{\text{m}^3}{\text{kg} \cdot \text{sec}^2} \cdot \frac{\text{m}^3}{\text{sec}^2}$$

$$= 1.9892 \times 10^{30} \text{ kg}$$

$$\text{Actual } 1.9891 \times 10^{30} \text{ kg}$$

Howard University Astronomical Observatory

Long  $77^{\circ} 03' 14''$  W

Lat  $39^{\circ} 19' 05''$  N

Observatorio Astronomico de Minas, Uruguay

Long  $55^{\circ} 14' 42''$  W

Lat  $34^{\circ} 22' 27''$  S

~~Delhi, India~~

~~Delhi~~

Worth Hill Observatory Dorset, England

Lat  $50^{\circ} 36' N$  Long  $2^{\circ} 2'$

Australia Perth Observatory

I 13:09 Local Western Australia  $-32.068$  latitude

II 13:28  $116.135$  E Long

My observations

Astroleague Homepage

Send Tim Brown

2) Calculate the AU

Venus greatest elongation  $46^\circ$

$$VS = .72 \text{ AU}$$

$$EV_2 = 1 - .72 \text{ AU}$$

$$= 0.28 \text{ AU}$$

$$X = 126 \times 10^6 \text{ miles} \times \frac{1 \text{ AU}}{.28 \text{ AU}} = 92.857 \times 10^6 \text{ miles}$$

3) Calculate Venus Orbital Period

$$P^2 = A^3$$

so  $A = \text{Avg distance from Sun} = 0.723 \text{ AU}$

$$P^2 = .3779331$$

$$P = .6147626 \text{ yrs}$$

$$= 224.39 \text{ days}$$

Actual Value = 224.7 days

error  $< 1\%$