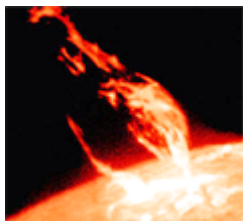


The Sun



가 가 . 1 5 km

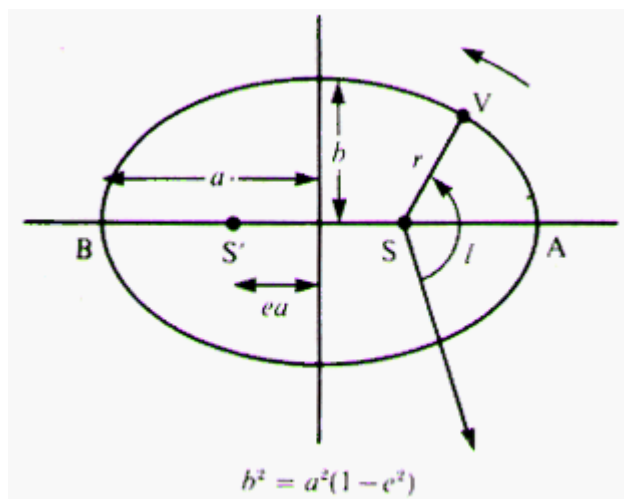
8

가 .

Orbits

가

가



(eccentricity, e)

S S'
 $e=0$

가

1

0.1

V

(perihelion)

(aphelion)

가 가

A

가

B

r

가

l

a

The apparent orbit of the Sun

365.25

가

가

0

가 가 1990 1 0.0

(JD=2447891.5).

$\epsilon_g = 279.403303$

가

가

가

$\epsilon_g()$	279.403303
$\omega_g()$	282.768422
$e()$	0.016713

$$\omega_g = 282.768422$$

$$e = 0.017813$$

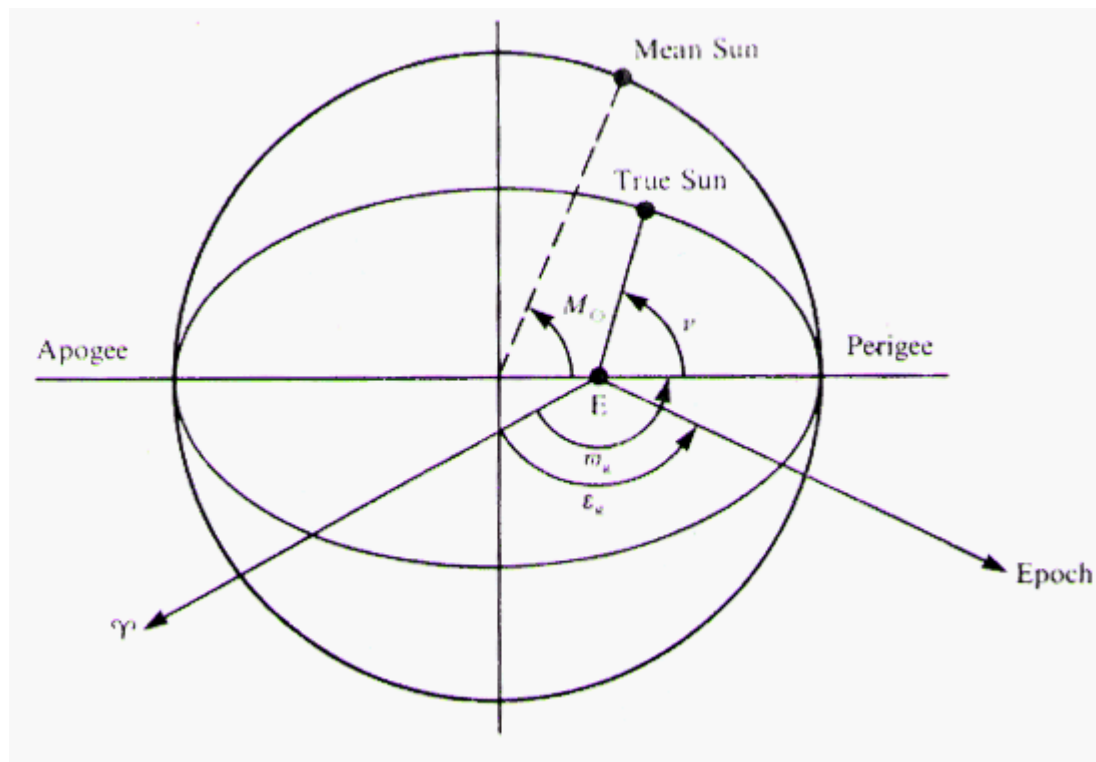
$$\epsilon_g = 279.6966778 + 36000.76892T + 0.0003025T^2$$

$$\omega_g = 281.2208444 + 1.719175T + 0.000452778T^2$$

$$e = 0.01675104 - 0.0000418T - 0.000000126T^2$$

$$T = 1900 \quad 1 \quad 0.5$$

$$T = (JD - 2415020.0) / 36525$$



가

$$M_\odot = \frac{360}{365.242191} d$$

45.5) d

1990.0

, D

$$M_\odot = \frac{360}{365.242191} D + \epsilon_g - \omega_g$$

ϵ_g

ω_g

$\epsilon_g - \omega_g$

1 , 365.242191 (365 5 48

$M_\odot$ mean anomaly

$M_\odot$

$M_{\odot}$ 가 . 가 가 true anomaly, ν

degree

$$\nu + \omega_g = \lambda_{\odot}$$

 $M_{\odot}$

$$E - e \sin E = M_{\odot}$$

- 가 E M
- $\delta = E - \epsilon \sin E - M$
- $|\delta|$ 가 가

$$\Delta E = \frac{\delta}{1 - \cos E} \quad E \quad \Delta E \quad E$$

가 E

$$\tan \frac{\nu}{2} = \sqrt{\frac{(1+e)}{(1-e)}} \tan \frac{E}{2}$$

true anomaly, ν

radian

✓

true anomaly, ν , r θ .

$$r=r_0\frac{(1-e^2)}{(1+e\cos\nu)}$$

$$\theta=\theta_0\frac{(1+e\cos\nu)}{(1-e^2)}$$

. r_0 θ_0 .

r_0 ()	$1.495985 \times 10^8\text{km}$
$\theta_0(r=r_0)$)	0.533128

, α δ 가 α δ 가 가

$$GST=\frac{(24.07\times GST1)-T00\times (GST2-GST1)}{24.07+GST1-GST2}$$

GST Greenwich Sidreal Time . GST1 , GST2 . T00 UT 0 (,) Greenwich Sidreal Time . 0.985647 가

Twilight

, 18 , 108 , 18 가 (Astronomical Twilight)

$$\cos H=-\tan \phi \tan \delta$$

ϕ , δ .

108

$$\cos H'=\frac{\cos 108-\sin \phi \sin \delta}{\cos \phi \cos \delta}$$

-23.5 23.5 가 , 48.5 48.5

60 4 23 8 22

, $\cos H$ -1 1 가 ,

error

The Equation of Time

16

가

1. 가 가 , 가
2. 23 26

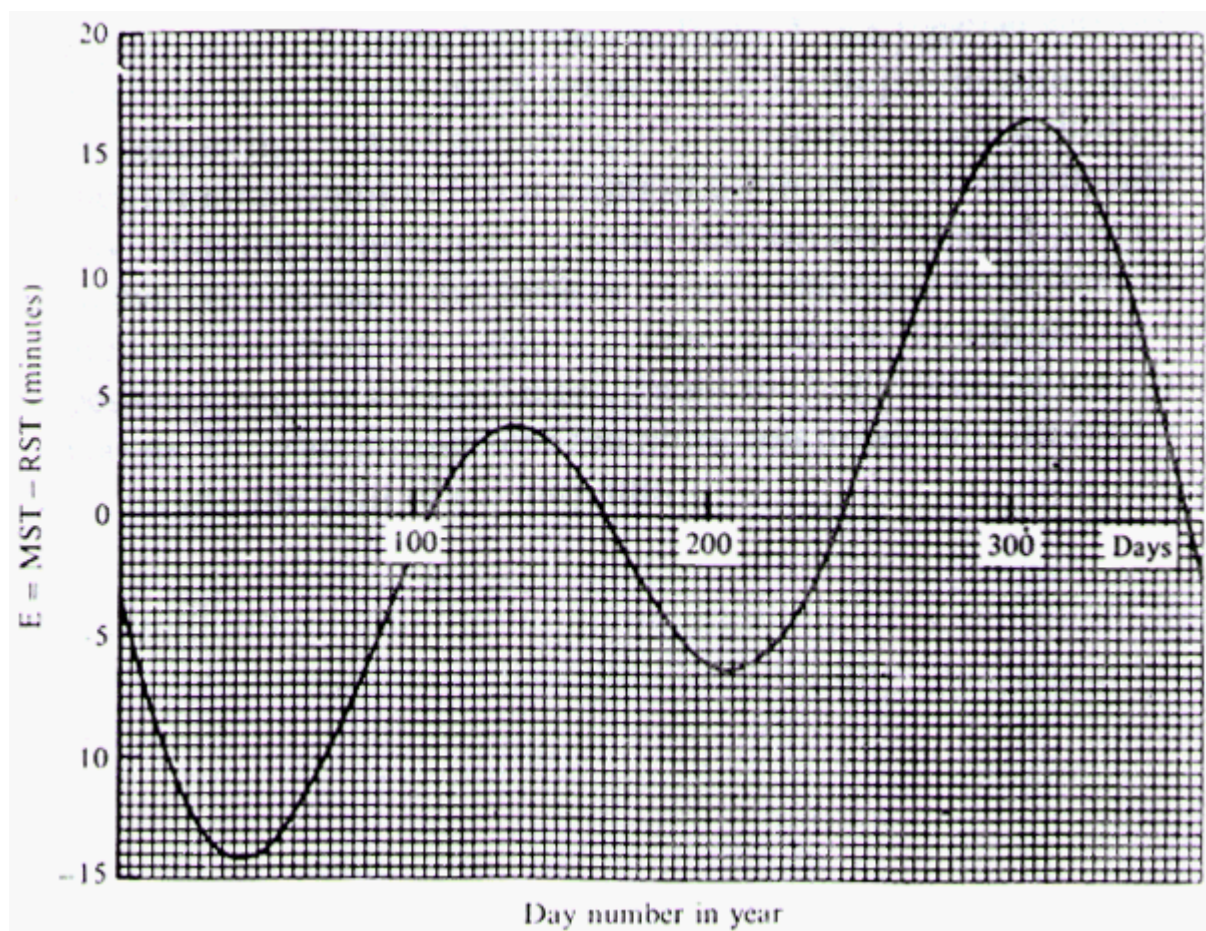
, 가 , 가

가 (Mean Sun)

UT

(The Equation of Time)

$$E = MST - RST$$



UT UT 12h 00m .()

Solar elongation

가 가 , - - 가 . 가 가 가, , 가 . , ε

$$\cos \epsilon = \sin \delta_p \sin \delta_\odot + \cos (\alpha_p - \alpha_\odot) \cos \delta_\odot \cos \delta_p$$

$$\alpha_\odot \quad \delta_\odot \quad , \quad \alpha_p \quad \delta_p$$