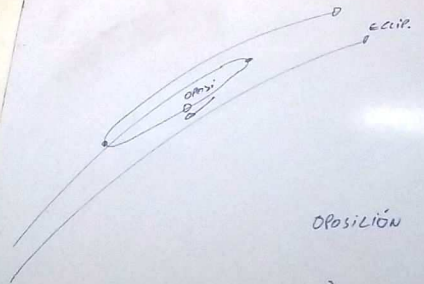


$$PS = F - R$$

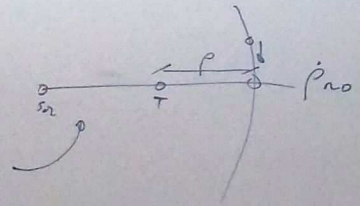
OPosición
Fases y brillo
COORD. PLANETA
ANG. POSICIÓN
PER. SÍMBOLO
OBLICUINAN



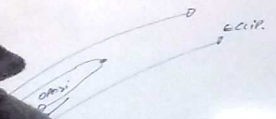
$$\rho \hat{s} = \vec{r} - \vec{R}$$

$$\cancel{\dot{\hat{s}}} + \rho \dot{\hat{s}} = \dot{\vec{r}} - \dot{\vec{R}} \Rightarrow \dot{\hat{s}} = \frac{\dot{\vec{r}} - \dot{\vec{R}}}{\rho}$$

EN OPPOSICIÓN = $r - \delta_{\text{sun}}$



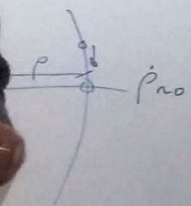
OPPOSICIÓN
 FASE Y BRILLO
 CÓDIGO PLANETA
 MUC. POSICIÓN
 POR SIMBOLO
 OBSERVACION



$$\rho \dot{\zeta} = \dot{r} - \dot{R}$$

$$\cancel{\dot{\zeta}} + \rho \dot{\zeta} = \dot{r} - \dot{R} \Rightarrow \dot{\zeta} = \frac{\dot{r} - \dot{R}}{\rho}$$

Oposición



EN OPOSICIÓN = $r - R_{sun}$

Órb. circ.

$$\dot{r} = a \cdot \dot{M} = a \cdot \sqrt{\mu/a^3} = k \cdot a \cdot a^{-3/2} = k \cdot a^{-1/2}$$

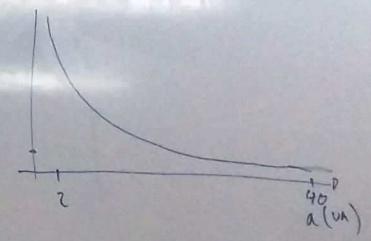
$$\dot{R} = k \cdot (1)^{-1/2} = k$$

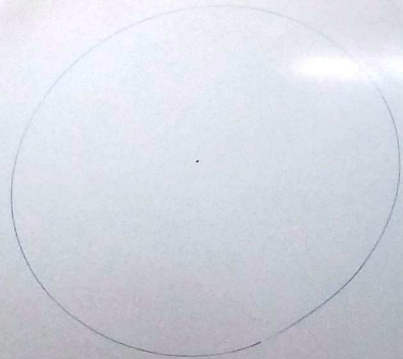
$$\Rightarrow \dot{\zeta} = \frac{k(a^{-1/2} - 1)}{a - 1} < 0$$

OBJETO EXTERIOR $a > 1$

OPOSICIÓN
FASE Y BRILLO
COORD. PLANETA
MAG. POSICIÓN
PER. SIMBOL
OBLICUIDAD

RETROGRADO





dos. circ.

$$\dot{r} = a \cdot M = a \cdot \sqrt{\mu/a^3} = k \cdot a \cdot a^{-3/2} = k \cdot a^{-1/2}$$

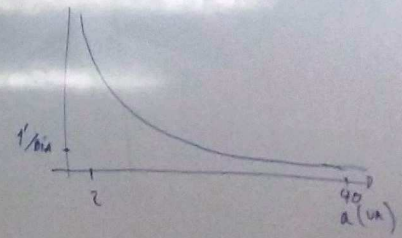
$$\ddot{r} = k \cdot (-1/2) \cdot a^{-3/2} = k \cdot a^{-3/2}$$

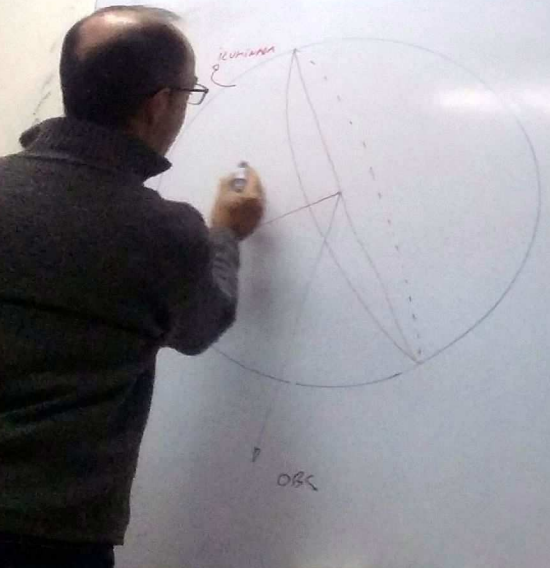
$$\Rightarrow \dot{s} = \frac{k(a^{-1/2} - 1)}{a - 1} < 0$$

OBJETO EXTERIOR $a > 1$

OPosición
Fase y brillo
COORD. PLANEAS
MUE. POSICION
Por similitud
OBLICUIDAD

RETARDADO





Geo. circ.

$$\dot{r} = a \cdot m = a \cdot \sqrt{\mu/a^3} = k \cdot a \cdot a^{-3/2} = k \cdot a^{-1/2}$$

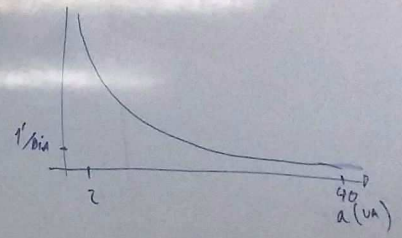
$$\ddot{r} = k \cdot (-1/2) \cdot a^{-3/2} = -k \cdot a^{-3/2}$$

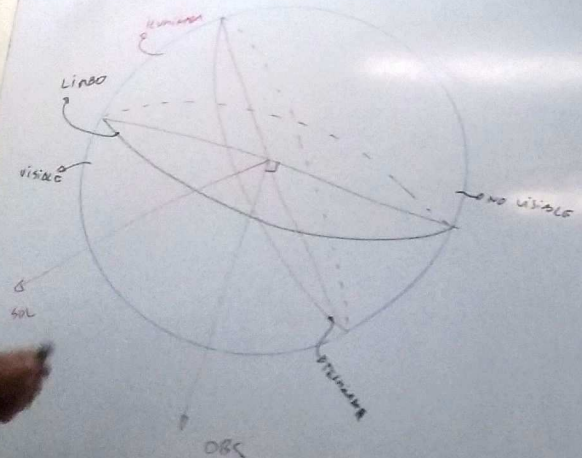
$$\Rightarrow \dot{s} = \frac{k(a^{-1/2} - 1)}{a - 1} < 0$$

OBJETO EXTERIOR $a > 1$

OPosición
Fases y brillo
COORD. PLANETA
MAG. POSITIVA
PER SIMBOL
OBLICUIDAD

RETROGRADO





óro. circ.

$$\dot{r} = a \cdot M = a \cdot \sqrt{\mu/a^3} = k \cdot a \cdot a^{-3/2} = k \cdot a^{-1/2}$$

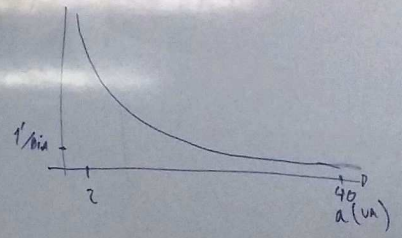
$$\ddot{r} = k \cdot (-1/2) \cdot a^{-3/2} = -k \cdot a^{-3/2}$$

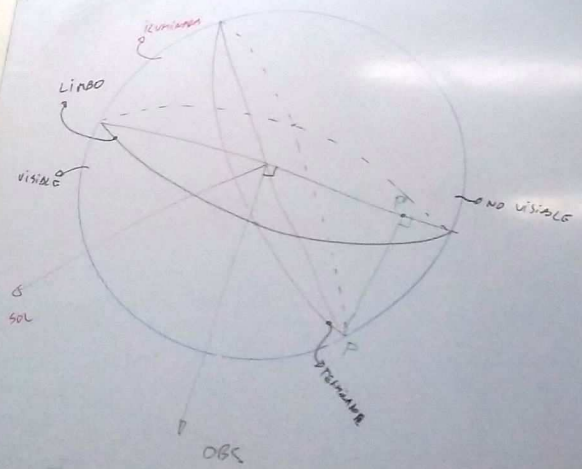
$$\Rightarrow \dot{S} = \frac{k(a^{-1/2} - 1)}{a - 1} < 0$$

OBJETO EXTERIOR $a > 1$

- OPosición
- Fases y brillo
- CONDICIONES PARA VER
- MAG. POSICION
- PER SINGULO
- OBLICUINAN

RETROGRADO





AREA ILLUMINADA

GRA. CIRC.

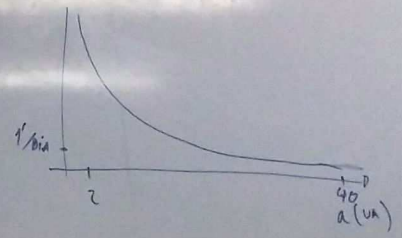
$$\dot{r} = a \cdot M = a \cdot \sqrt{\mu/a^3} = k \cdot a \cdot a^{-3/2} = k \cdot a^{-1/2}$$

$$\ddot{r} = k \cdot (-1/2) \cdot a^{-3/2} = -k \cdot a^{-3/2}$$

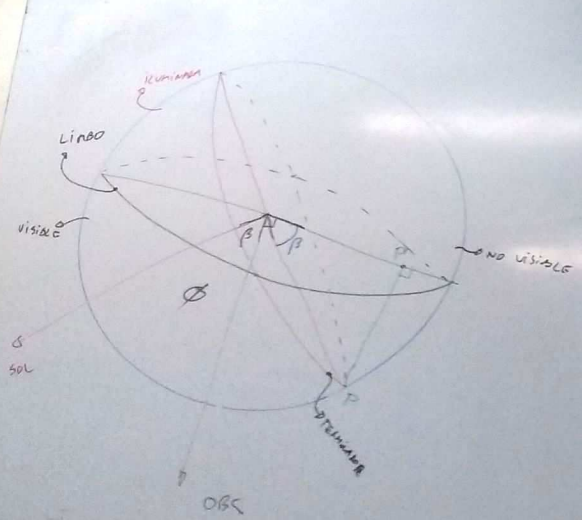
$$\Rightarrow \ddot{S} = \frac{k(a^{-1/2} - 1)}{a-1} < 0$$

OBJETO EXTERIOR $a > 1$

RETROGRADO



- OPOSICION
- FASOS Y GABILLO
- COORD. PLANETAS
- MAG. POSICION
- PER. SINODICO
- OBLICUIDAD

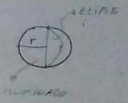


$$\text{AREA ILUMINADA} = \frac{\pi r^2}{2} + \frac{\pi r \cdot r \cos \beta}{2}$$

$$\text{"FASE"} = \frac{\text{AREA ILUMINADA}}{\text{AREA TOTAL}} = \frac{\pi r^2}{\pi r^2} = 1 + \dots$$

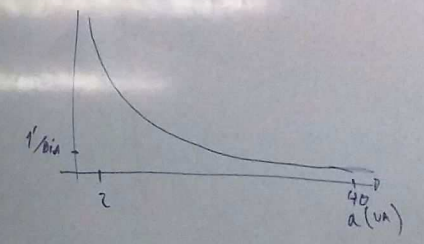
$$= \frac{\pi r^2}{2} \left(1 + \dots \right)$$

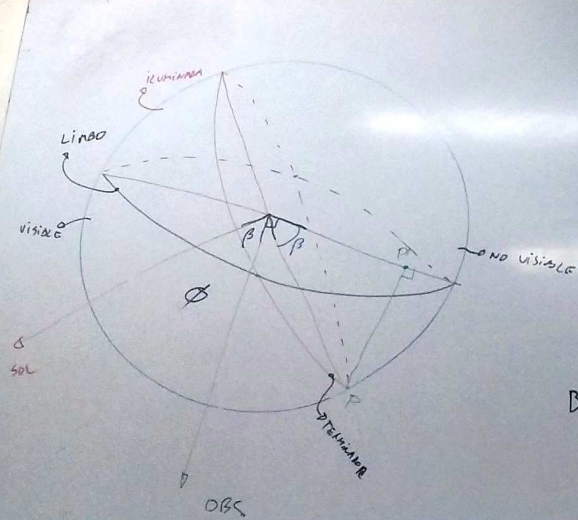
$$= 1 + G$$



$$b \cdot a^{-1/2}$$

- OPOSICIÓN
- FASES Y BRILLO
- COORD. PLANETA
- MAG. POSICIÓN
- PER. SINODICA
- OBLICUIDAD





$$\text{AREA iluminada} = \frac{\pi r^2}{2} + \frac{\pi r \cdot r \cos \phi}{2} = \frac{\pi r^2}{2} (1 + \cos \phi)$$

$$\text{"FASE"} = \frac{\text{AREA iluminada}}{\text{AREA TOTAL}} = \frac{\pi r^2 (1 + \cos \phi)}{2 \pi r^2}$$

$$\text{Brillo} \propto \frac{1 + \cos \phi}{d^2 \cdot p^2}$$

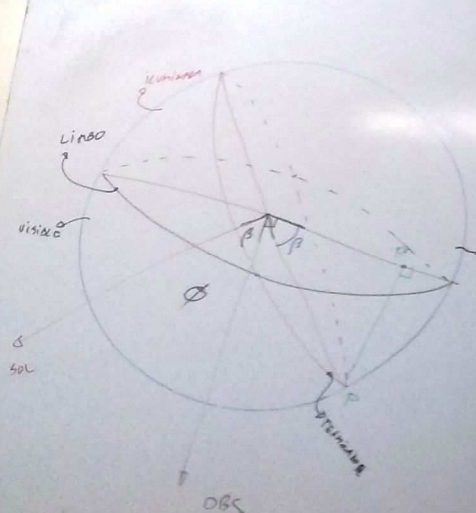
$d^2 \rightarrow \text{HELOS.}$ $p^2 \rightarrow \text{GEOC.}$

$$b \propto a^{-1/2}$$

OPosición
FASE y BRILLO
COORD. PLANETA
MÁS POSICIÓN
POR SIMBOL
OBLICUIDAD

$$= \frac{1 + \cos \phi}{2}$$

$0 \Rightarrow \phi = 180^\circ$ (NUEVA)
 $1 \Rightarrow \phi = 0^\circ$ (LLENA)



$$AREA = \pi r^2 + \frac{\pi r^2 \cos \phi}{2} = \frac{\pi r^2}{2} (1 + \cos \phi)$$

AREA iluminada
AREA TOTAL
 πr^2

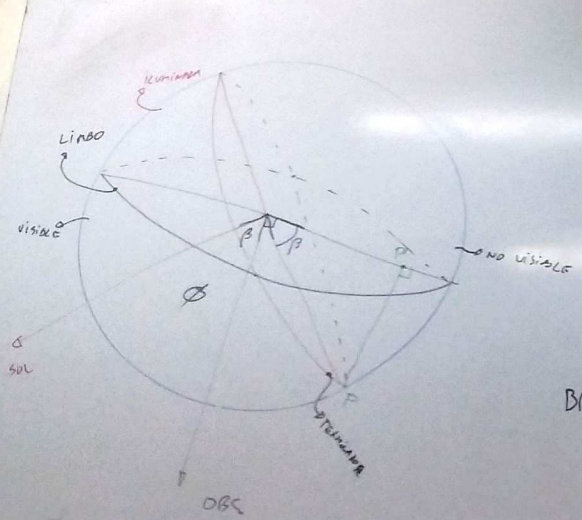
$$= \frac{(1 + \cos \phi)}{2}$$

$0 \Rightarrow \phi = 180^\circ$ (NUEVA)
 $1 \Rightarrow \phi = 0^\circ$ (LLENA)

$$M = CTE - 2.5 \log B$$

$b \cdot a^{-1/2}$

OPosición
Fases y brillo
COORD. PLANETA
MAG. POSICIÓN
PER. SÍMBOL
OBLICUIDAD



$$\text{AREA iluminada} = \frac{\pi r^2}{2} + \frac{\pi r \cdot r \cos \phi}{2} = \frac{\pi r^2}{2} (1 + \cos \phi)$$

$$\text{"FASE"} = \frac{\text{AREA iluminada}}{\text{AREA TOTAL}} = \frac{\pi r^2 (1 + \cos \phi)}{2 \pi r^2}$$

$$\text{BRILLO} \propto \frac{1 + \cos \phi}{d^2 \cdot p^2}$$

$\xrightarrow{\text{HELIOC.}}$ $\xrightarrow{\text{GEOC.}}$

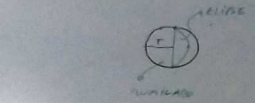
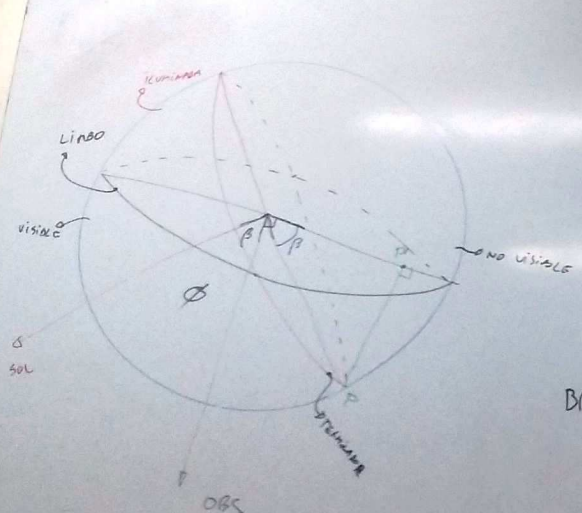
$b \cdot a^{-1/2}$

OPOSICION
 FASES Y BRILLO
 COORD. PLANETAS
 ANG. POSICION
 PER SIMBOL
 OBLICUIDAD

$$= \frac{1 + \cos \phi}{2}$$

$0 \Rightarrow \phi = 180^\circ$ (NUEVA)
 $1 \Rightarrow \phi = 0^\circ$ (LLENA)

$$M = \text{CTE} - 2.5 \log B$$



$$\text{AREA iluminada} = \frac{\pi r^2}{2} + \frac{\pi r \cdot r \cos \phi}{2} = \frac{\pi r^2}{2} (1 + \cos \phi)$$

$$\text{"FASE"} = \frac{\text{AREA iluminada}}{\text{AREA TOTAL}} = \frac{1 + \cos \phi}{2}$$

$$\text{Brillo} \propto \frac{1 + \cos \phi}{2}$$

$$\frac{d^2}{\text{Helioc.}} \cdot \frac{p^2}{\text{Geoc.}}$$

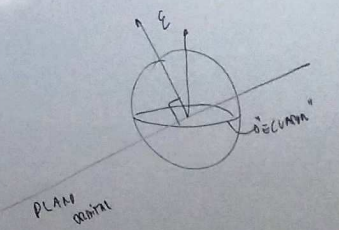
b. a^{-1/2}

$$= \frac{1 + \cos \phi}{2}$$

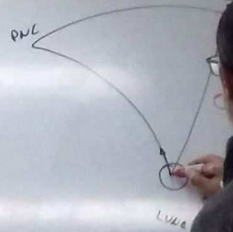
$0 \Rightarrow \phi = 180^\circ$ (NUEVA)
 $1 \Rightarrow \phi = 0^\circ$ (LLENA)

$$M = \text{cte} - 2.5 \log B$$

OPosición
 FASES y BRILLO
 COORD. PLANETAS
 MUG. POSICION
 DEL SIMBOL
 OBLICUIDAD

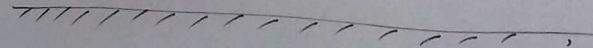
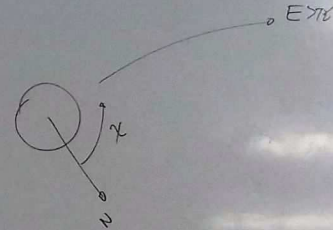
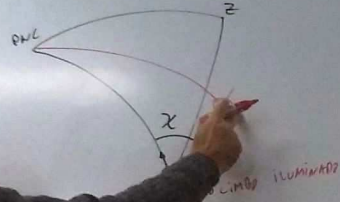
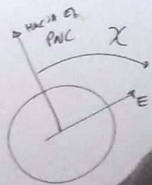


ÁNGULO DE POSICIÓN χ



OPUSCULO
FAS Y BRILLO
COORD. PLANAS
ANG. POSICION
DEL SOL
OBLICUIDAD

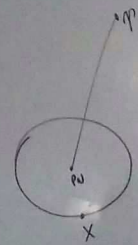
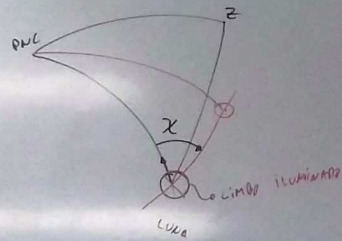
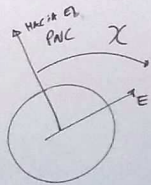
ÁNGULO DE POSICIÓN χ



• PNC

- OPOSICIÓN
- FASES Y BRILLO
- COORD. PLANETA
- MAG. POSICIÓN
- DE LA SÍMBOLA
- OBLICUINAN

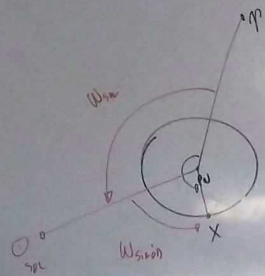
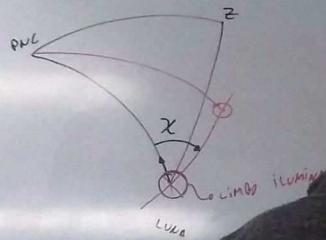
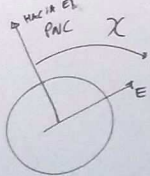
ÁNGULO DE POSICIÓN χ



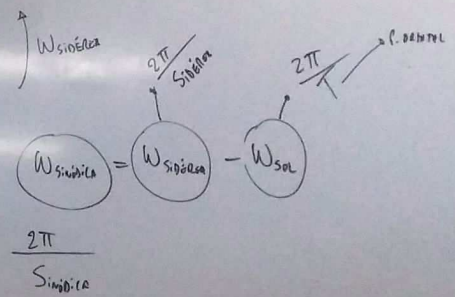
OPOSICIÓN
FASE Y BRILLO
COORD. PLANETA
ANG. POSICIÓN
DEL SOLAR
OSCURIDAD



ÁNGULO DE POSICIÓN χ

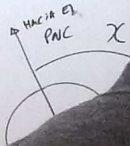


OPOSICIÓN
 FASES Y BRILLO
 COORD. PLANETA
 ANG. POSICIÓN
 DEL SINOIDA
 OBLICUIDAD



$$\frac{2\pi}{\text{Sin}\delta\alpha}$$

ÁNGULO DE POSICIÓN χ

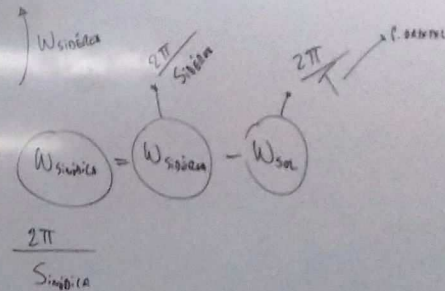
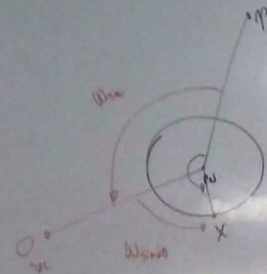


TIERRA $\left\{ \begin{array}{l} \text{SID: } 23^h 56^m 4^s \\ \text{TORO: } 365.25 \text{ DIAS} \end{array} \right.$

$$\frac{1}{S_{\text{SID}}} = \frac{1}{23^h 56^m 4^s} - \frac{1}{365.25 \text{ D}} = \frac{1}{24 \text{ HS}}$$

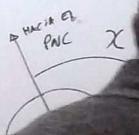
URCIO $\left\{ \begin{array}{l} \text{SID: } 58.646 \text{ AÑOS} \\ \text{TORO} \end{array} \right.$

$$\frac{1}{S_{\text{SID}}} = \frac{1}{S_{\text{URCIO}}} - \frac{1}{T_{\text{ORDINE}}}$$



OPORTUNIDAD
FASE Y BRILLO
CORRE PLANEOS
ANG POSICION
DEL SINICIA
OBLICUIDAD

ÁNGULO DE POSICIÓN χ



TIERRA $\left\{ \begin{array}{l} \text{SID: } 23^{\text{h}} 56^{\text{m}} 4^{\text{s}} \\ \text{Torb: } 365.25 \text{ DIAS} \end{array} \right.$

$$\frac{1}{S_{\text{SID}}} = \frac{1}{23^{\text{h}} 56^{\text{m}} 4^{\text{s}}} - \frac{1}{365.25 \text{ d}} = \frac{1}{24^{\text{h}}}$$

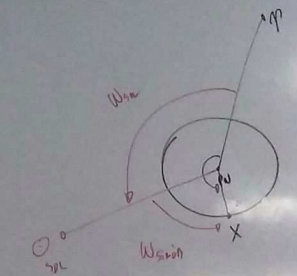
MERCURIO \rightarrow SID. 88.646 días

$$T_{\text{orb}} = a^{3/2} \times 365.25 \text{ días} = 87.9$$

3841 ua

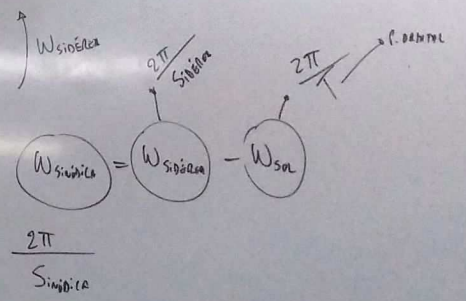
Sinódica =

$$T = a^{3/2}$$



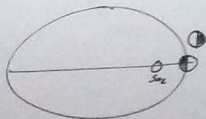
$$\frac{1}{S_{\text{SID}}} = \frac{1}{S_{\text{SIDERA}}} - \frac{1}{T_{\text{ORDINAL}}}$$

OPOSICIÓN
FASE Y BRILLO
COORD. PLANETA
ANG. POSICIÓN
DEL SINOÍDICO
OBLICUIDAD



PERIODOS SIDÉREO Y SIDERICO

DIA MERCIURIO = 2 AÑOS MERCIURIOS



$$\frac{T^2}{a^2} = 1$$

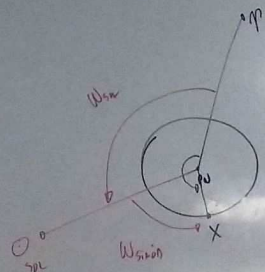
$$T = a^{3/2}$$

TIERRA
 Sid: $23^h 56^m 4^s$
 T_{orb}: 365.25 días

$$\frac{1}{S_{sid}} = \frac{1}{23^h 56^m 4^s} - \frac{1}{365.25 \text{ d}} = \frac{1}{24 \text{ hrs}}$$

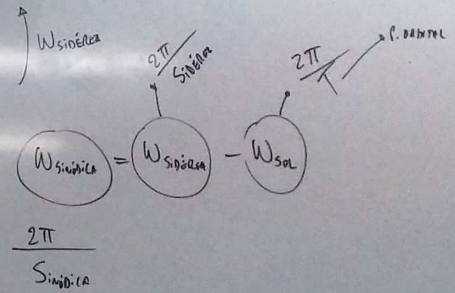
MERCURIO
 Sid: 58.646 días
 T_{orb} = $a^{3/2} \times 365.25 \text{ días} = 87.5$
 $a = 0.3841 \text{ ua}$

Siderico = 176 días

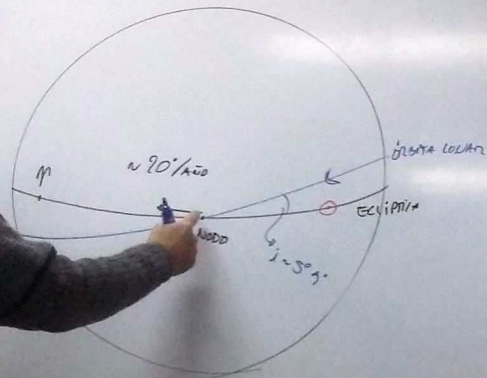


$$\frac{1}{S_{sid}} = \frac{1}{S_{sidera}} - \frac{1}{T_{ORDINAL}}$$

OPOSICIÓN
 FASE Y BRILLO
 COORD. PLANETA
 AUG. POSICIÓN
 DEL SIDERICO
 OBLICUIDAD

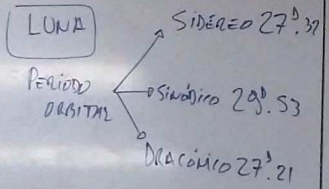


OCULTACIONES Y ECLIPSES

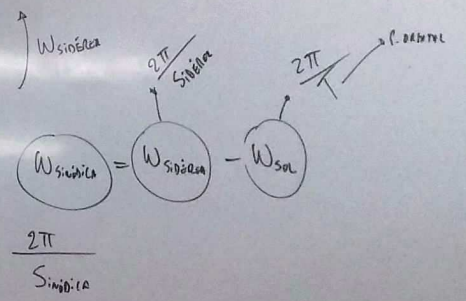
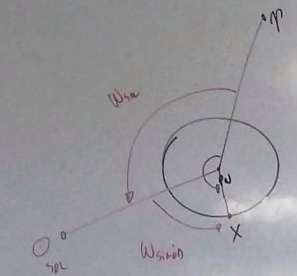


346.62 días

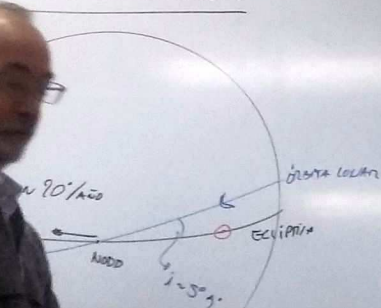
173.3 días



$$\frac{1}{S_{\text{sin}}} = \frac{1}{S_{\text{sider}}} - \frac{1}{T_{\text{orbital}}}$$

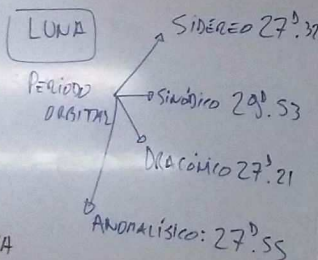


OCULTACIONES Y ECLIPSES

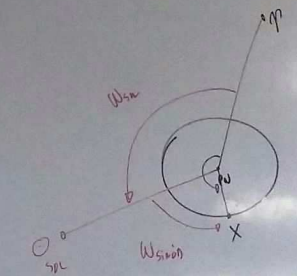


346.62 días

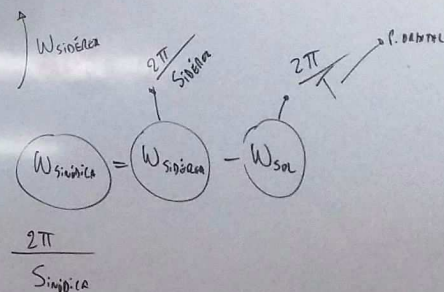
173.3 días



LUNA NUEVA

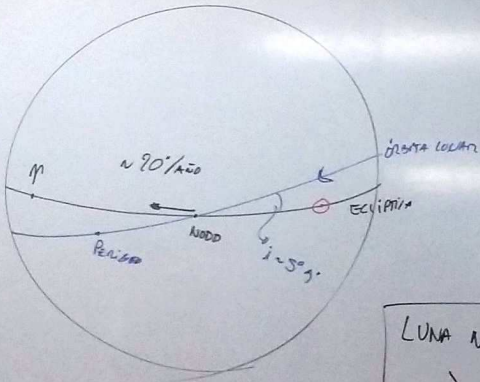


$$\frac{1}{S_{\text{syn}}} = \frac{1}{S_{\text{sidera}}} - \frac{1}{T_{\text{orbital}}}$$



OPOSICIÓN
 FASE Y BRILLO
 CDAD PLANETA
 ANG. POSICIÓN
 DEL SINOIDE
 OBLICUIDAD

OCULTACIONES Y ECLIPSES



346.62 días

173.3 días

LUNA

PERIODO ORBITAL

SIDÉREO 27^d.37

SINODICO 29^d.53

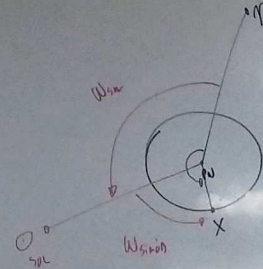
DRACÓNICO 27^d.21

ANOMALÍSTICO: 27^d.55

LUNA NUEVA

$$\lambda_L = \lambda_S$$

COND. ECLIP.



$$\frac{1}{S_{syn}} = \frac{1}{S_{sid}} - \frac{1}{T_{orbital}}$$

OPOSICIÓN
FASES Y BRILLO
COORD. PLANETA
MUC. POSICIÓN
PER. SINODICO
OBLICUIDAD

