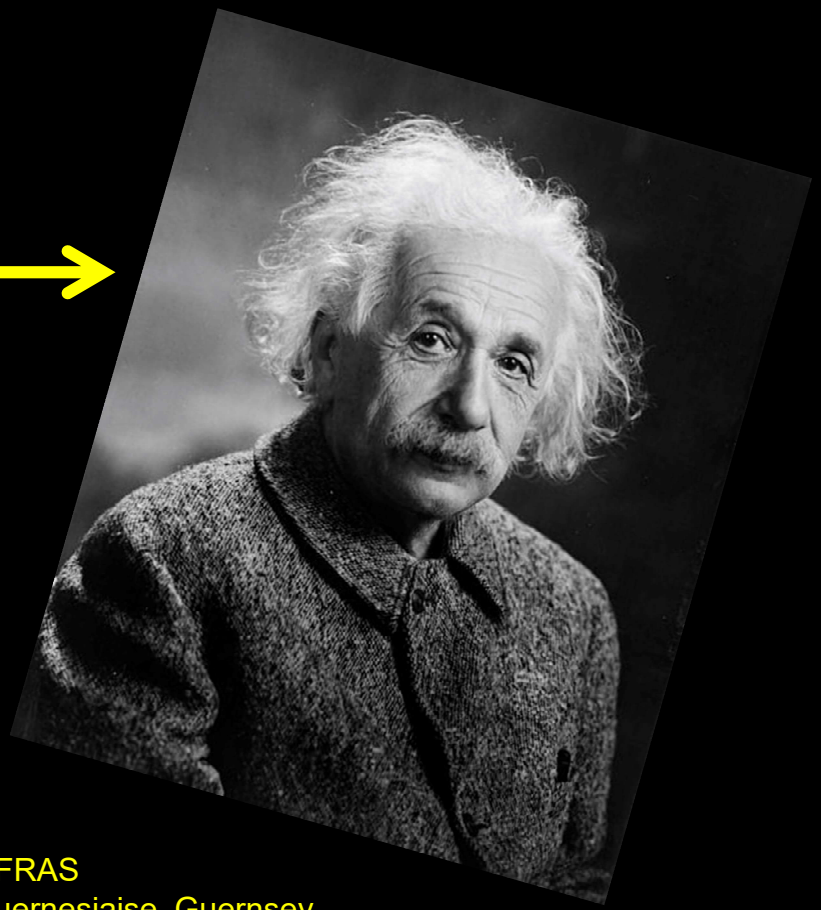
Pythagoras to Einstein

The development of our understanding of the motions of solar system objects



David Le Conte, FRAS
Astronomy Section, La Société Guernesiaise, Guernsey

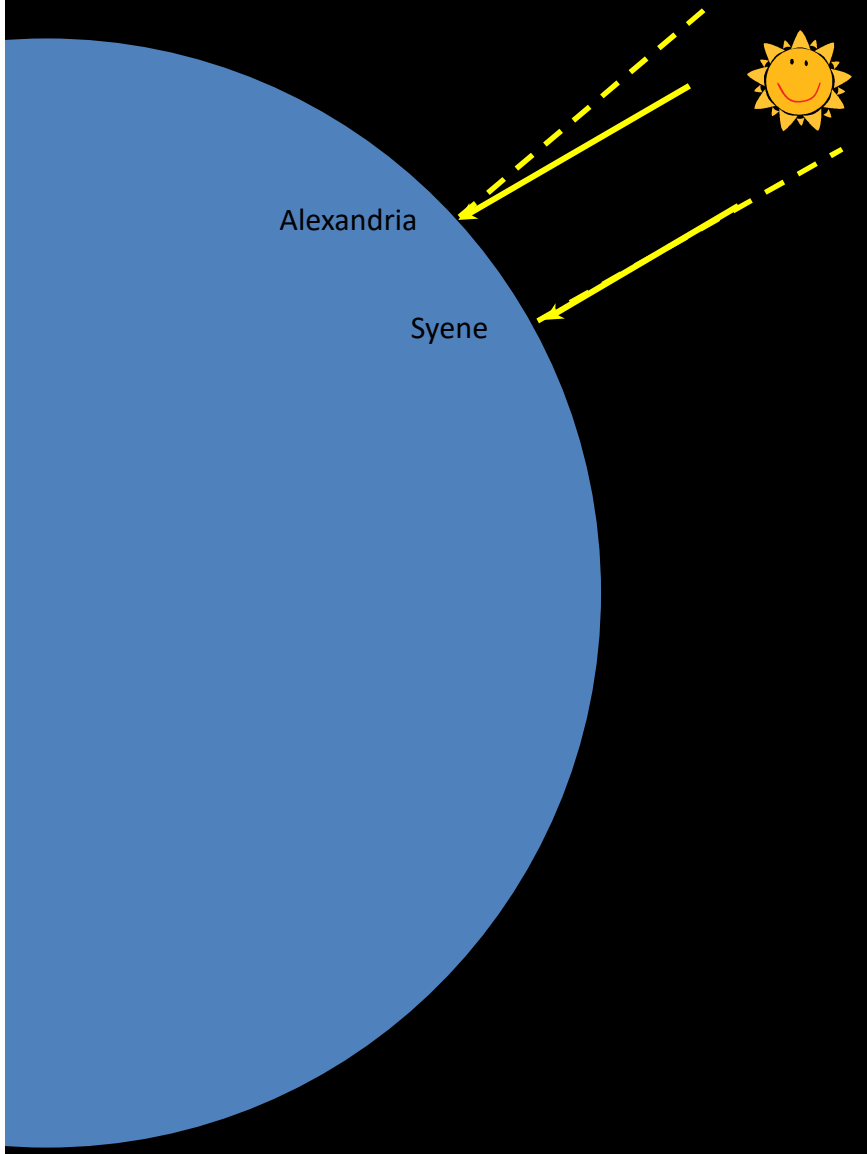
Pythagoras c550 BC

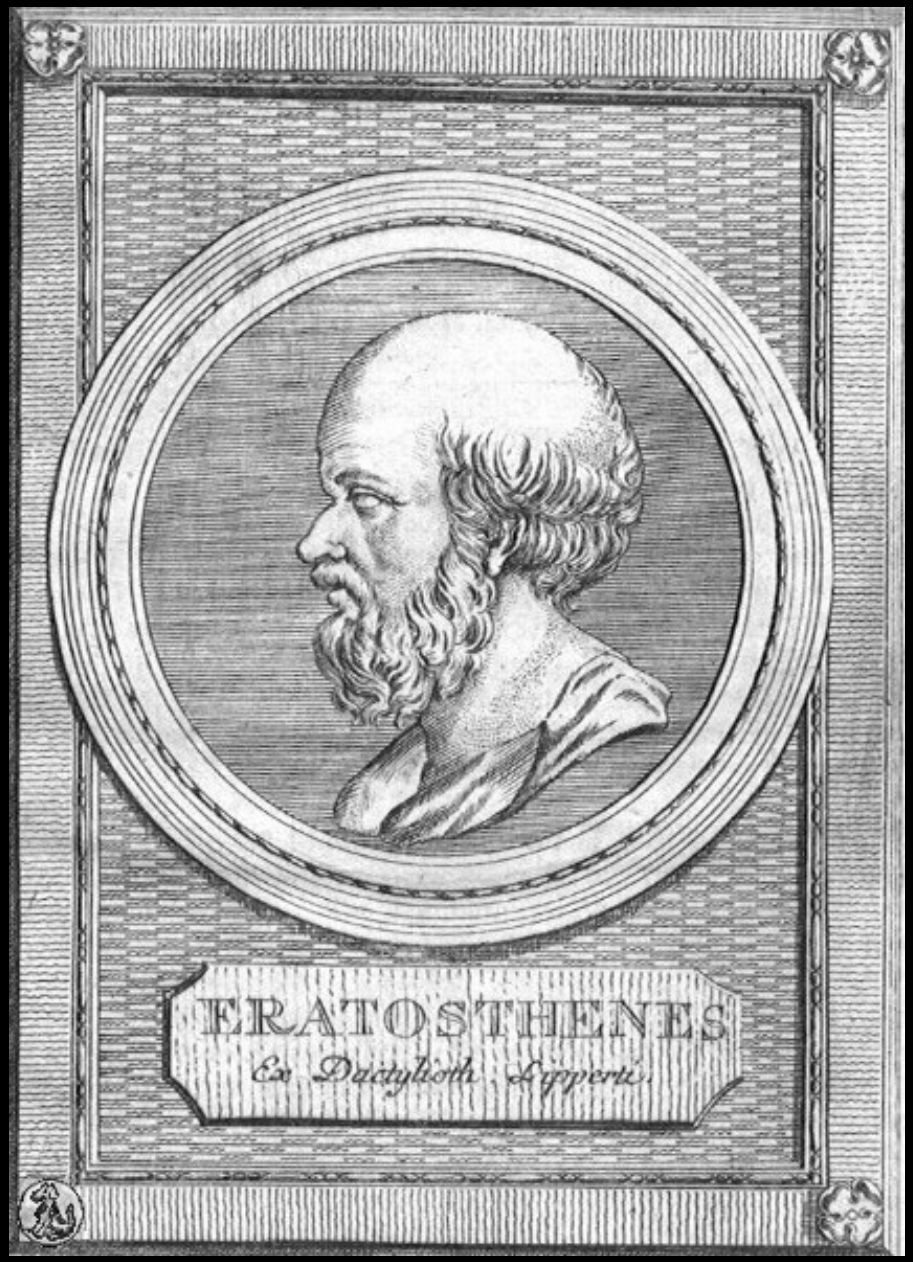
Aristotle c350BC

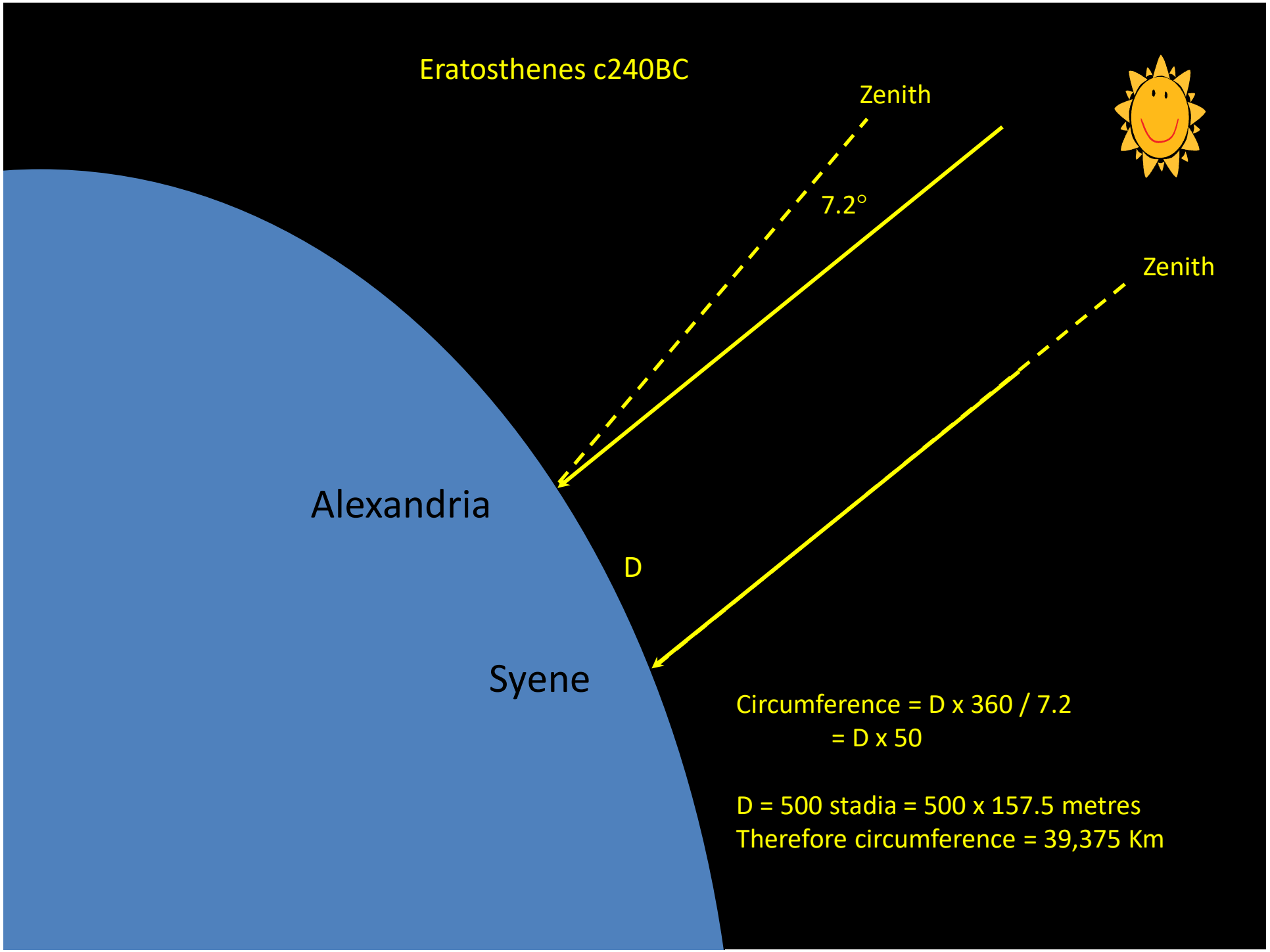
by Francesco Hayez, 1811

Aristarchus, c 280BC

Eratosthenes c240BC

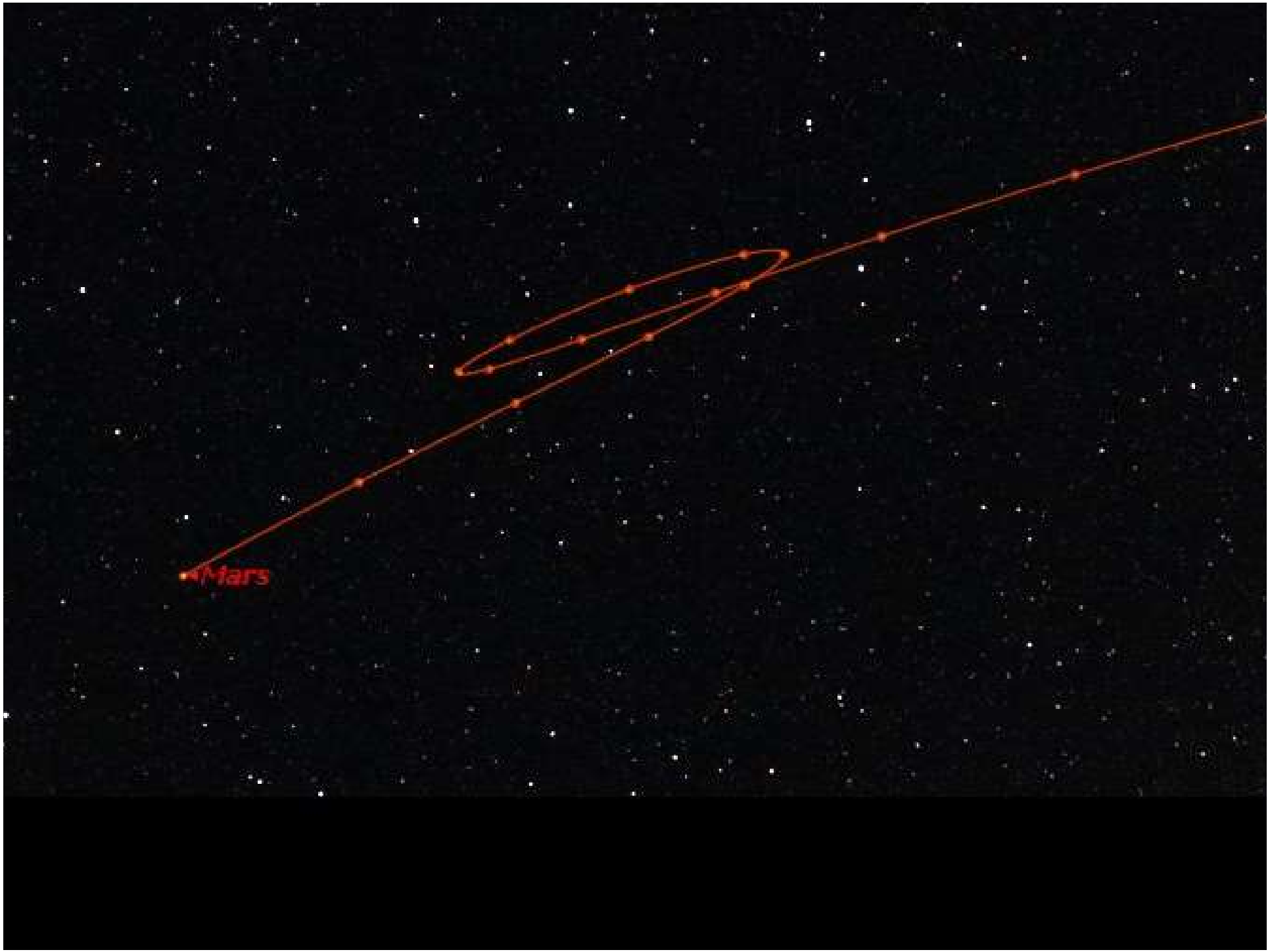


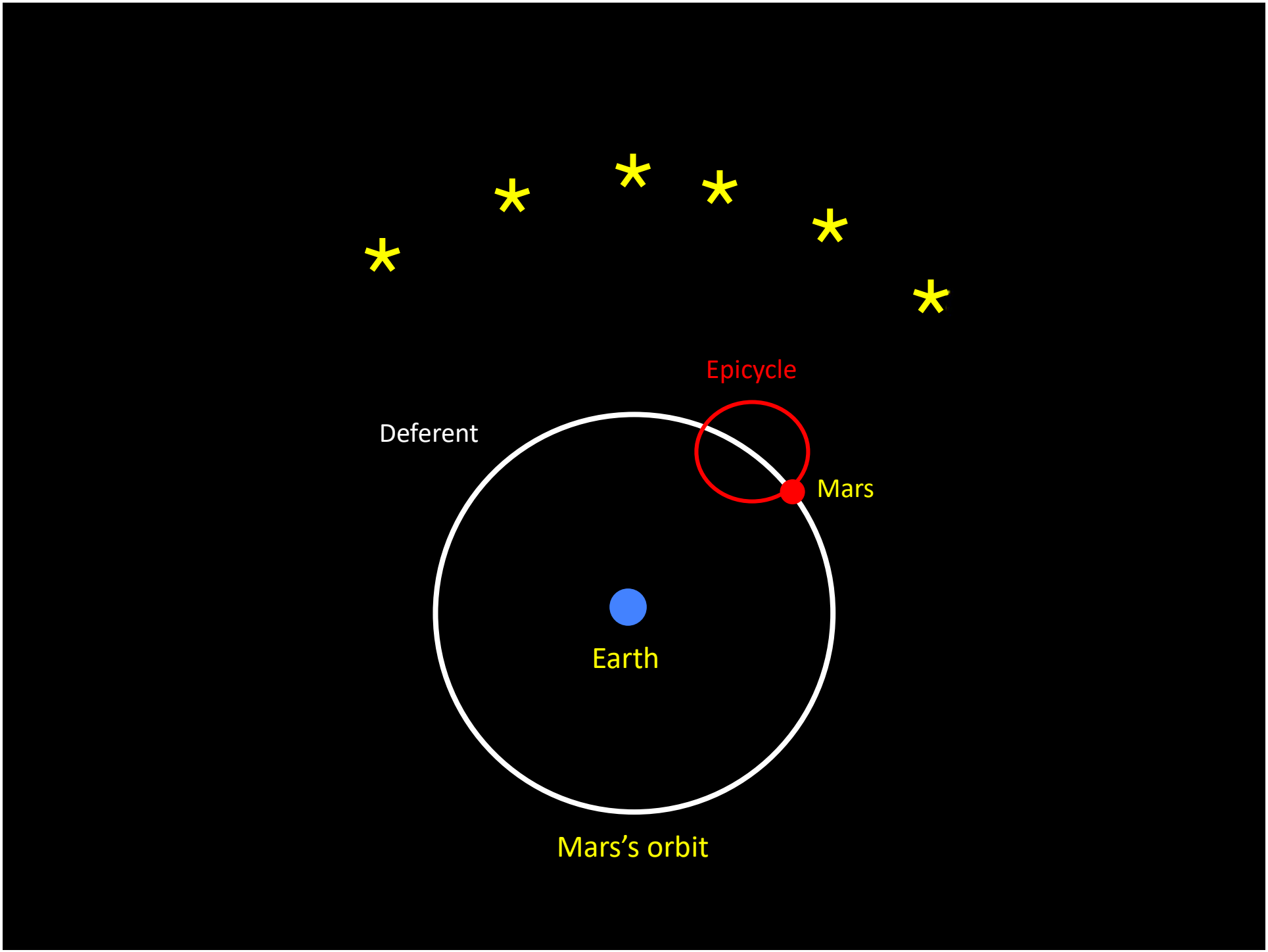



Eratosthenes c240BC
Zenith
7.2°
Zenith
Alexandria
D
Syene
Circumference = D x 360 / 7.2
= D x 50
D = 500 stadia = 500 x 157.5 metres
Therefore circumference = 39,375 Km

Hipparchus c130BC

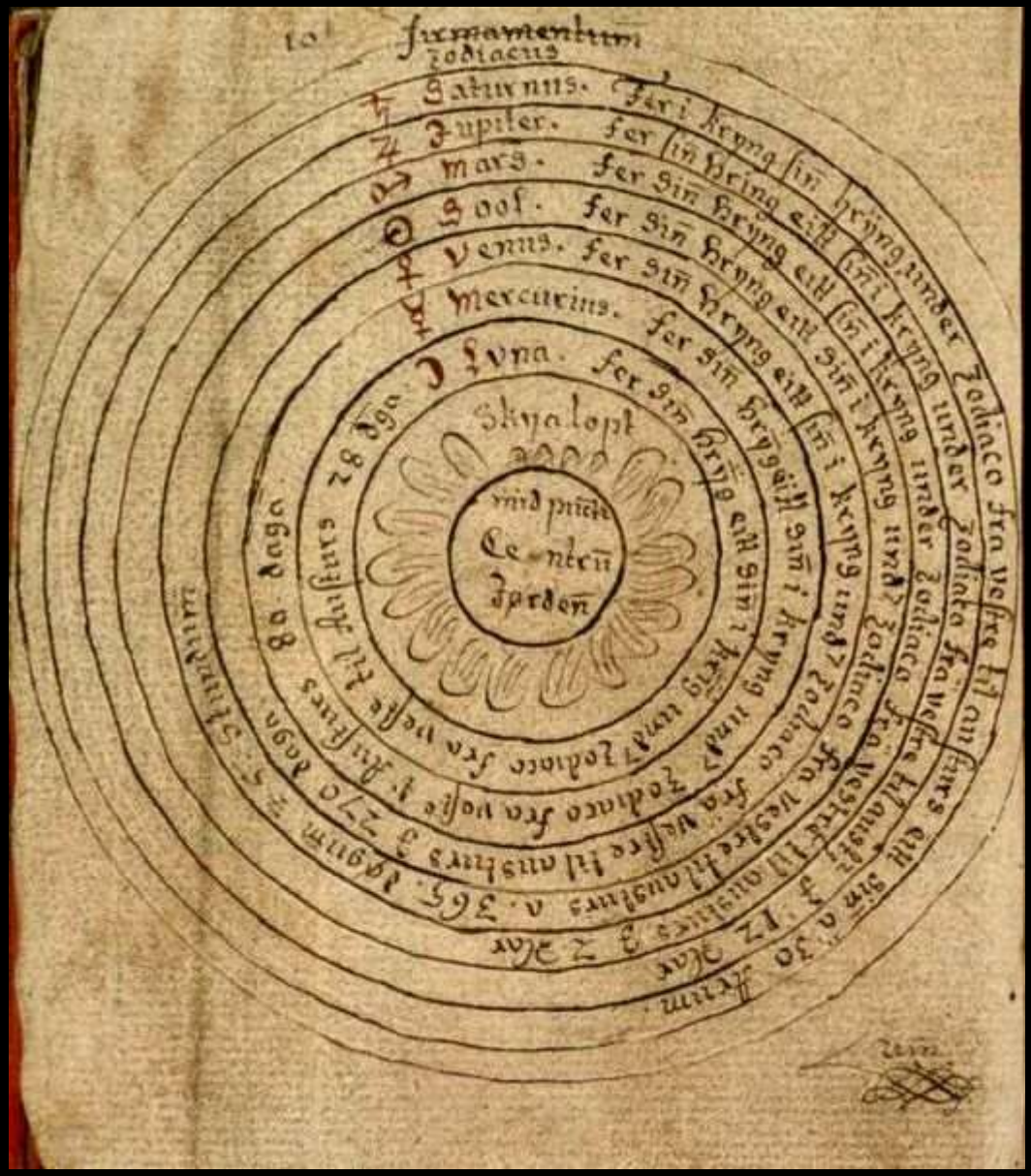
Ptolemy 140AD


Mars


Epicycle
Deferent
Mars
Earth
Mars's orbit

The Ptolemaic geocentric system

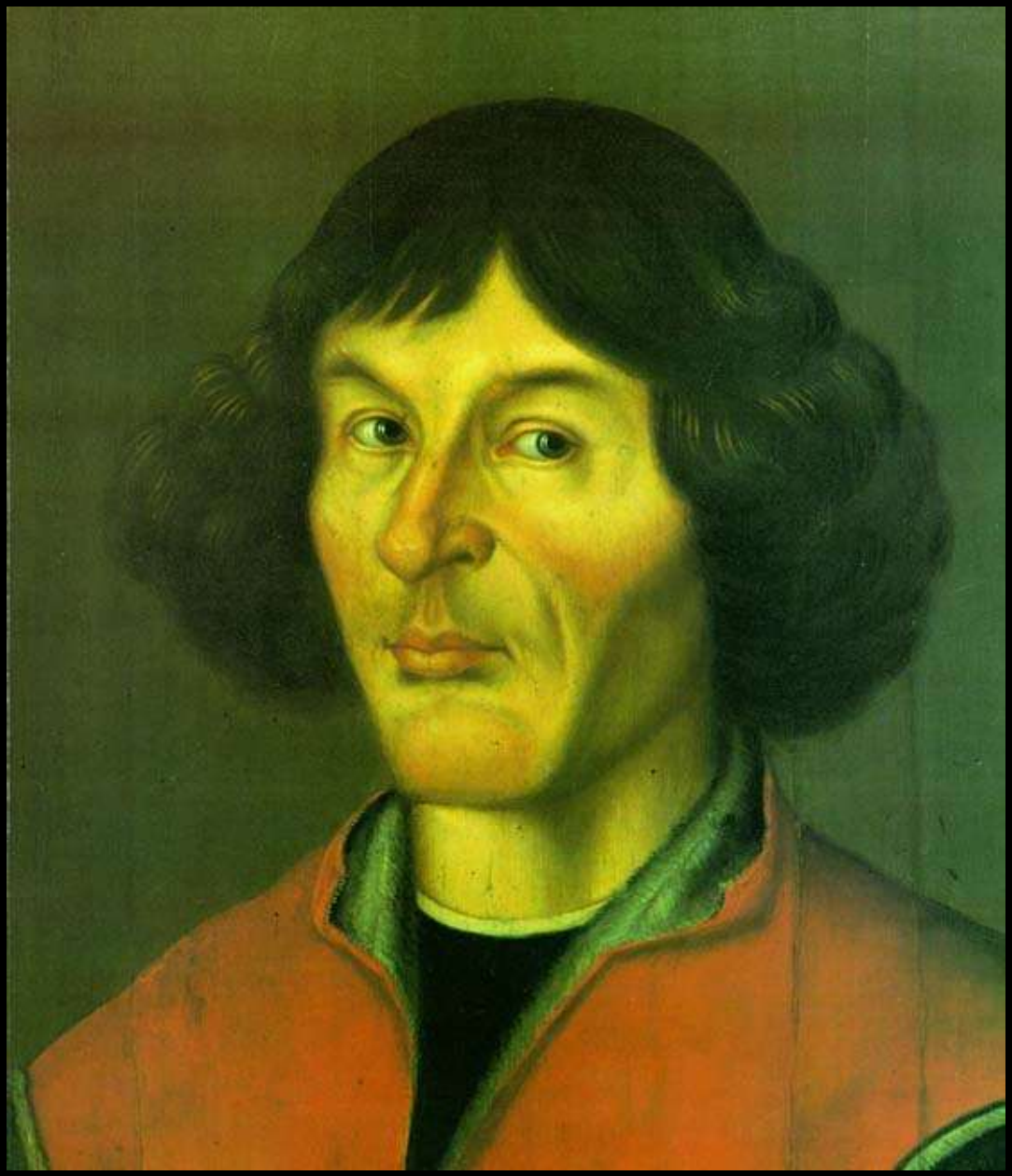
Earth
Moon
Mercury
Venus
Sun
Mars
Jupiter
Saturn
Stars

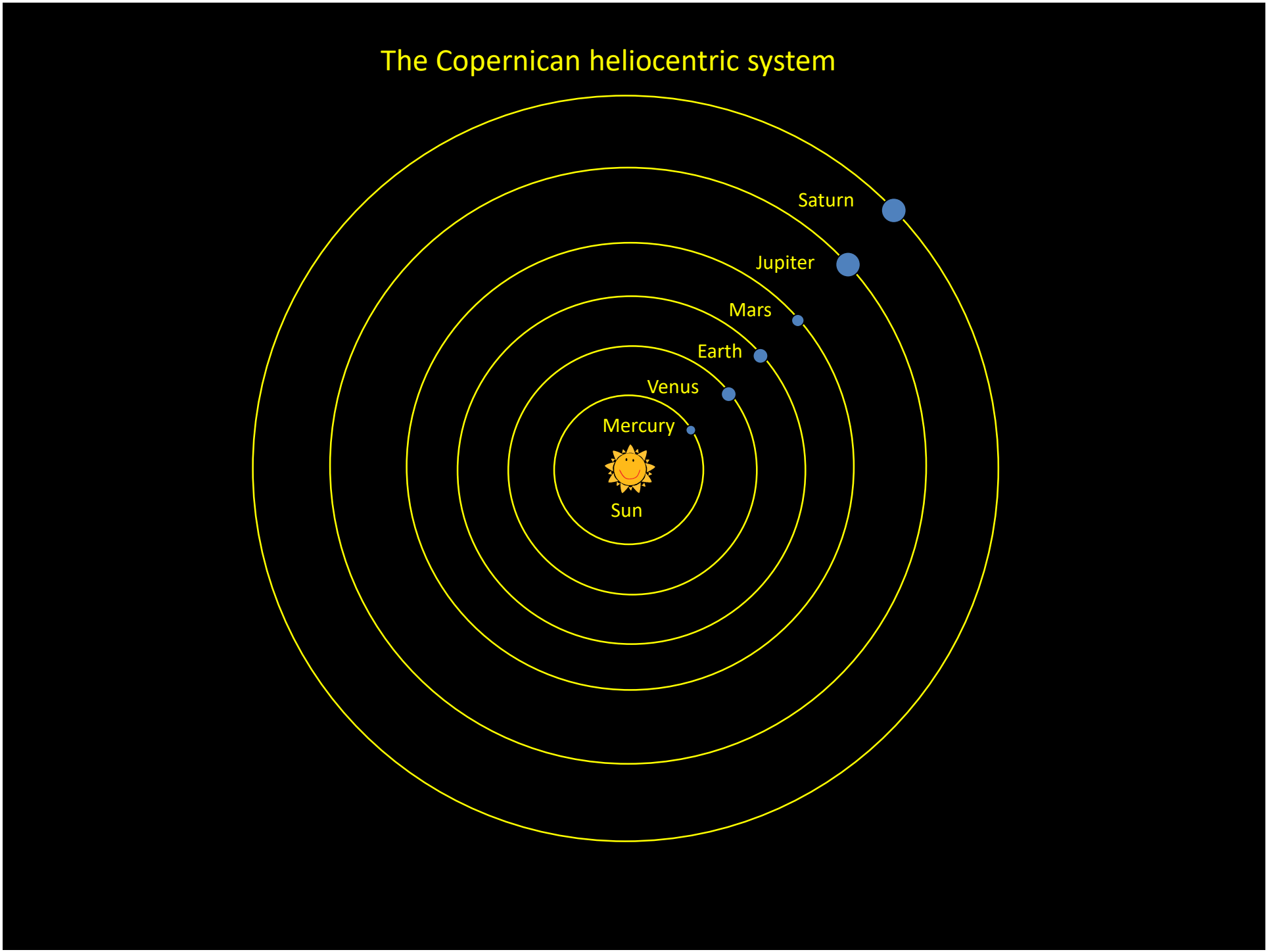


Icelandic manuscript, c1750

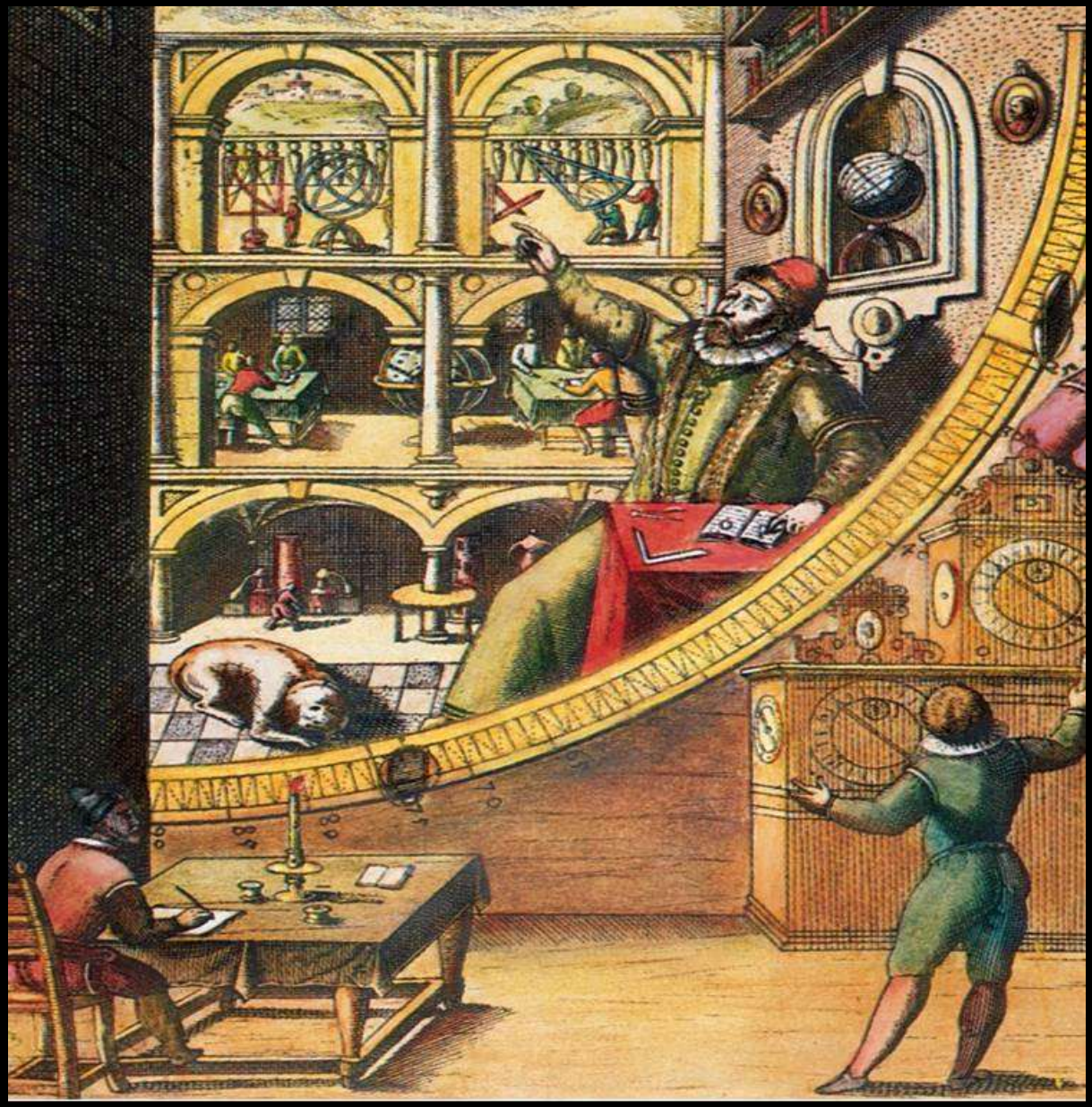

IOANNIS KEPPLERI
Mathematici Cæsarei
hanc Imaginem
ARGENTORATENSI BIBLIOTHECÆ
Consecr.
MATTHIAS BERNEGGERVS
Kal. Ianuar. Anno Chr.
M DC. XXVII
EDMVND. HALLEIVS LL.D.
GEOM. PROF. SAVIL. & R.S. SECRET.

Nicholas Copernicus (1473-1543)

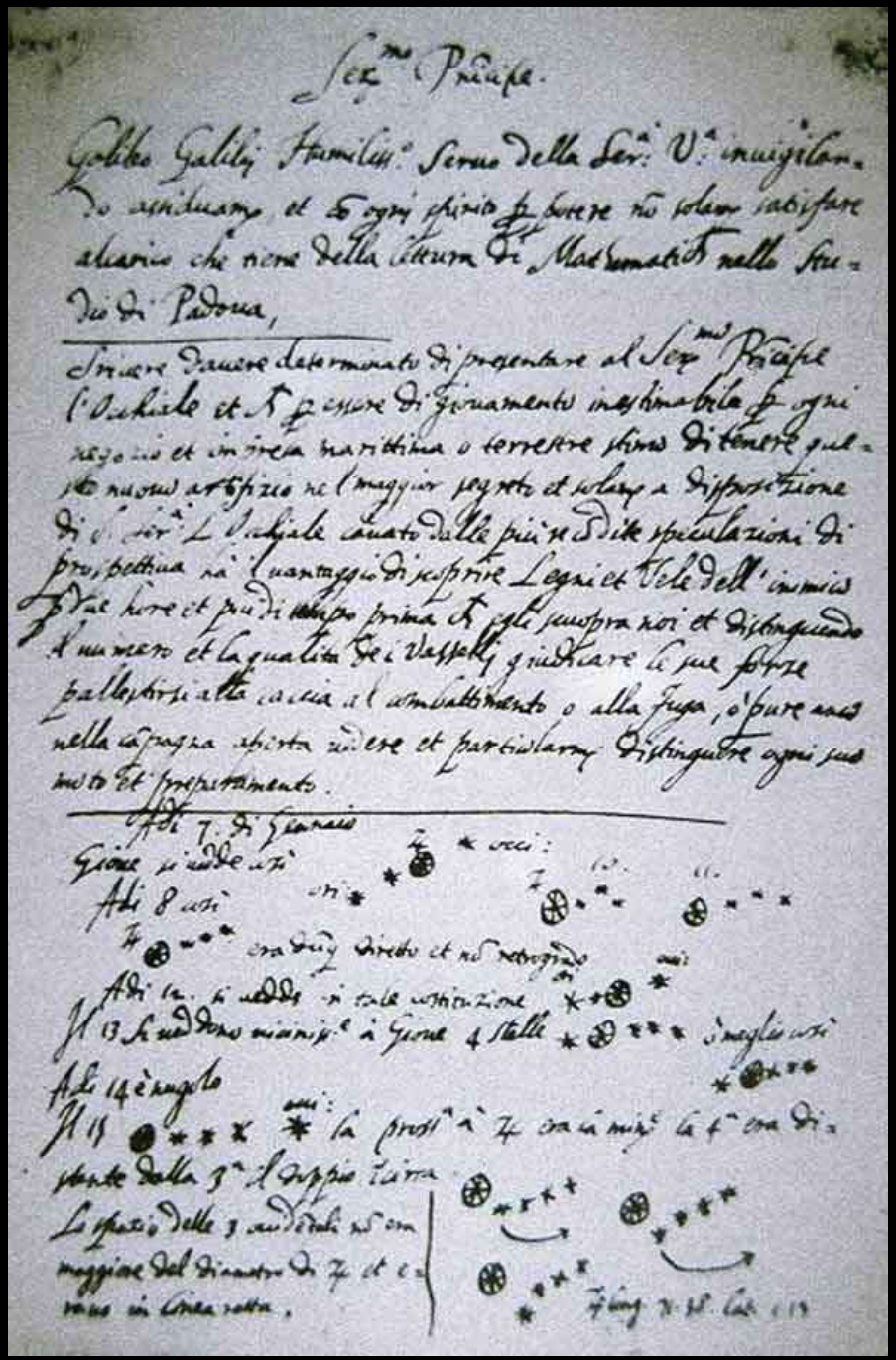



The Copernican heliocentric system
Saturn
Jupiter
Mars
Earth
Venus
Mercury
Sun

Tycho Brahe (1546 – 1601)



Galileo Galilei (1564 – 1642)



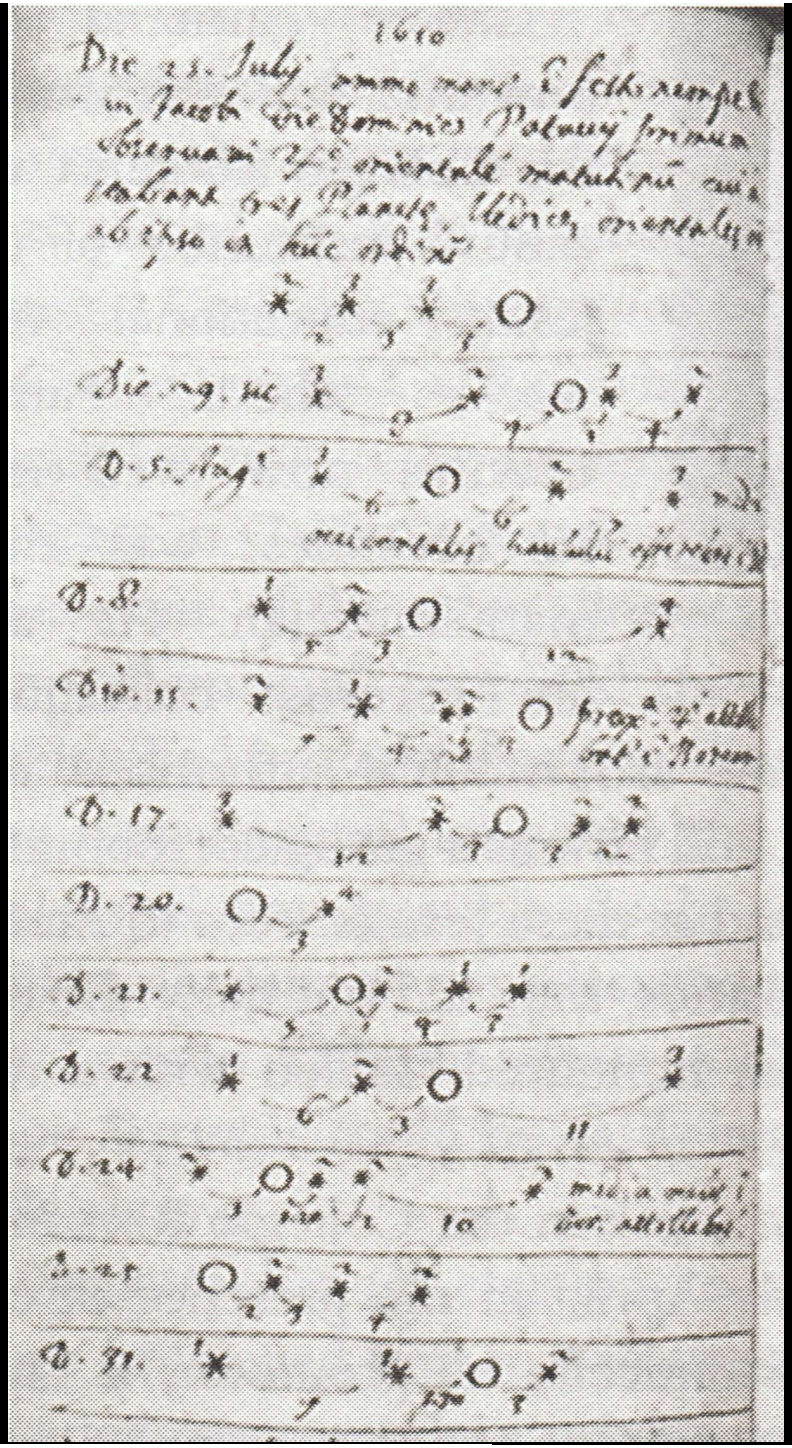
Sen^mo Prencipe.

Galileo Galilei Fiorentino Servo della Ser^a V. inuigilan-
do assiduamente et di ogni spirito si brama non solam sadisfare
alcuno che riceve della Lettura di Mathematica nello Stu-
dio di Padoua,

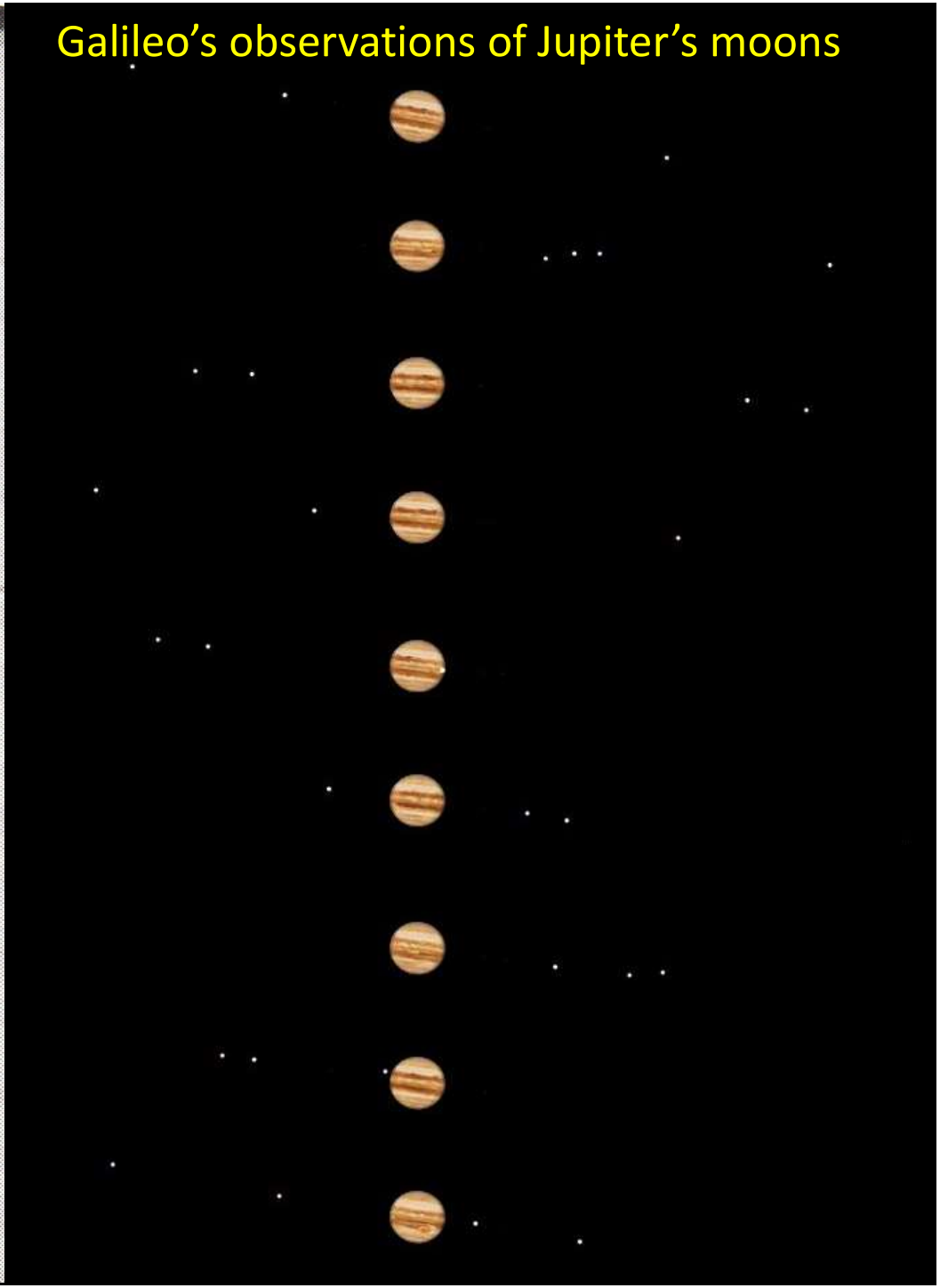
stimare douere determinato di presentare al Ser^mo Prencipe
l'Occhiale et di esso di giornamento inestimabile in ogni
negotio et impresa marittima o terrestre stimo di tenere qual-
sia nuouo artificio nel maggior segreto et solam a disposizione
di V. Ser^a L'Occhiale cauato dalle più recondite speculazioni di
prospettiua hà l'vantaggio di scoprire Legni et Vele dell'inimico
due hore et più di camino prima che quelle giungano noi et distinguendo
il numero et la qualità de i Vasselli giudicare le sue forze
potendosi ritirare alla caccia al combattimento o alla fuga, o pure assa-
nella campagna aperta vedere et particolarm^te distinguere ogni suo
moto et preparamento.

Adi 7. di Genaro
Giove si vedde così
Adi 8 così
Adi 13 si vedde in tale costituzione
Adi 14 è angolo
la prossima à ♃ era à mezza la 4ta era di-
stante dalla 3za il doppio minore
Lo spatio delle 3 vedette non è
maggiore del diametro di ♃ et e-
rano in linea retta.

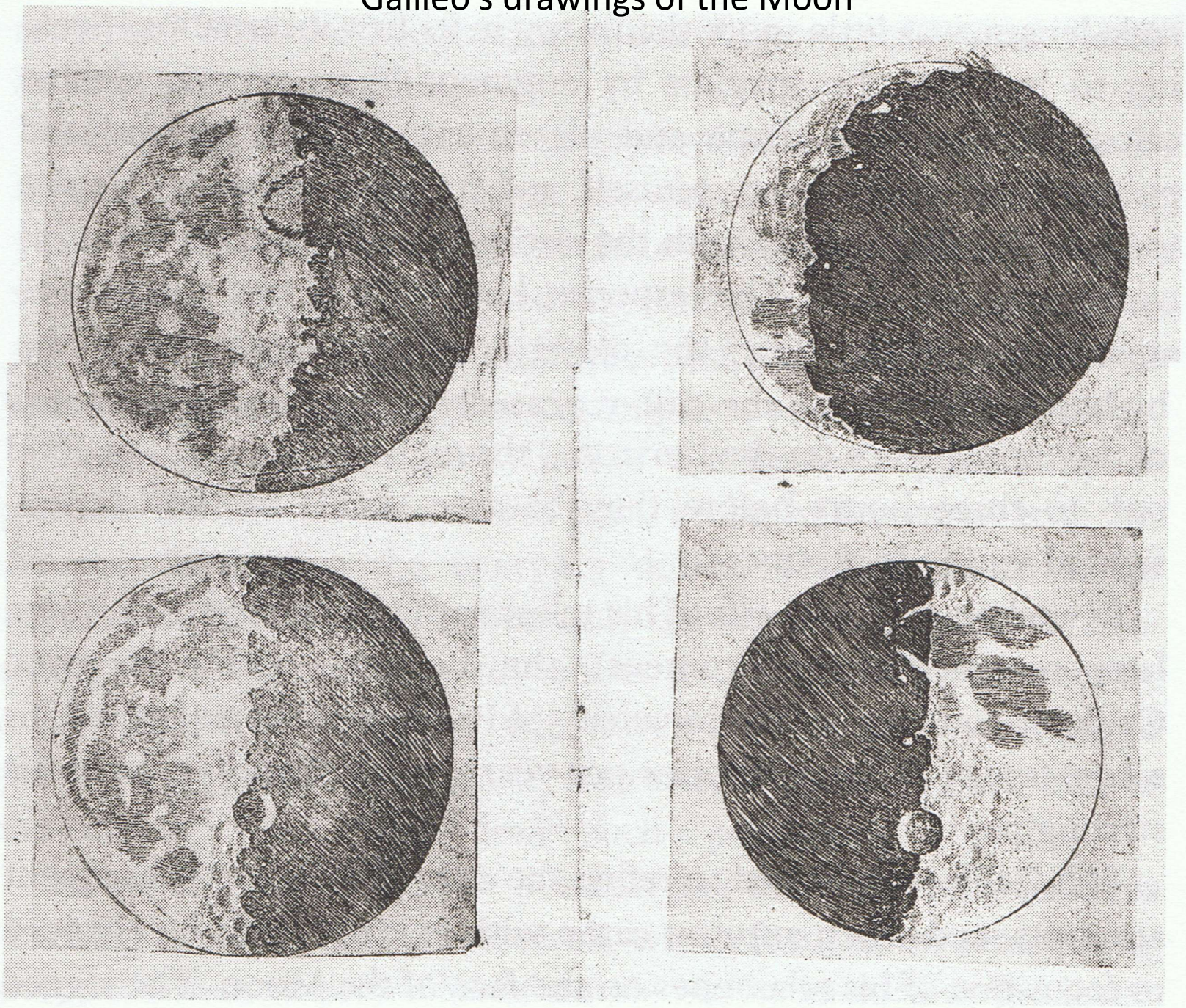
Galileo's telescope
and observations of Jupiter's moons



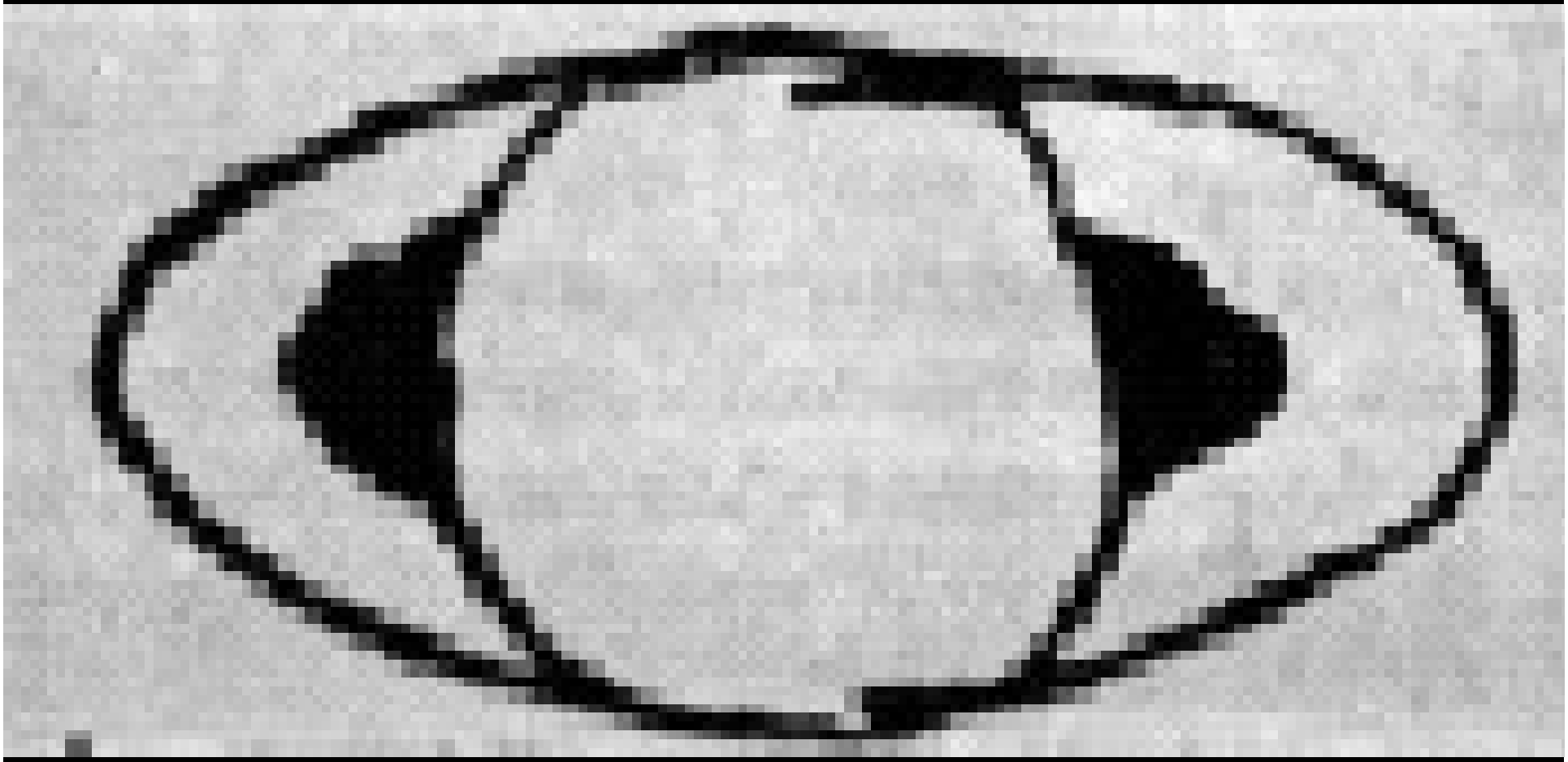
Galileo’s observations of Jupiter’s moons

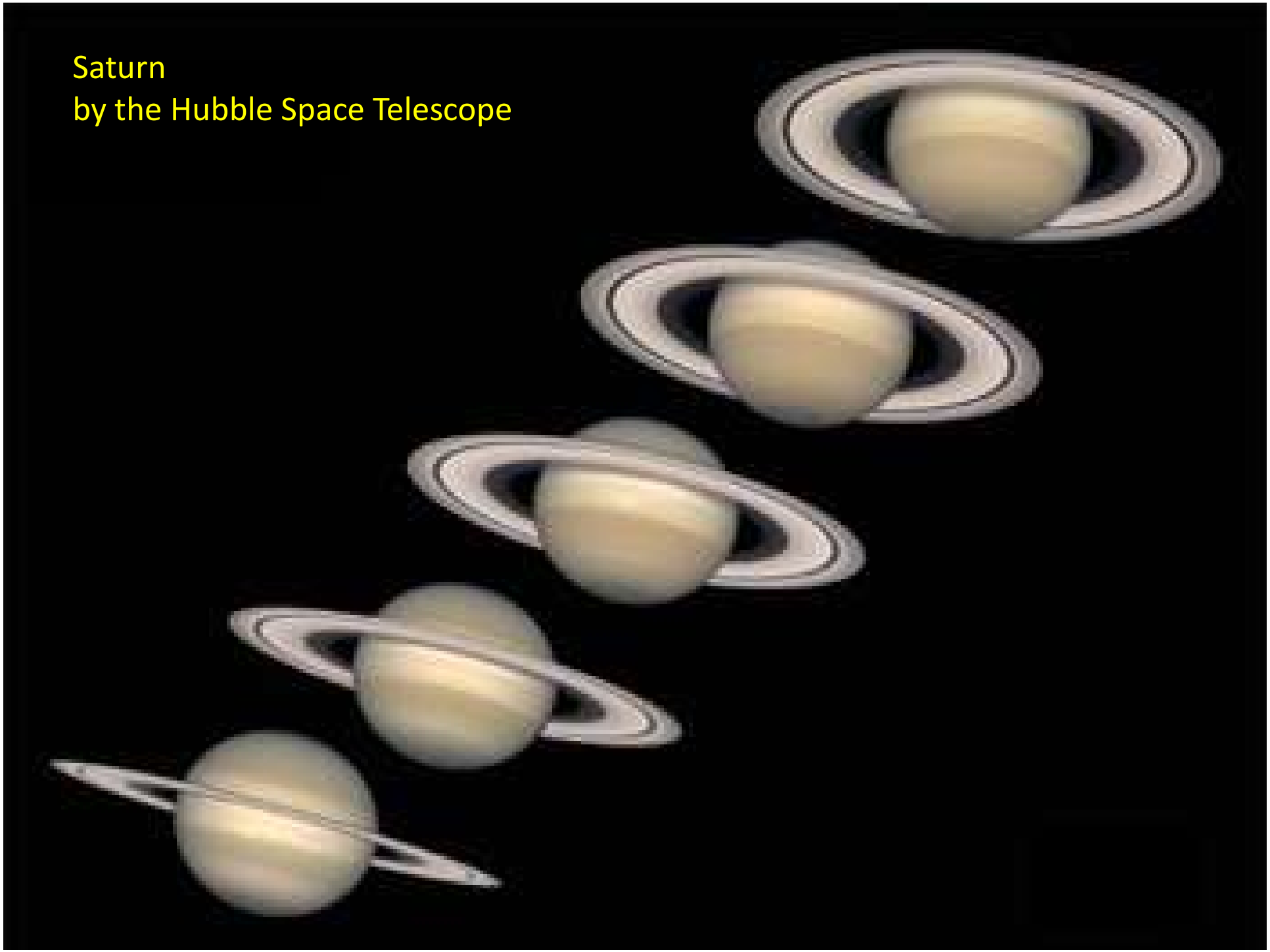


Galileo's drawings of the Moon

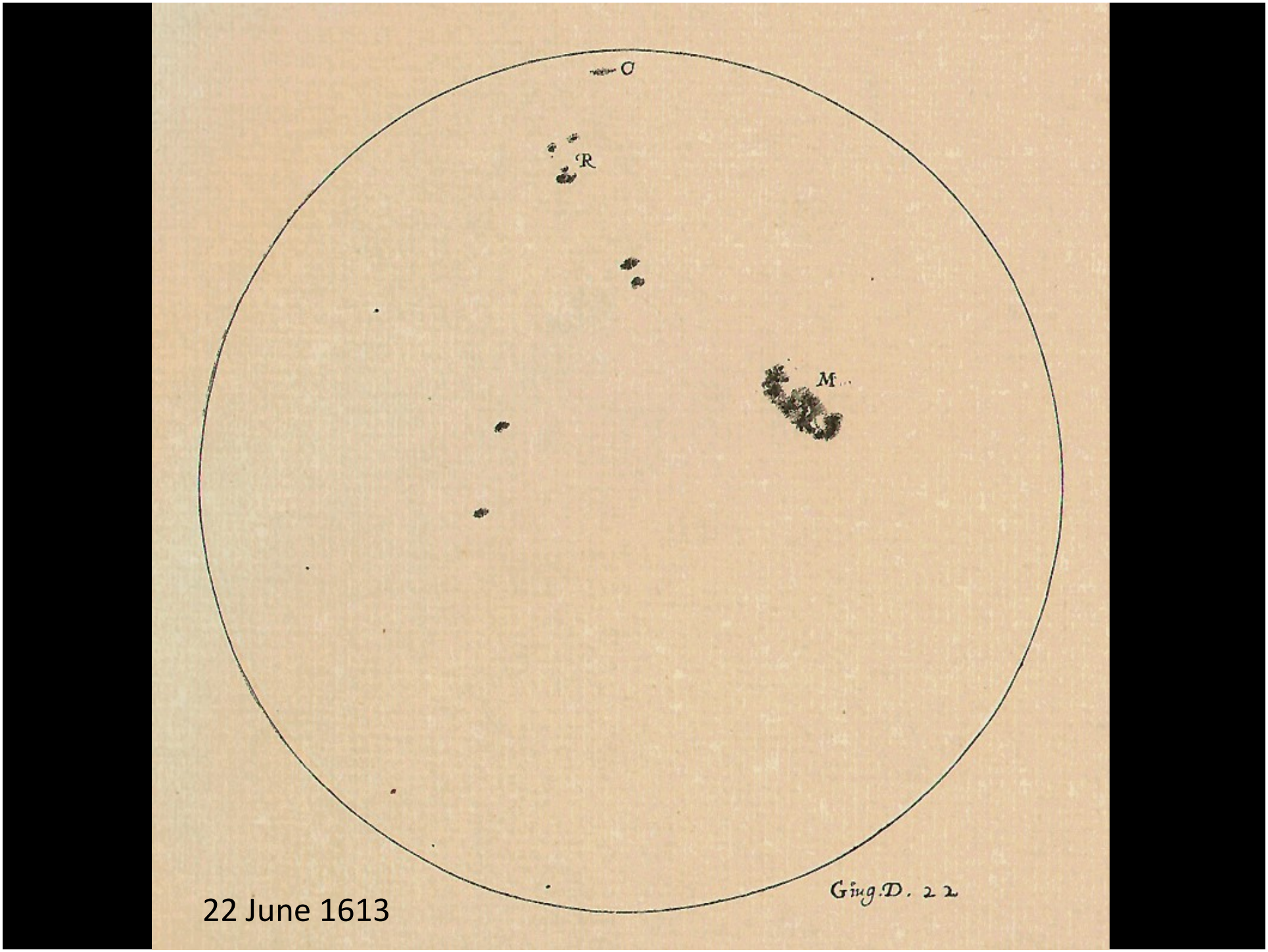


Galileo’s drawings of Saturn

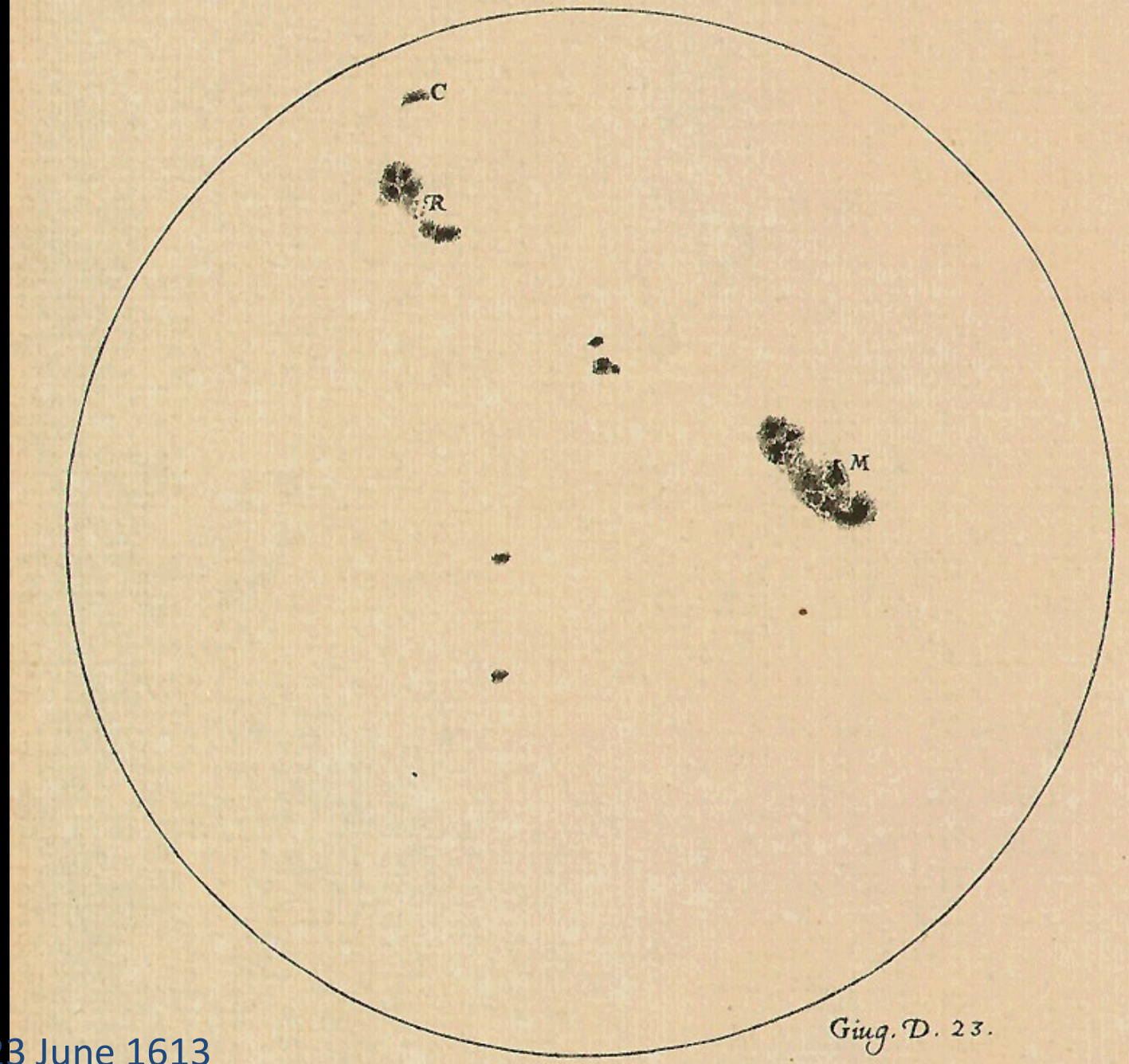



Saturn
by the Hubble Space Telescope

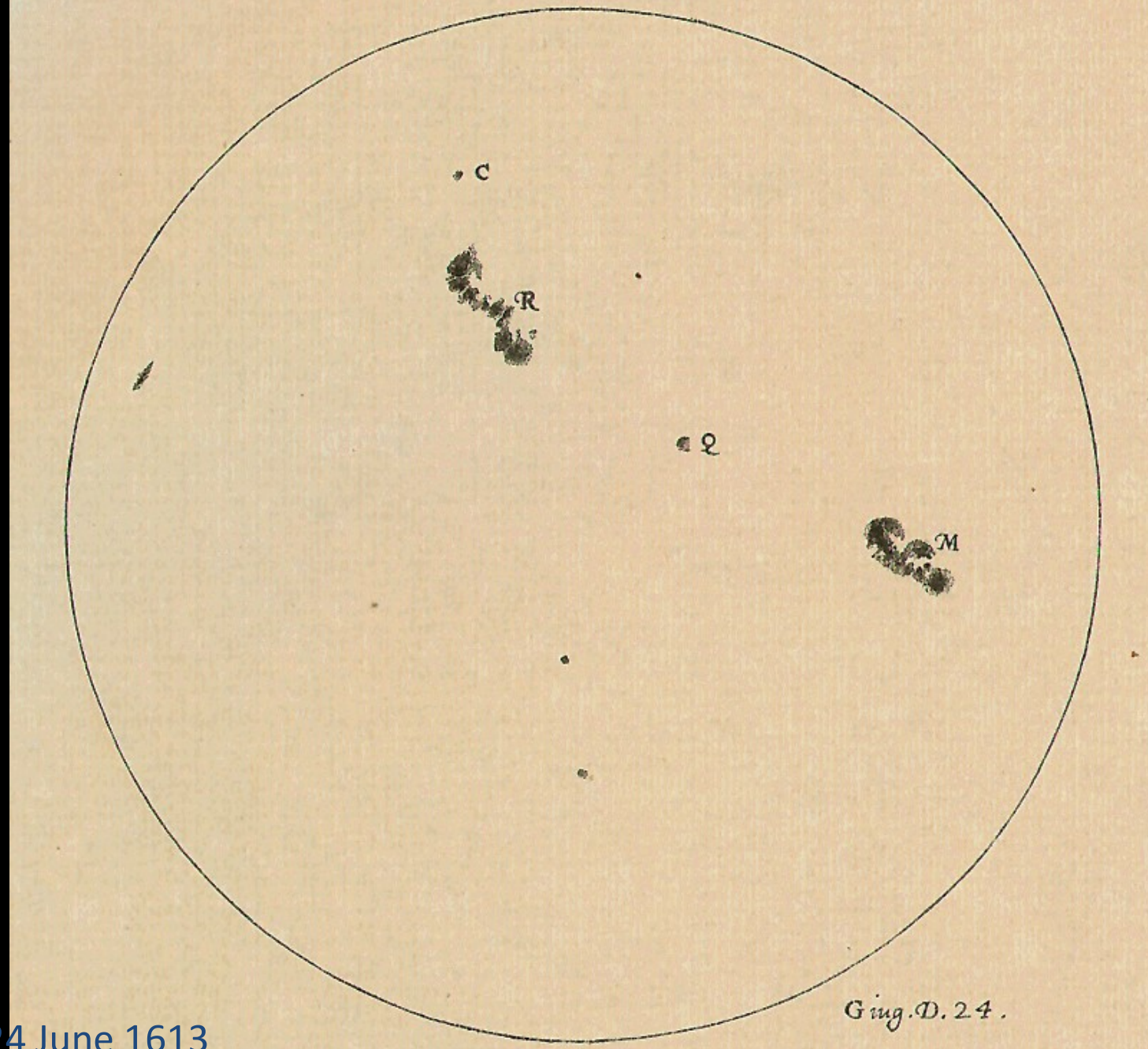

27/2/04
17/3/04
22/3/04
27/3/04
3/4/04
13/4/04
1/5/04
7/5/04
11/5/04
16/5/04
19/5/04
25/5/04
30/5/04
8/6/04



22 June 1613



23 June 1613



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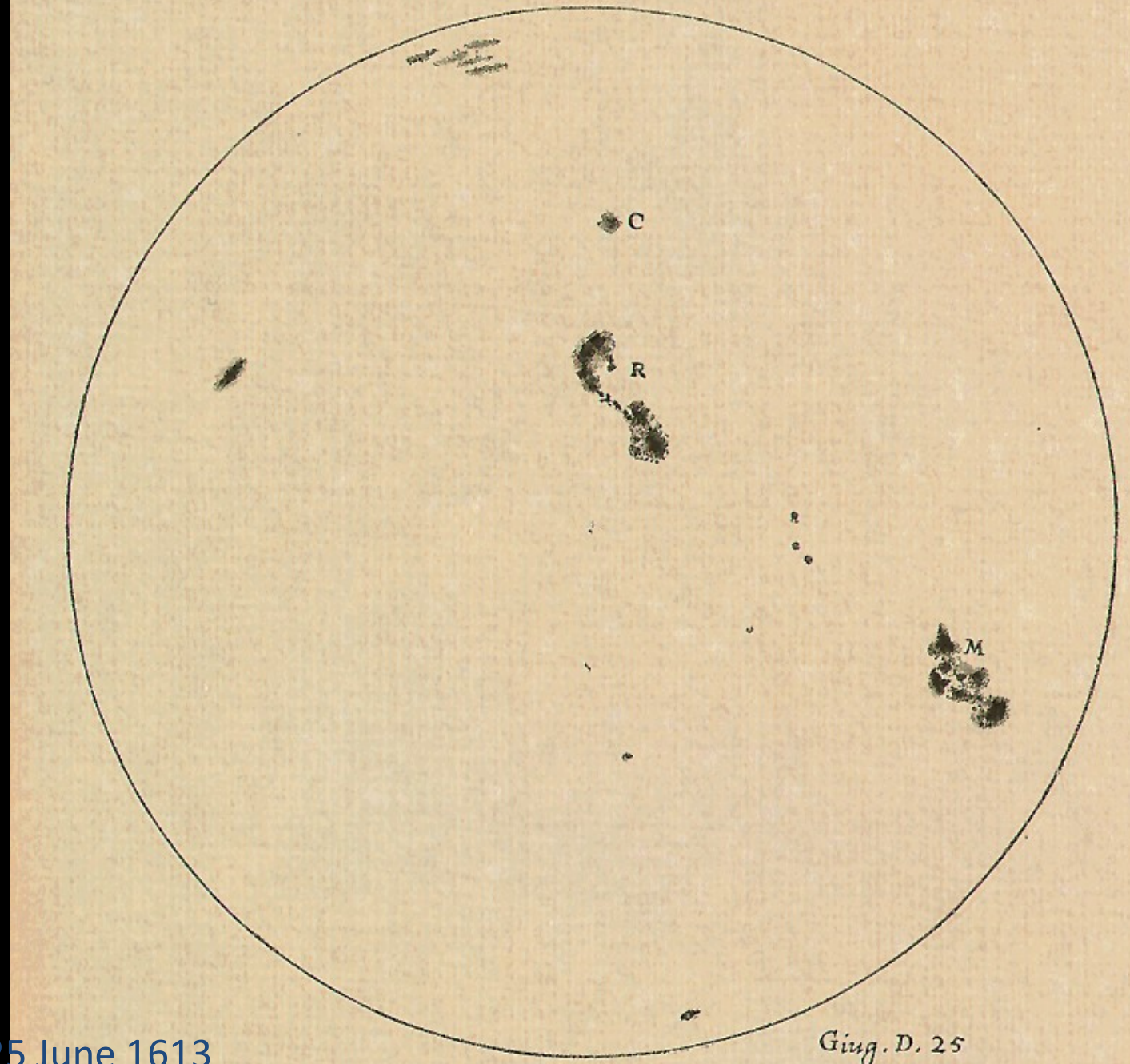
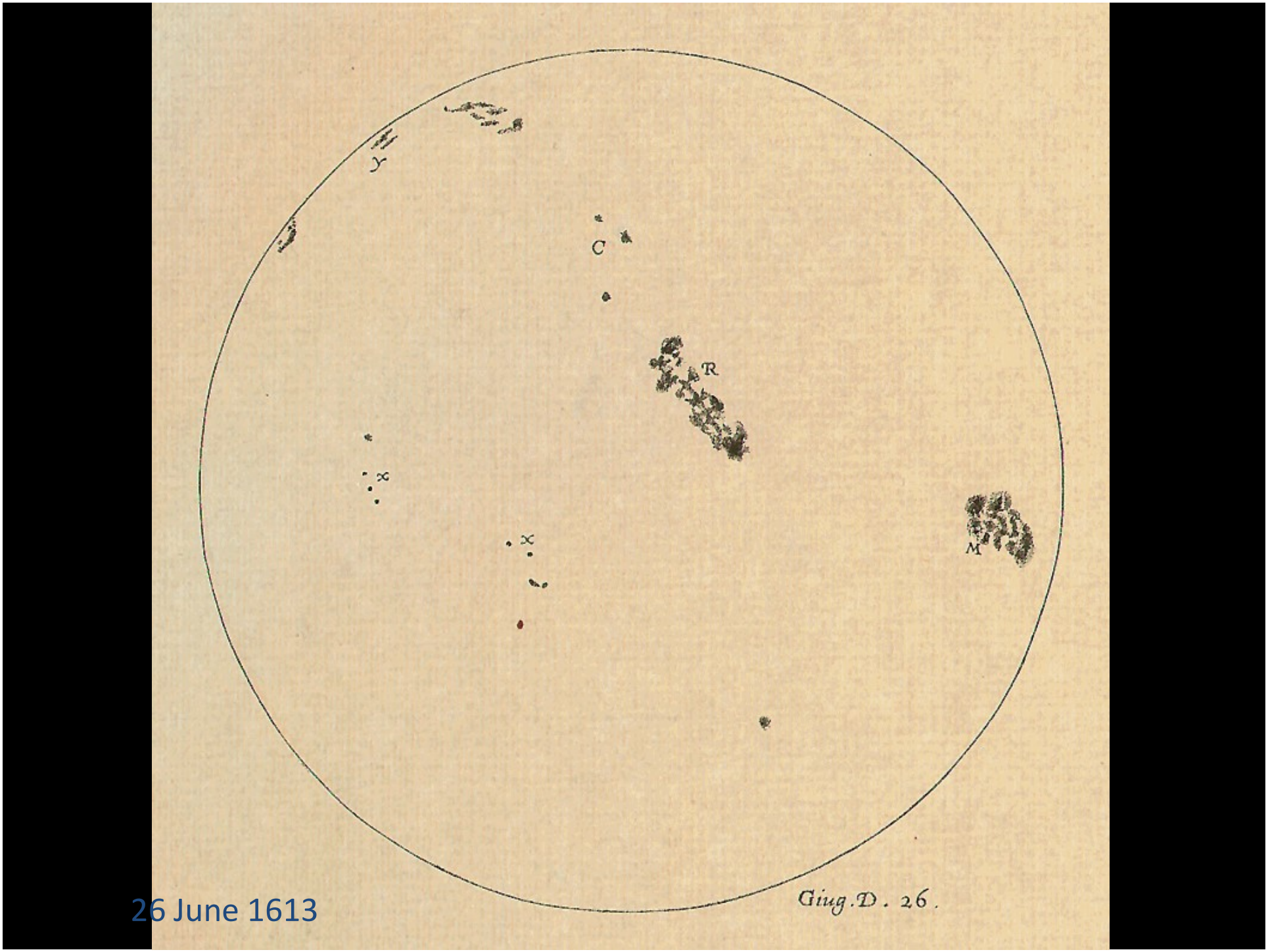
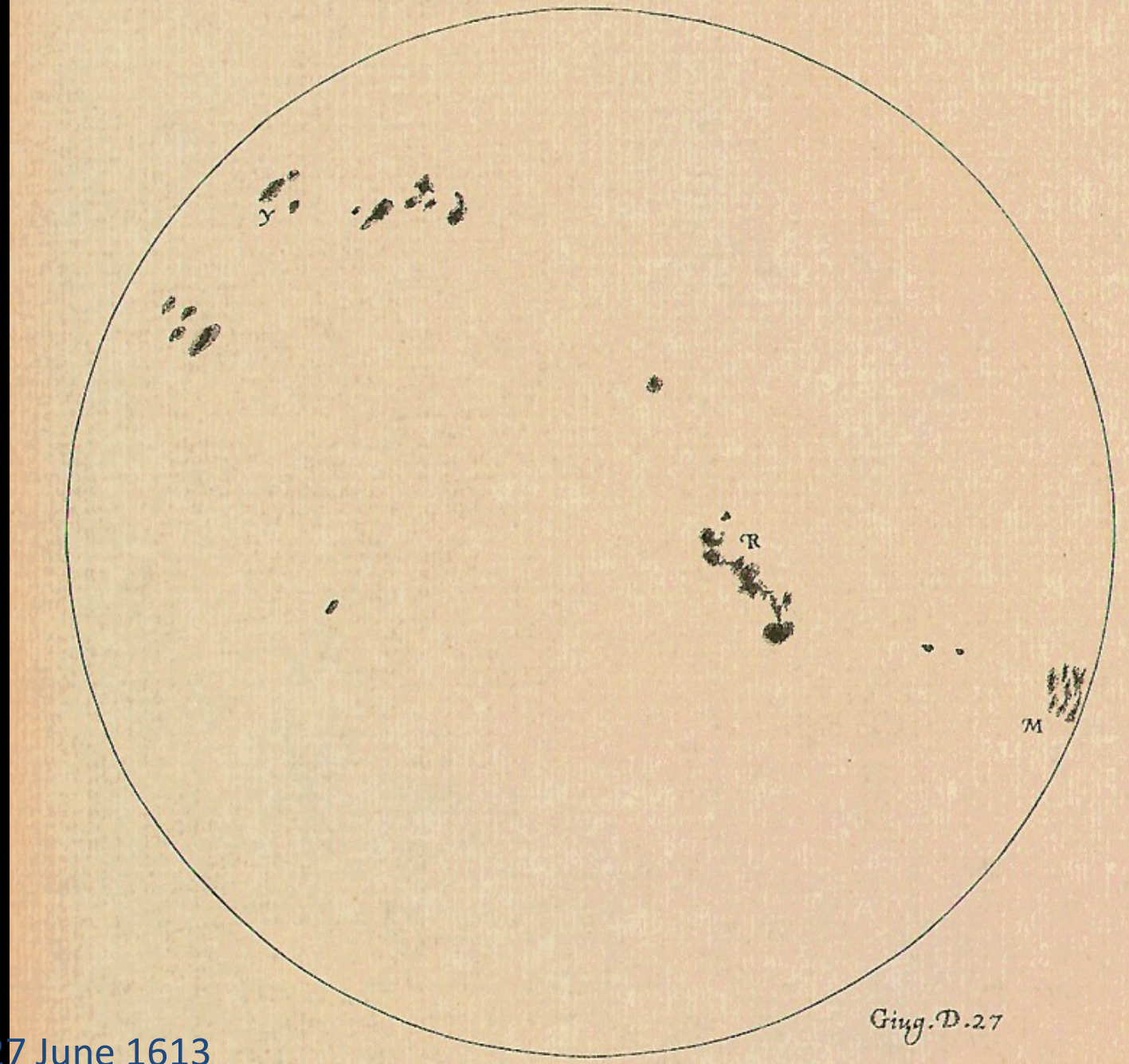


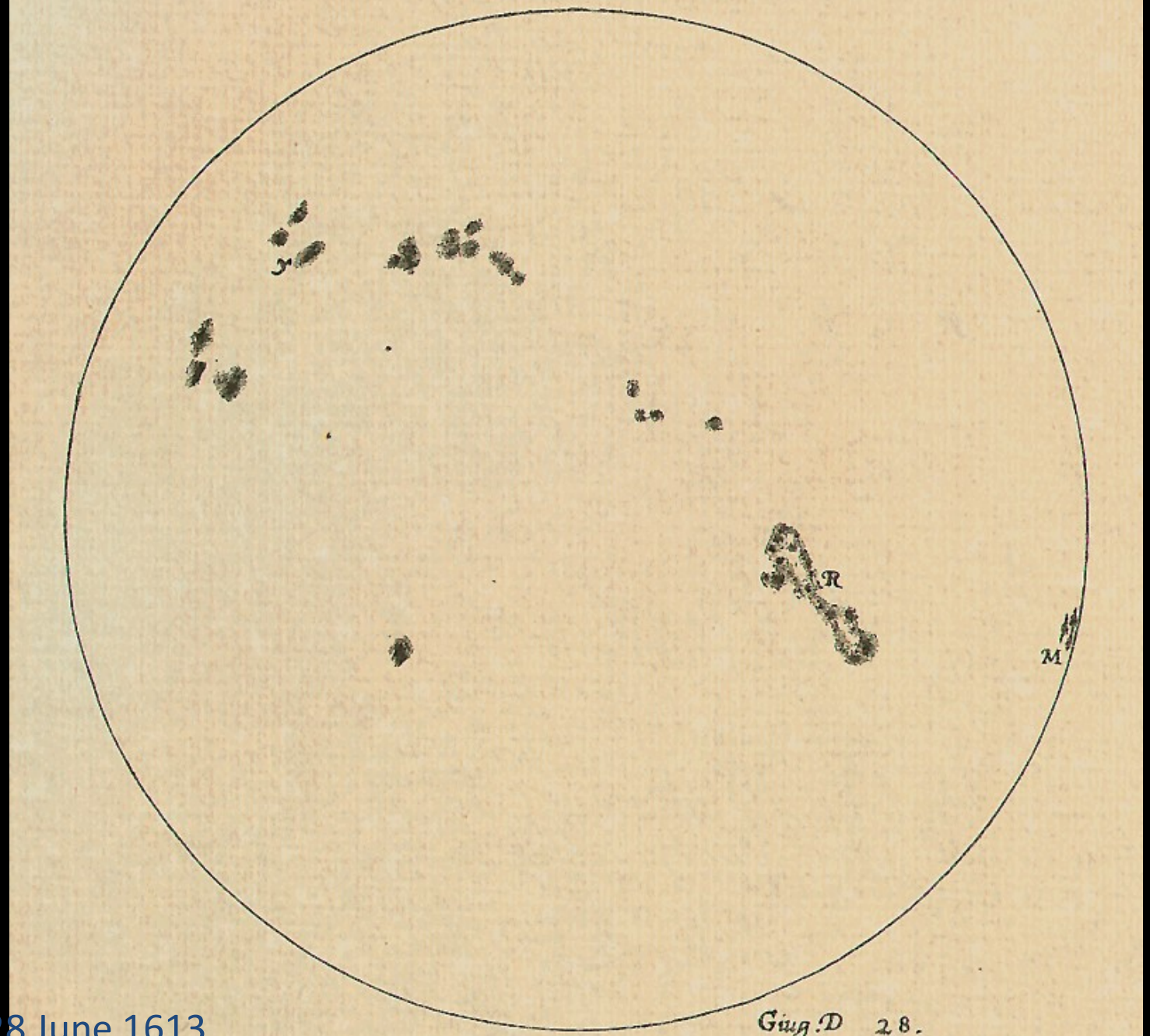
25 June 1613



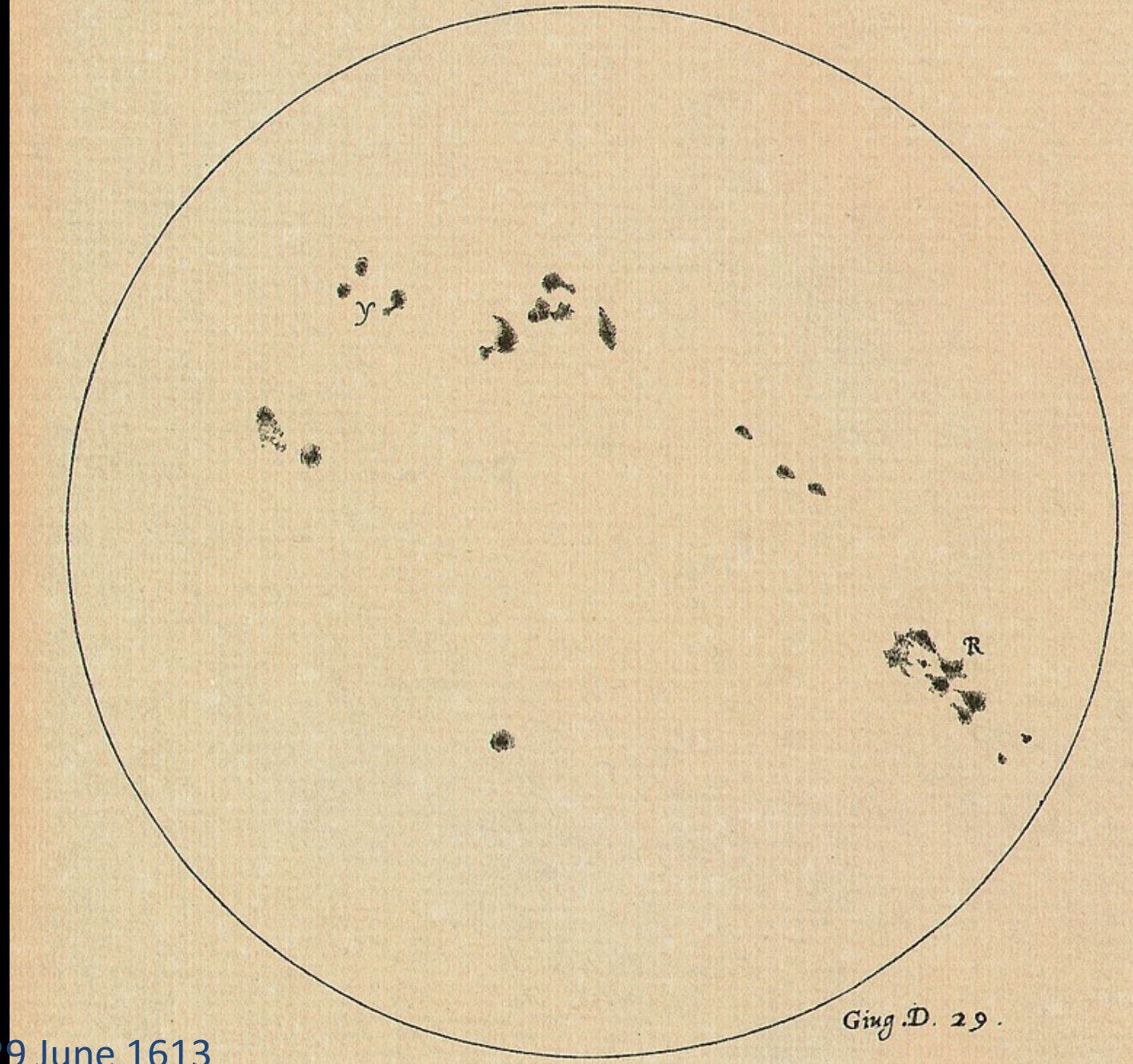
26 June 1613



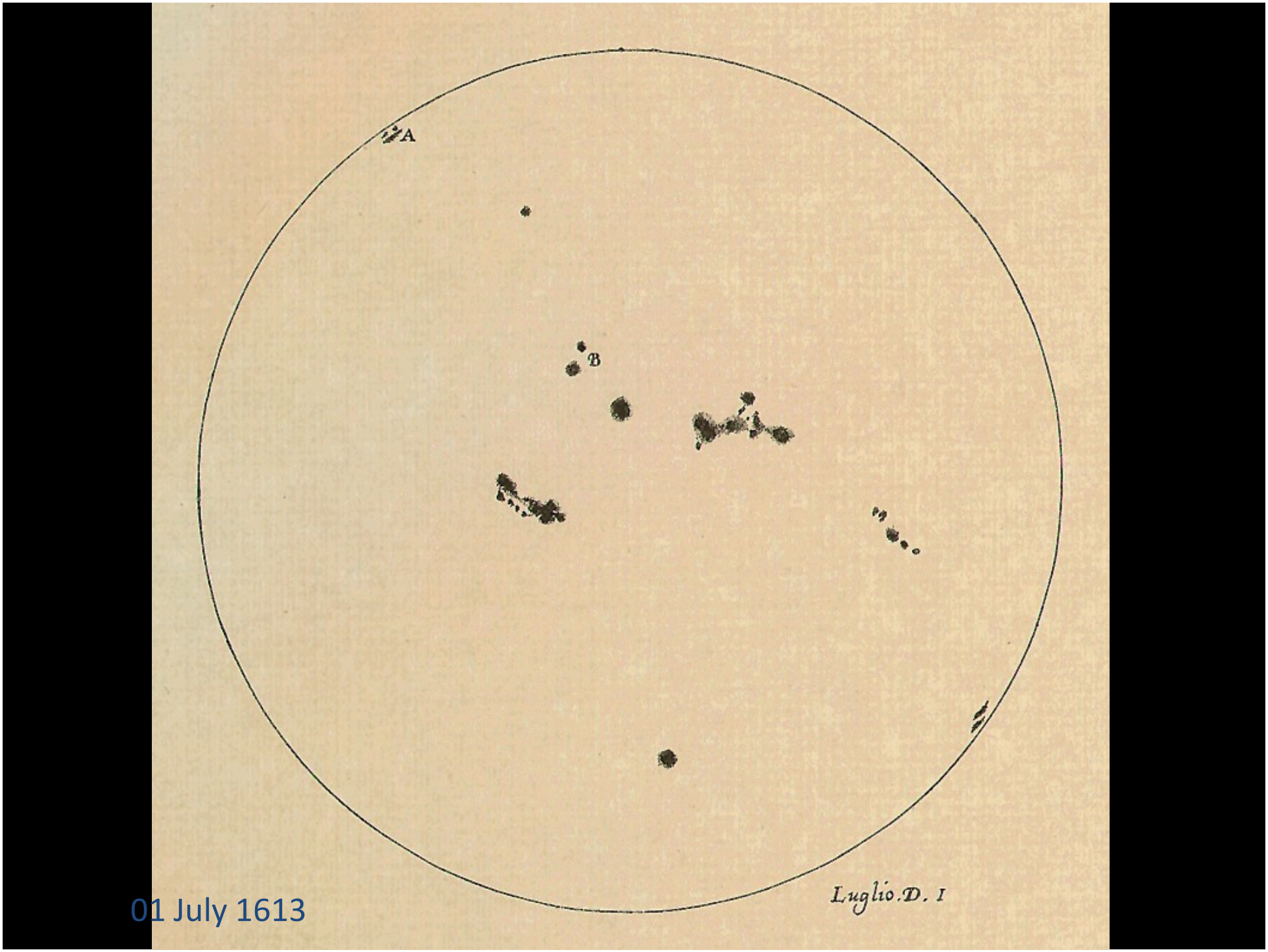
27 June 1613



28 June 1613



29 June 1613



01 July 1613

DIALOGO
DI
GALILEO GALILEI LINCEO
MATEMATICO SOPRAORDINARIO
DELLO STVDIO DI PISA.
E Filosofo, e Matematico primario del
SERENISSIMO
GR. DVCA DI TOSCANA.

Doue ne i congressi di quattro giornate si discorre sopra i due

MASSIMI SISTEMI DEL MONDO
TOLEMAICO, E COPERNICANO;

Proponendo indeterminatamente le ragioni Filosofiche, e Naturali tanto per l'vna, quanto per l'altra parte.

CON PRI VILEGI.

IN FIORENZA, Per Gio: Batista Landini MDCXXXII.

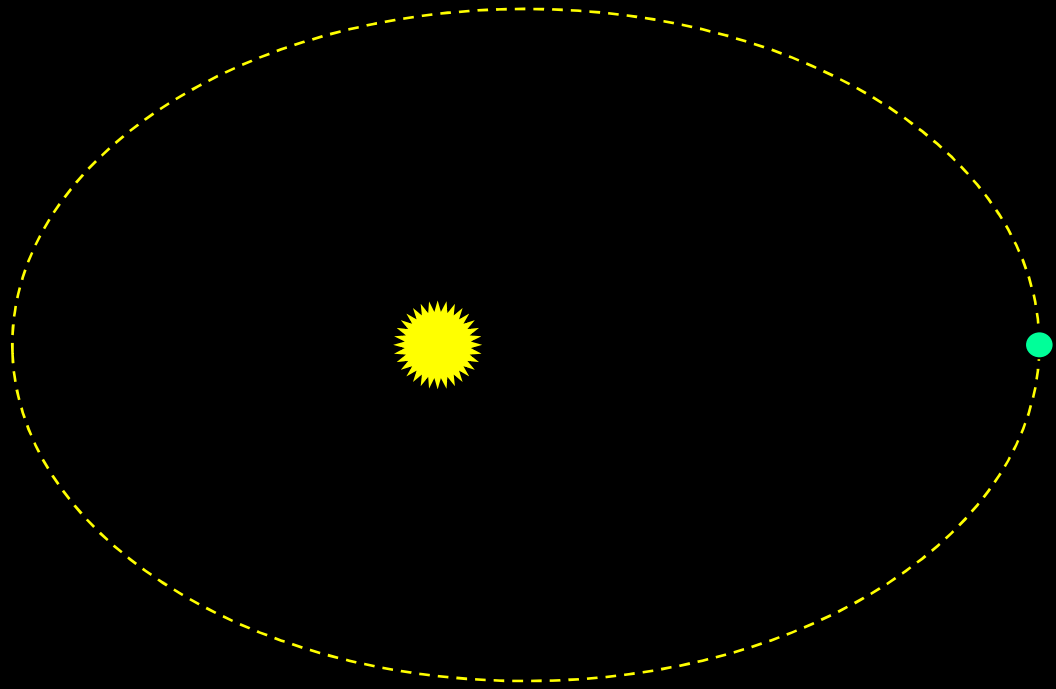
CON LICENZA DE' SVPERIORI.

Dialogue Concerning the Two Chief World Systems (1632)

Galileo facing the Roman Inquisition by Cristiano Banti (1857)

Johannes Kepler (1571 – 1630)

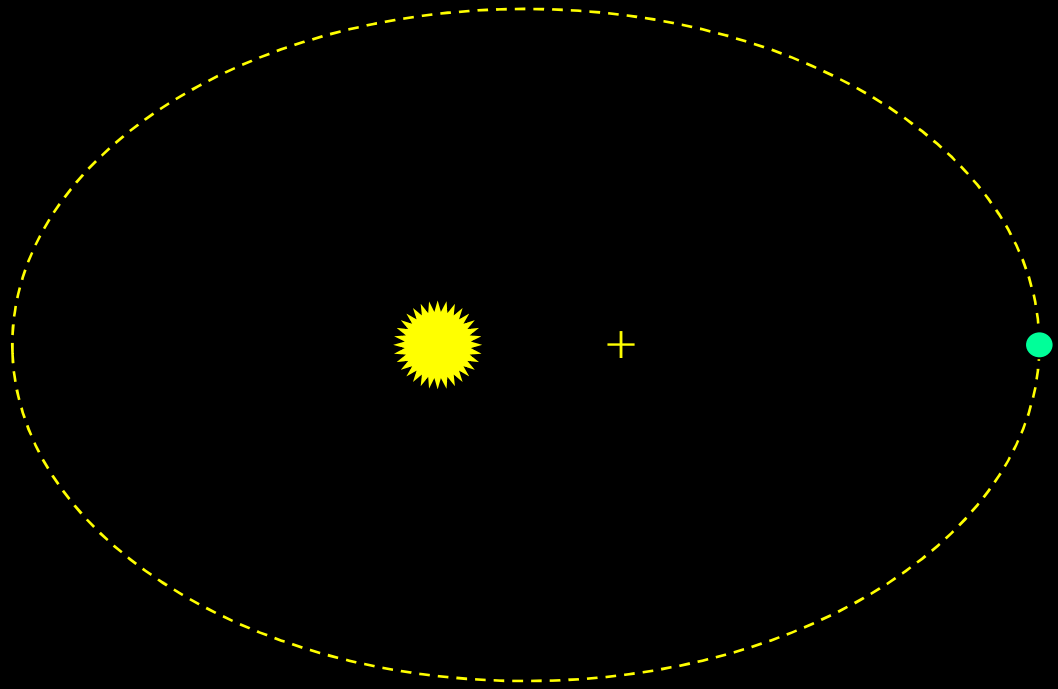
Kepler's Laws Of Planetary Motion



David Le Conte

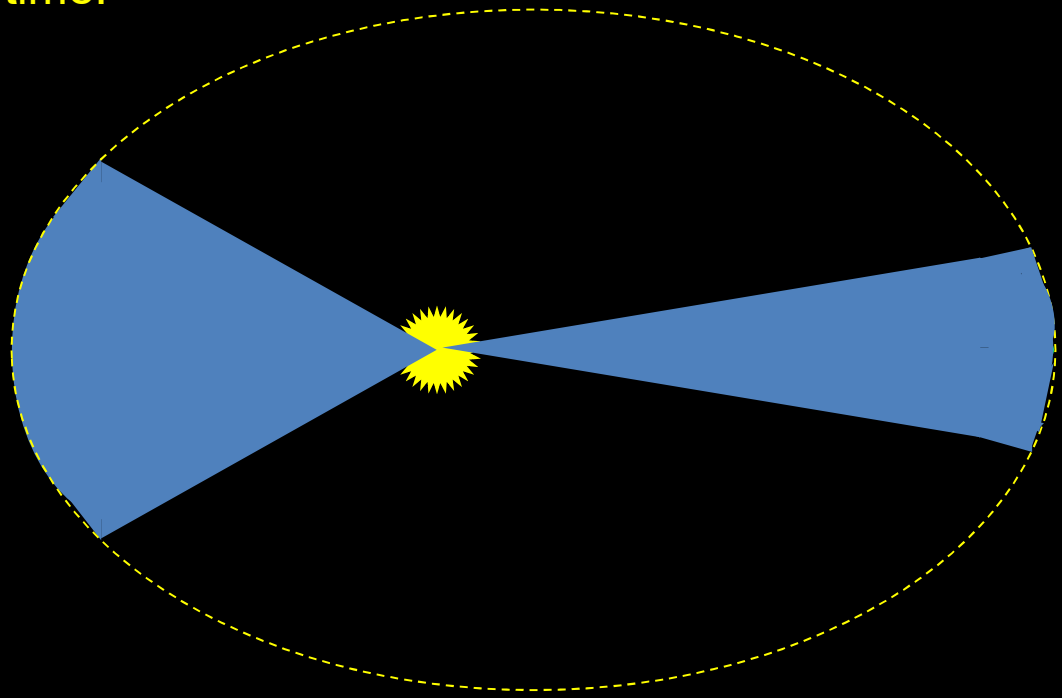
LAW 1:

The orbit of a planet about the Sun is an ellipse with the Sun's centre of mass at one focus.



LAW 2:

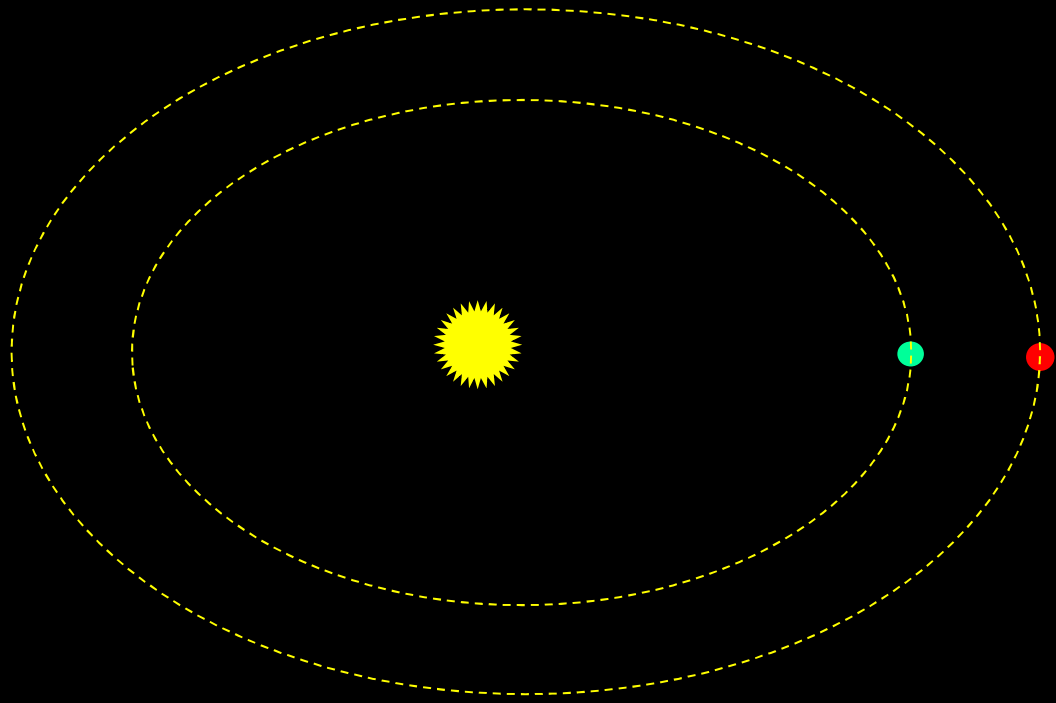
A line joining a planet and the Sun sweeps out equal areas in equal intervals of time.

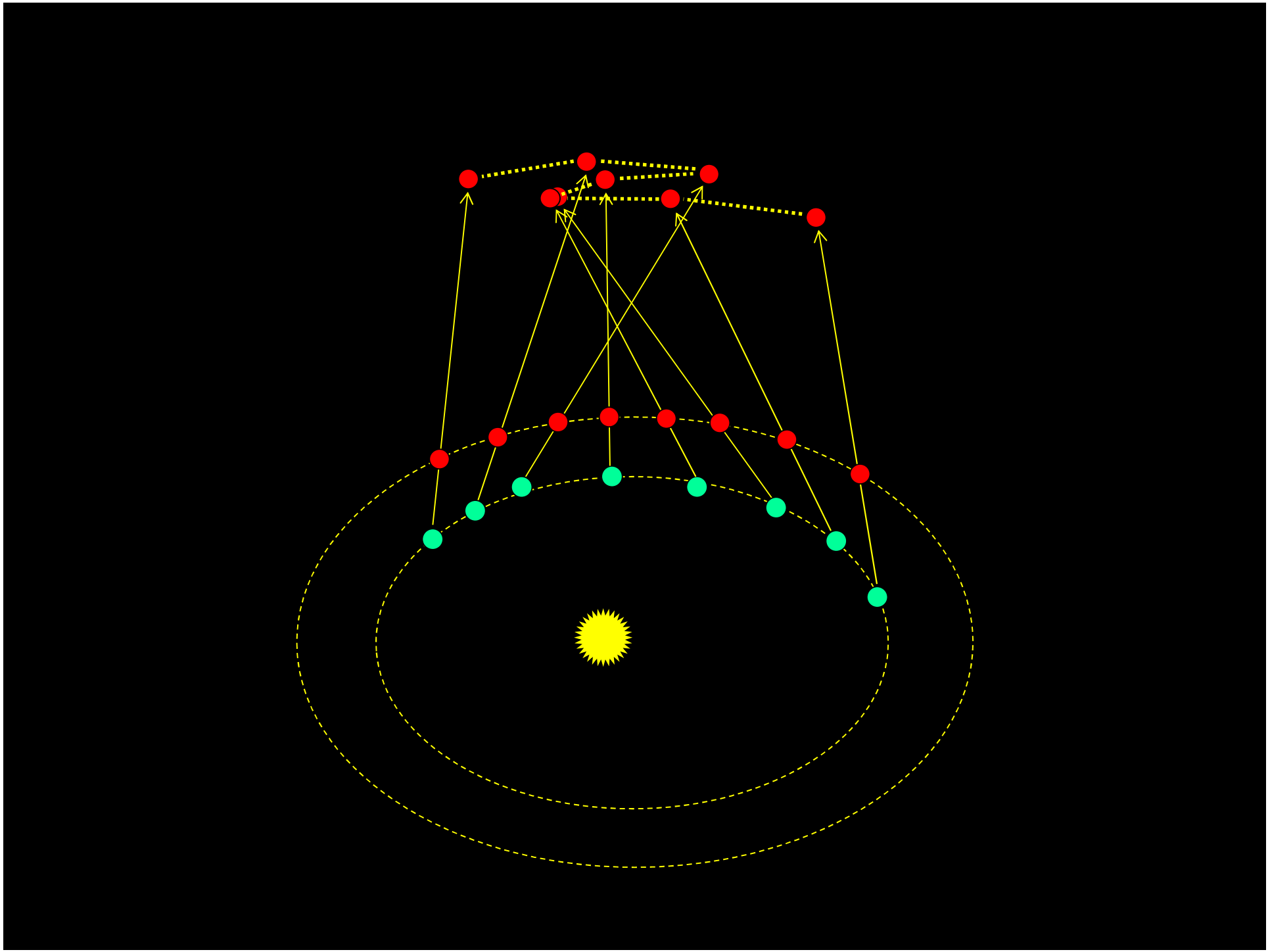


LAW 3:

The squares of the periods of the planets are proportional to the cubes of their semi-major axes.

$$\frac{T_{Earth}^{2}}{T_{Mars}^{2}} = \frac{R_{Earth}^{3}}{R_{Mars}^{3}}$$





Sir Isaac Newton (1642 - 1727)

Principia (1687)

PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

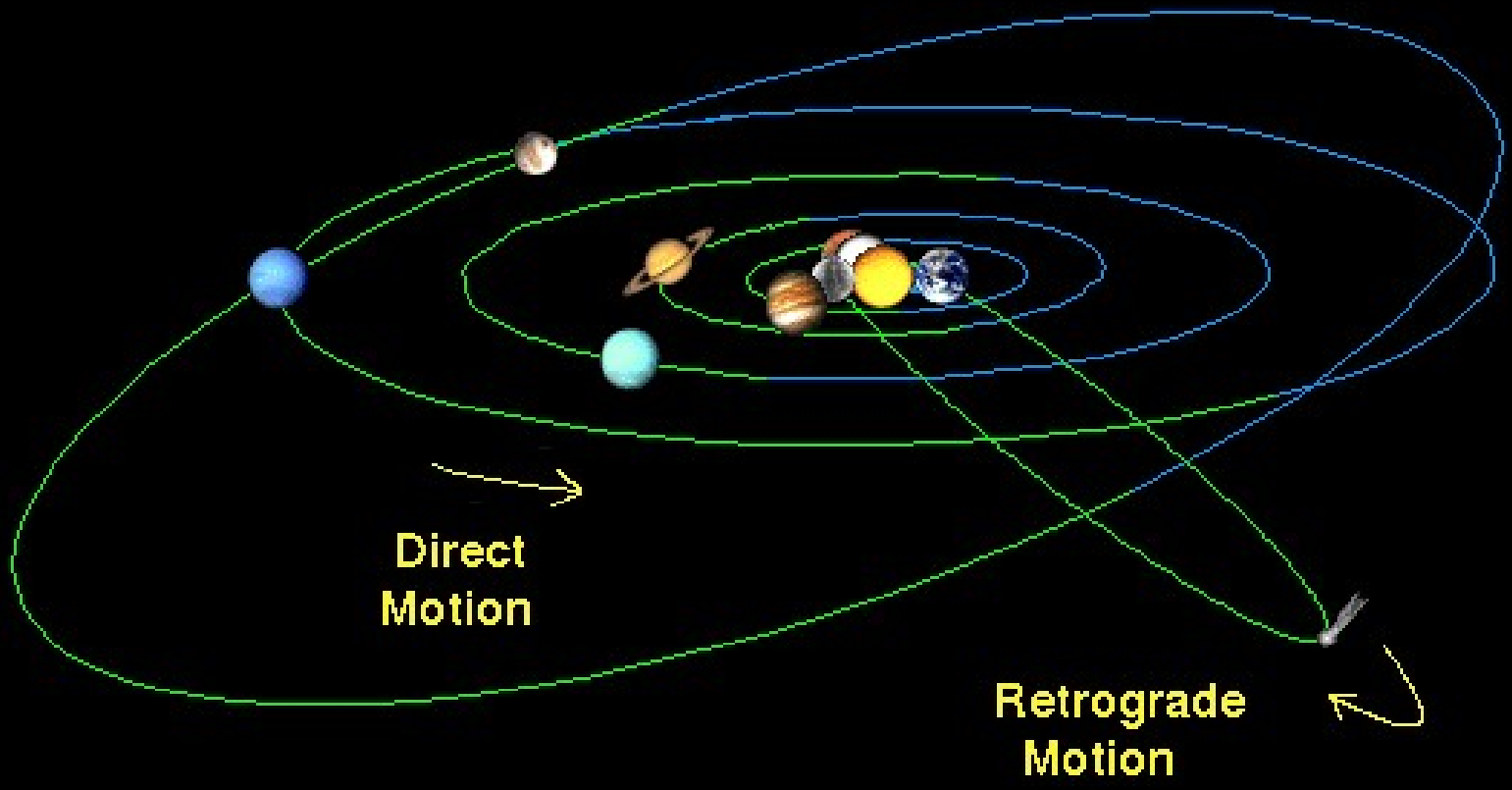
Autore *J S. NEWTON, Trin. Coll. Cantab. Soc.* Matheſeos Profeſſore *Lucaſiano*, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
Julii 5. 1686.

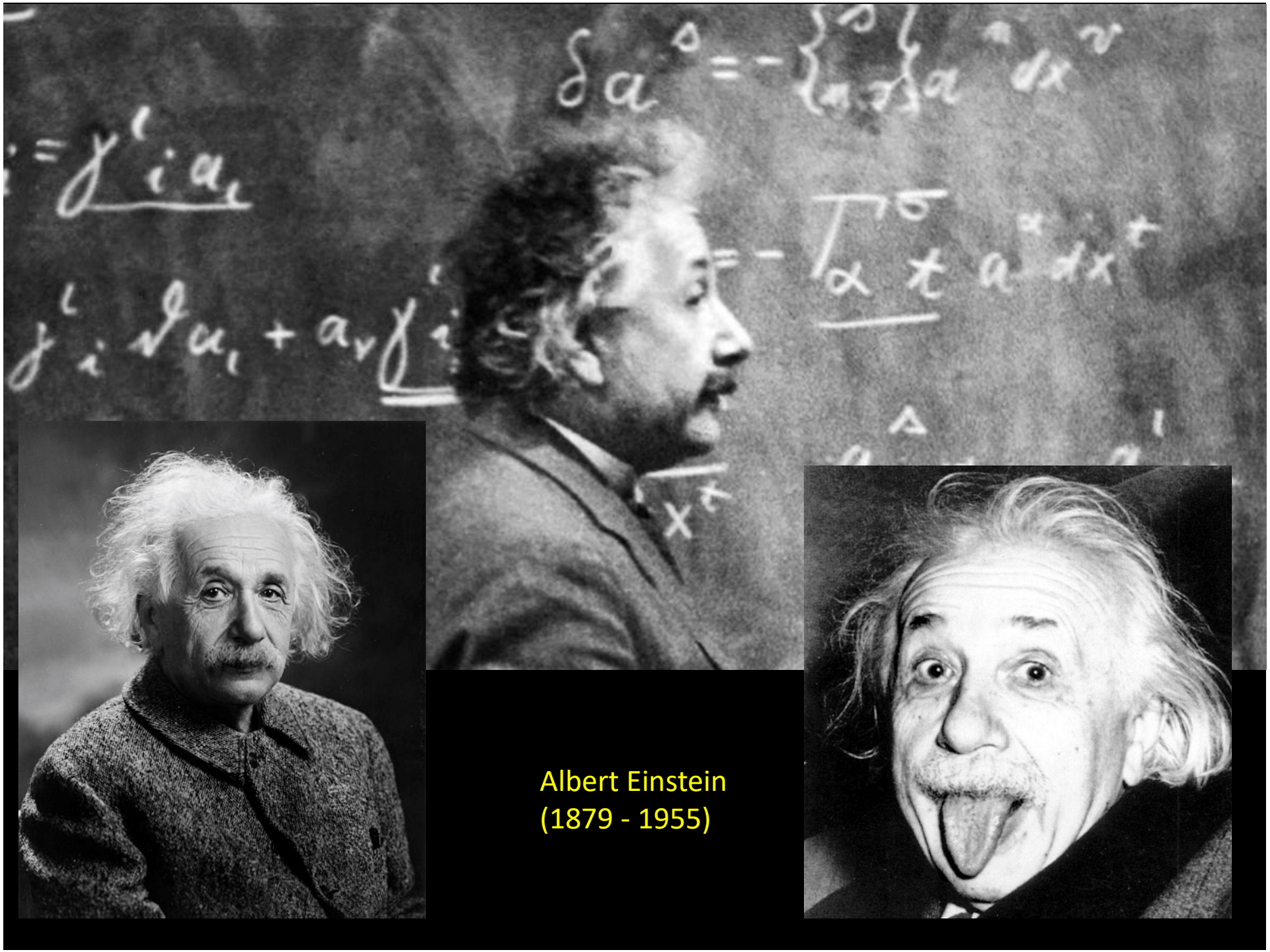
LONDINI,
Juſſu *Societatis Regiæ* ac Typis *Joſephi Streater*. Proſtat apud plures Bibliopolas. *Anno* MDCLXXXVII.

Edmond Halley (1556 – 1742)

Orbit of Comet Halley



Comet Halley crossing in front of the Milky Way (1986)



Albert Einstein
(1879 - 1955)

Nicolaus Copernicus	1473 - 1543
Tycho Brahe	1546 - 1601
Johannes Kepler	1571 - 1630
Galileo Galilei	1564 - 1642
Isaac Newton	1642 - 1727
Edmund Halley	1656 - 1742
Albert Einstein	1879 - 1955

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