

Huygens and his times

Albert van Helden
University of Utrecht





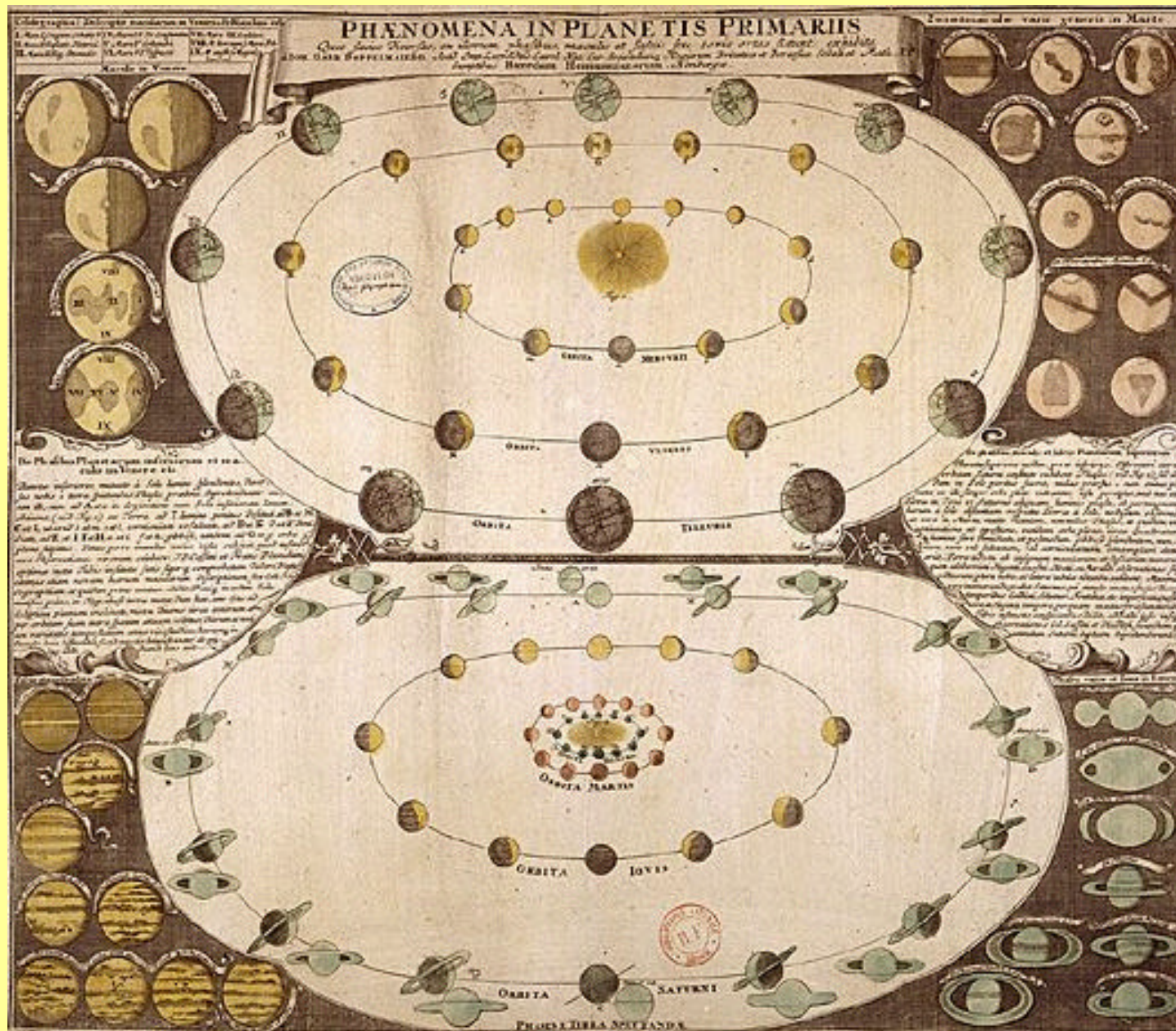




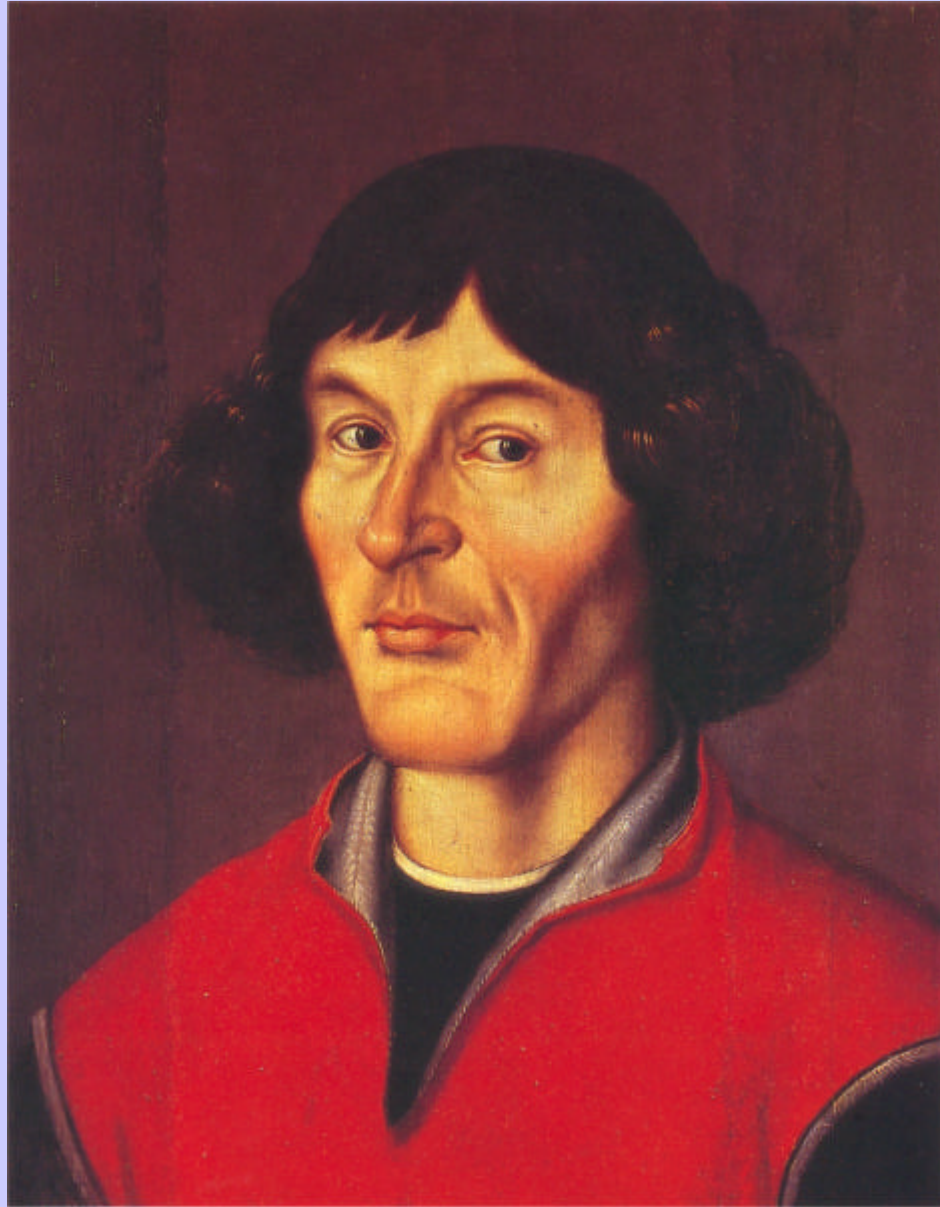
**HIS
PREDECESSORS**



The world
in 1500



The world in 1700



Nicholas Copernicus

1473-1543

NICOLAI CO-
PERNICI TORINENSIS
DE REVOLUTIONIBVS ORBI-
um coelestium, Libri VI.

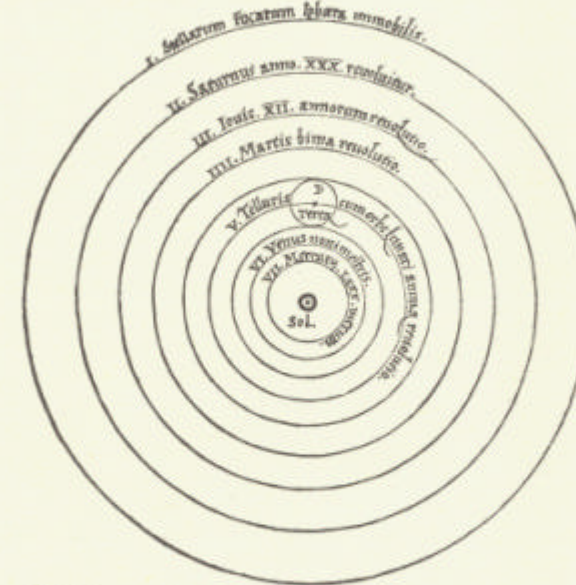
Habes in hoc opere iam recens nato, & ædito,
studiose lector, Motus stellarum, tam fixarum,
quàm erraticarum, cum ex ueteribus, tum etiam
ex recentibus obseruationibus restitutos: & no-
uis insuper ac admirabilibus hypothesibus or-
natos. Habes etiam Tabulas expeditissimas, ex
quibus eisdem ad quoduis tempus quàm facilli-
me calculare poteris. Igitur eme, lege, frue.

Ἀγαμέμνων Νίκης εὐχόμενος.

Norimbergæ apud Ioh. Petrcium,
Anno M. D. XLIII.

NICOLAI COPERNICI

net, in quo terram cum orbe lunari tanquam epicyclo contineri
diximus. Quinto loco Venus nono mense reducitur. Sextum
deniq; locum Mercurius tenet, octuaginta dierum spacio circū
currens. In medio uero omnium refidet Sol. Quis enim in hoc

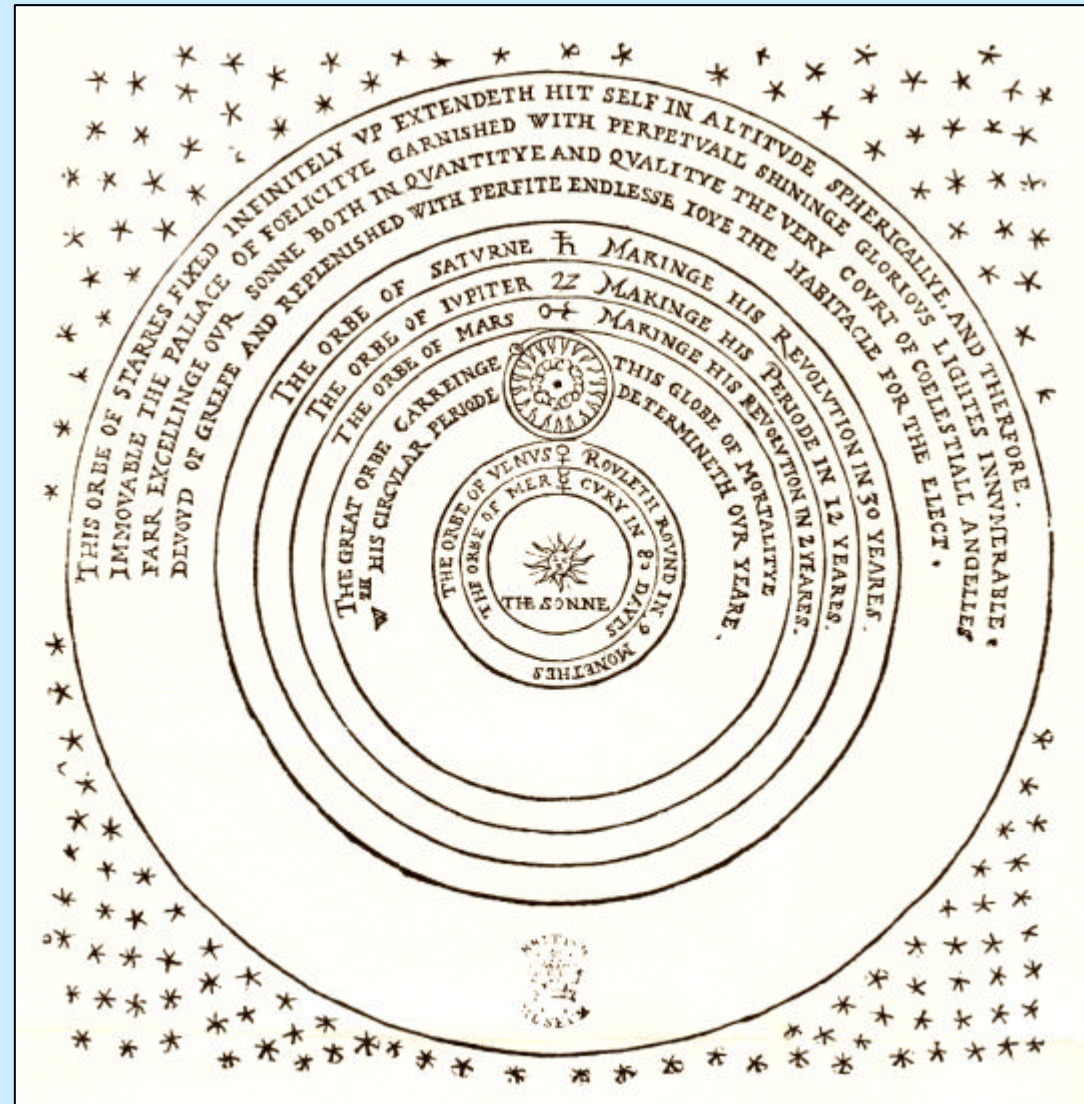


pulcherrimo templo lampadem hanc in alio uel meliori loco po-
neret, quàm unde totum simul possit illuminare: Siquidem non
inapte quidam lucernam mundi, alij mentem, alij rectorem uo-
cant. Trimegistus uisibilem Deum, Sophoclis Electra intuentē
omnia, ita profecto tanquam in solio regali Sol residens circum
agentem gubernat Astrorum familiam. Tellus quoq; minime
fraudatur lunari ministerio, sed ut Aristoteles de animalibus
ait, maximā Luna cū terra cognatio nē habet. Concipit interea à
Sole terra, & impregnatur annuo partu. Inuenimus igitur sub
hac

De Revolutionibus Orbium Coelestium, 1543

Thomas Digges c.
1546-1595

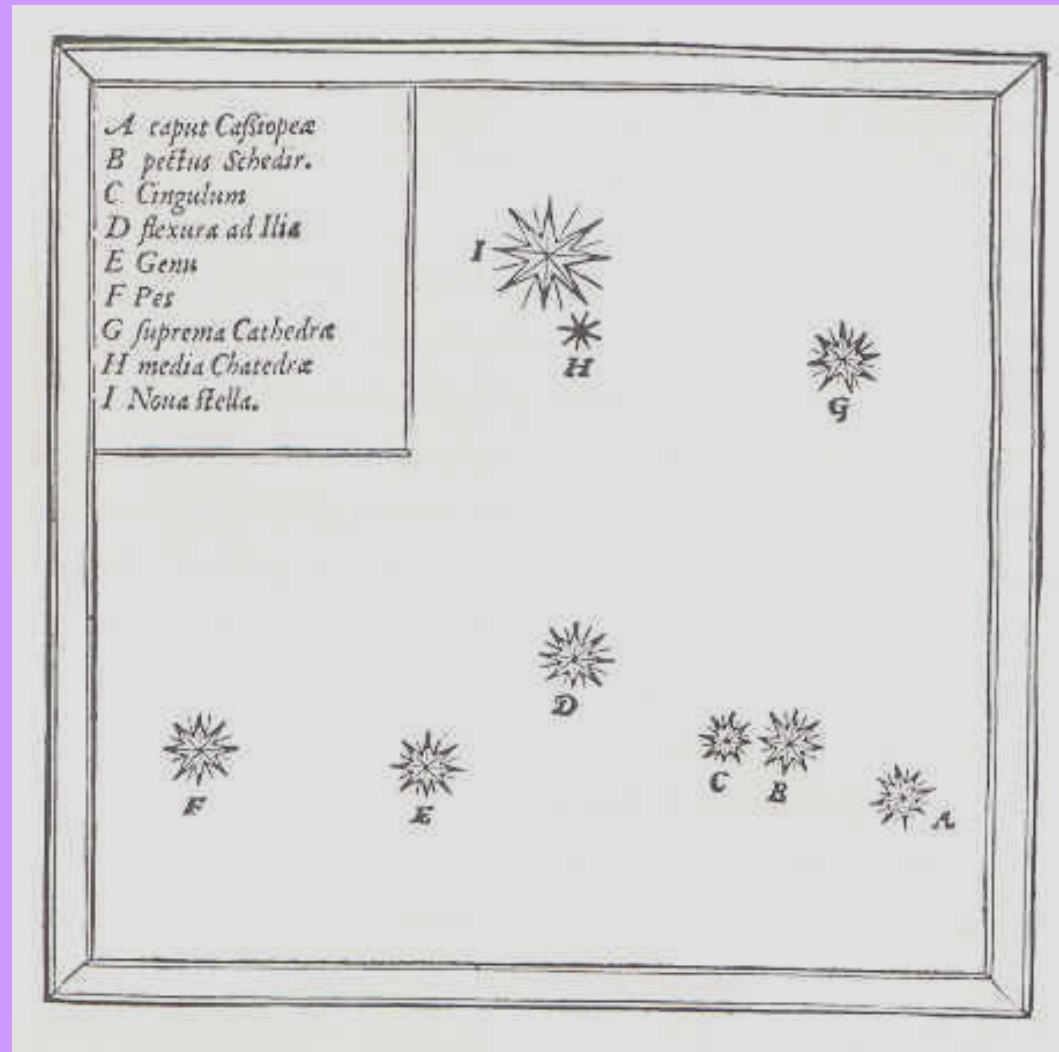
In the 1576 edition of
his father Leonard's
*Prognostications
Everlasting*





Tycho Brahe
1546-1601

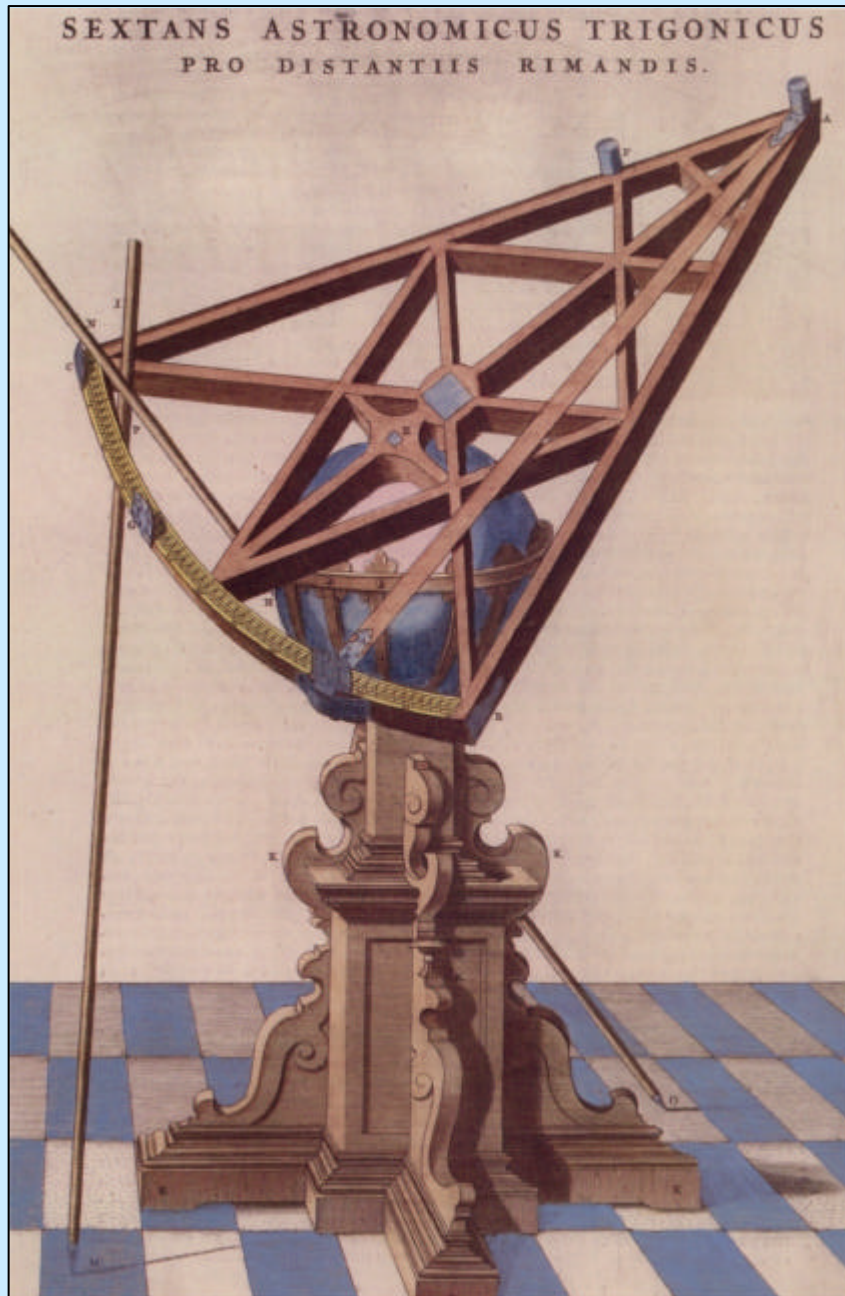
The Nova of 1572



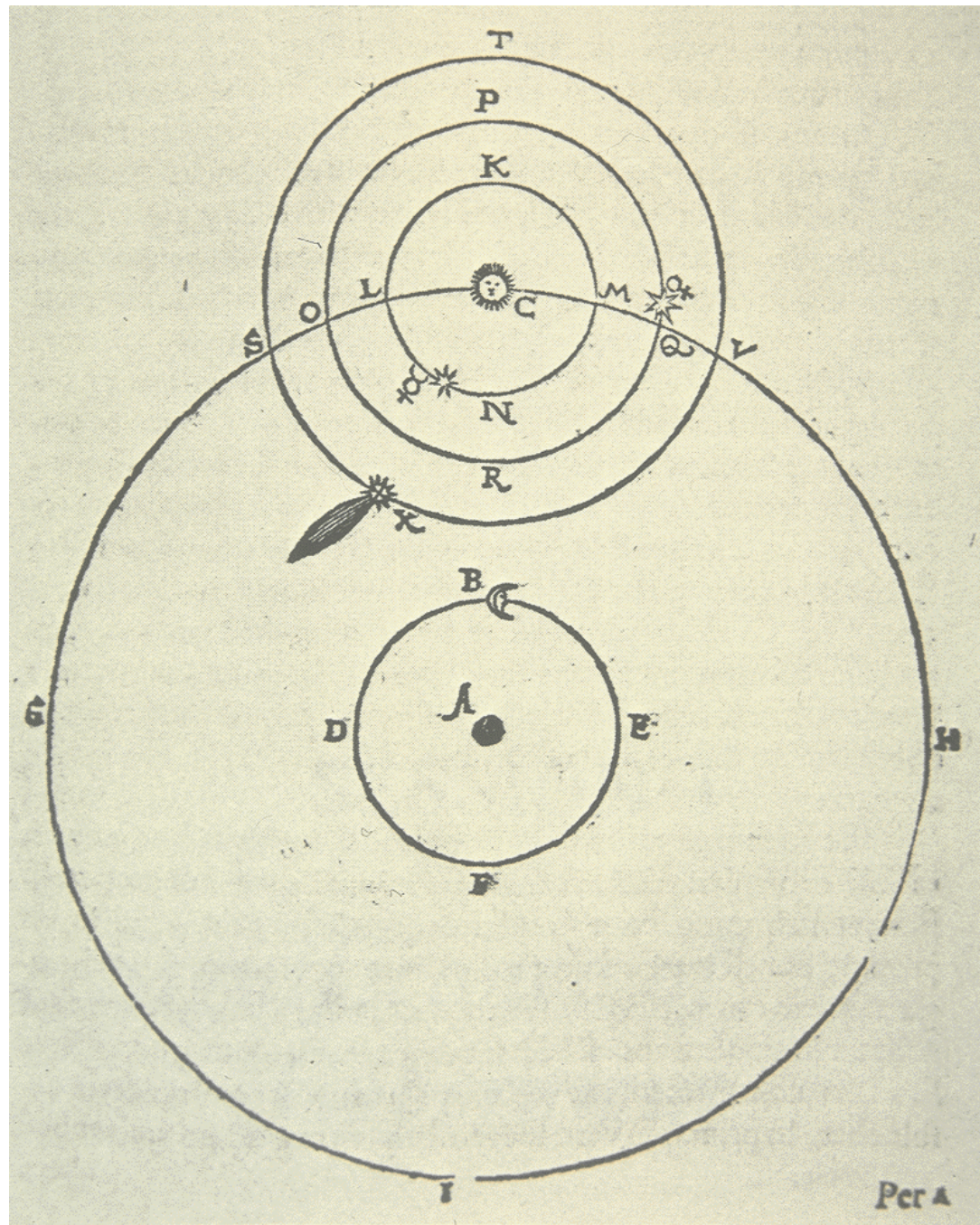
In Casseopeia



Tycho Brahe's observatory on Hven



Sextant
Wood and brass



Tycho's universe

A is the Earth

B is the Moon

C is the Sun

Johannes Kepler
1571-1630



Johannes Kepler

The New Astronomy . . .

1609

ASTRONOMIA NOVA
ΑΙΤΙΟΛΟΓΗΤΟΣ,

SEV

PHYSICA COELESTIS,

tradita commentariis

DE MOTIBVS STELLÆ

MARTIS,

Ex observationibus G. V.

TYCHONIS BRAHE:

Jussu & sumptibus

RV DOLPHI II.

ROMANORVM

IMPERATORIS &c:

Plurium annorum pertinaci studio
elaborata Pragæ ,

A S^e. C^e. M.^{ia} S^e. Mathematico

JOANNE KEPLERO,

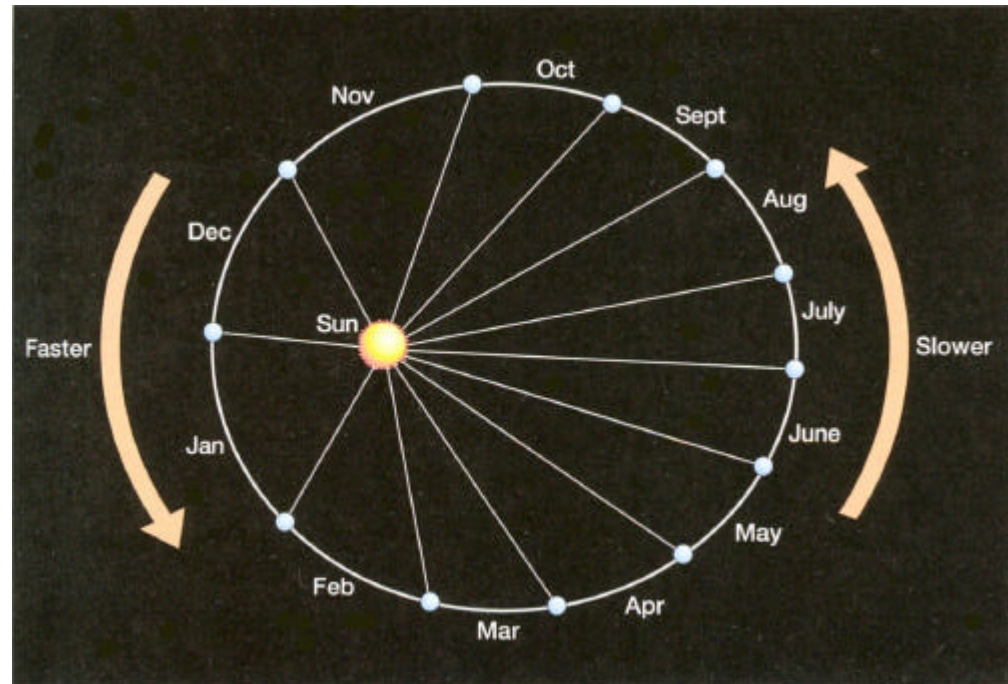
Cum ejusdem C^e. M.^{ia} privilegio speciali

ANNO æræ Dionysianæ cld .lvc ix.

Kepler's first two "laws"

The planets move around the Sun in elliptical orbits with the Sun at one of the foci

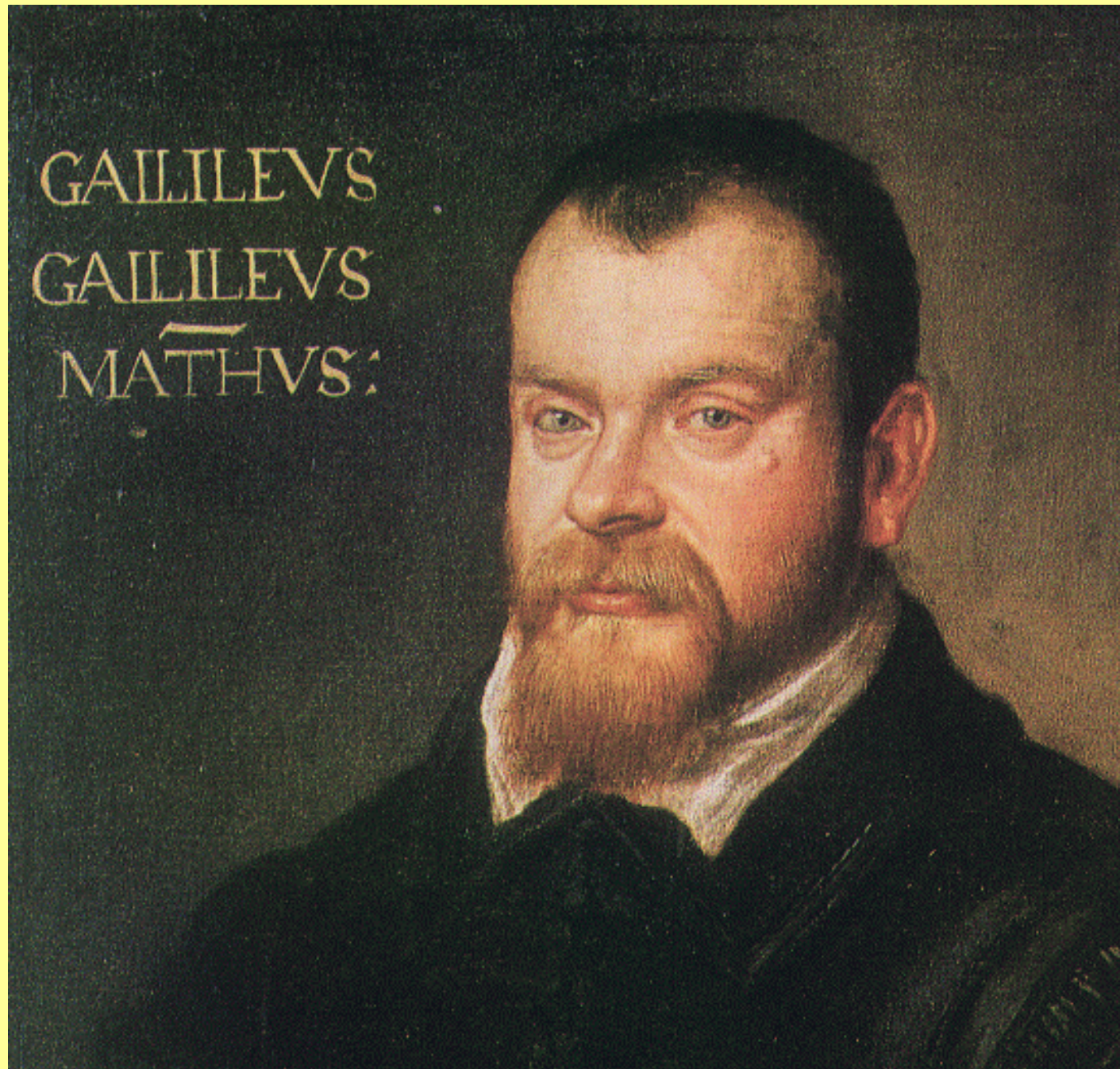
The line from the Sun to the planet sweeps out equal areas in equal times



Kepler's third "law

The square of a planet's period around the Sun is proportional to the cube of its mean distance from the Sun:

$$T^2/R^3 = C$$





S I D E R E V S
N V N C I V S

MAGNA, LONGEQVE ADMIRABILIA
Spectacula pandens, suspiciendaque proponens
vnicuique, præsertim verò

PHILOSOPHIS, atq; ASTRONOMIS, quæ à
G A L I L E O G A L I L E O
P A T R I T I O F L O R E N T I N O

Patauini Gymnasij Publico Mathematico

P E R S P I C I L L I

Nuper à se reperti beneficio sunt observata in LVNÆ FACIE, FIXIS IN-
NUMERIS, LACTEO CIRCVLO, STELLIS NEBVLOSIS,

Apprime verò in

Q V A T V O R P L A N E T I S
Circa IOVIS Stellam disparibus intervallis, atque periodis, celesti-
tate mirabili circumuolutis; quos, nemini in hanc vsque
diem cognitos, nouissimè Author depræ-
hendit primus; atque

M E D I C E A S I D E R A
N V N C V P A N D O S D E C R E V I T .



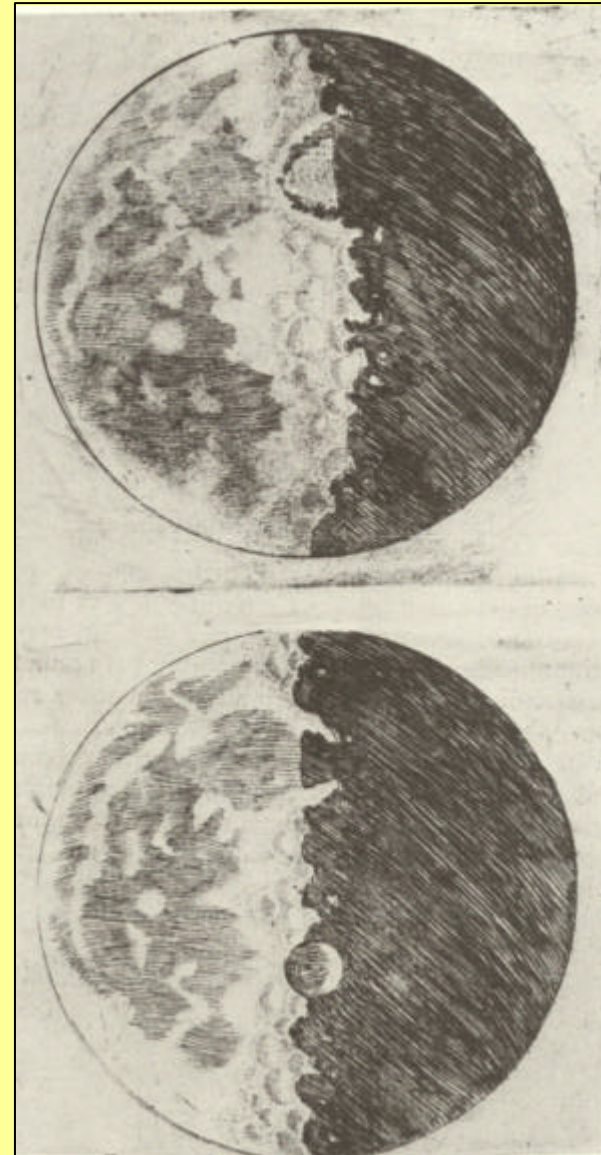
VENETIIS, Apud Thomam Baglionum. M D C X.
Superiorum Permissu, & Privilegio.

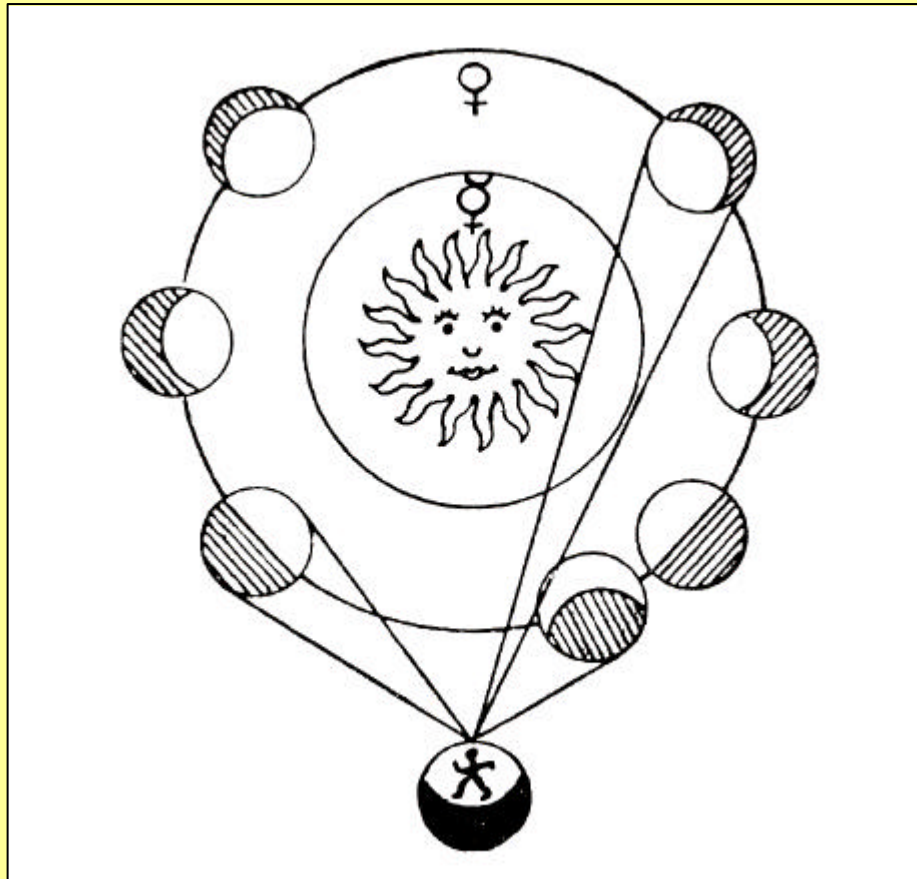
Galileo,
Sidereal Messenger

1610



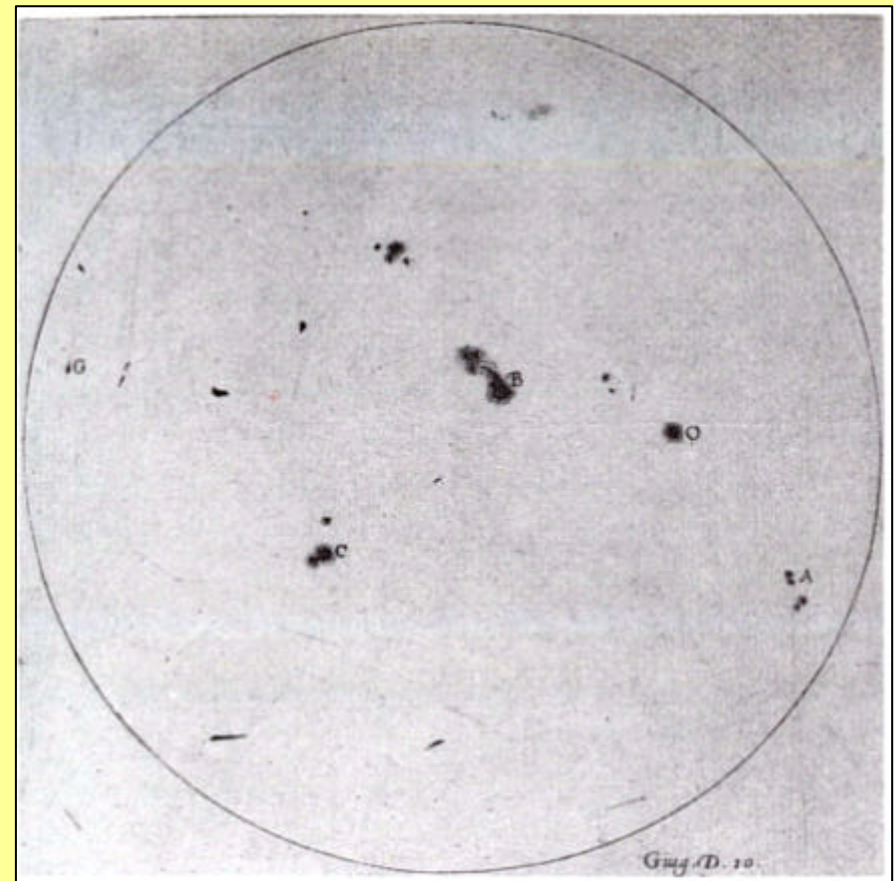
Unseen fixed stars
and
Mountains on the Moon





The Sun is imperfect

Venus goes around the Sun

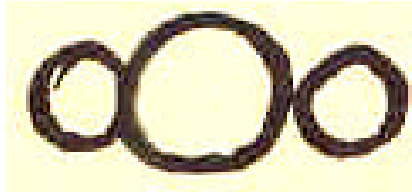


The book of nature is
written in the language of
mathematics

Galileo, 1623



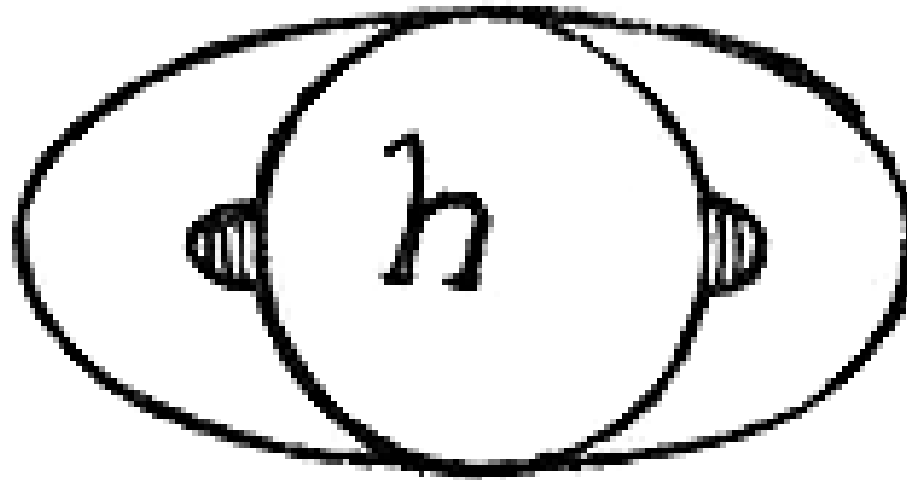
René Descartes, 1596-1650



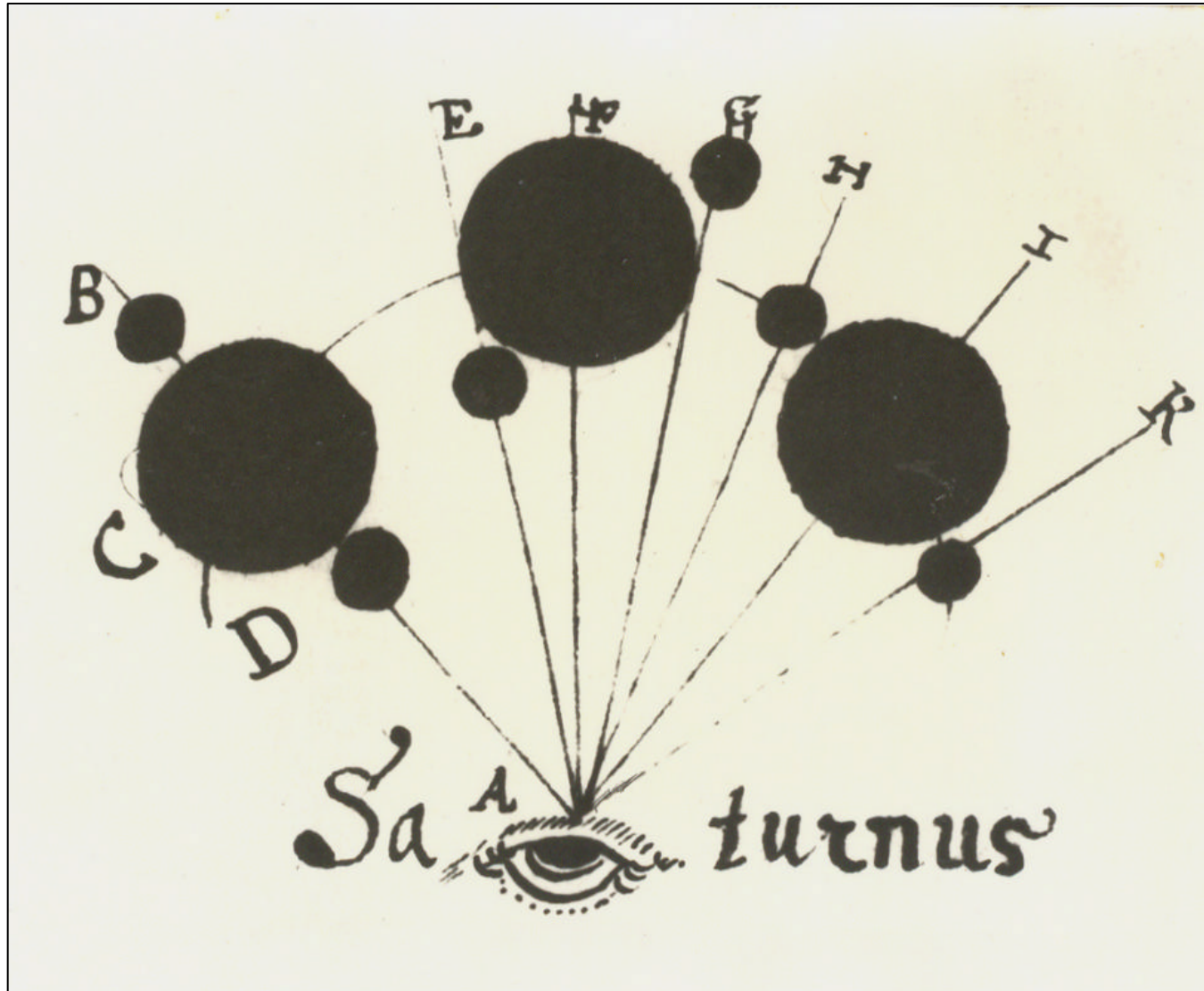
1610



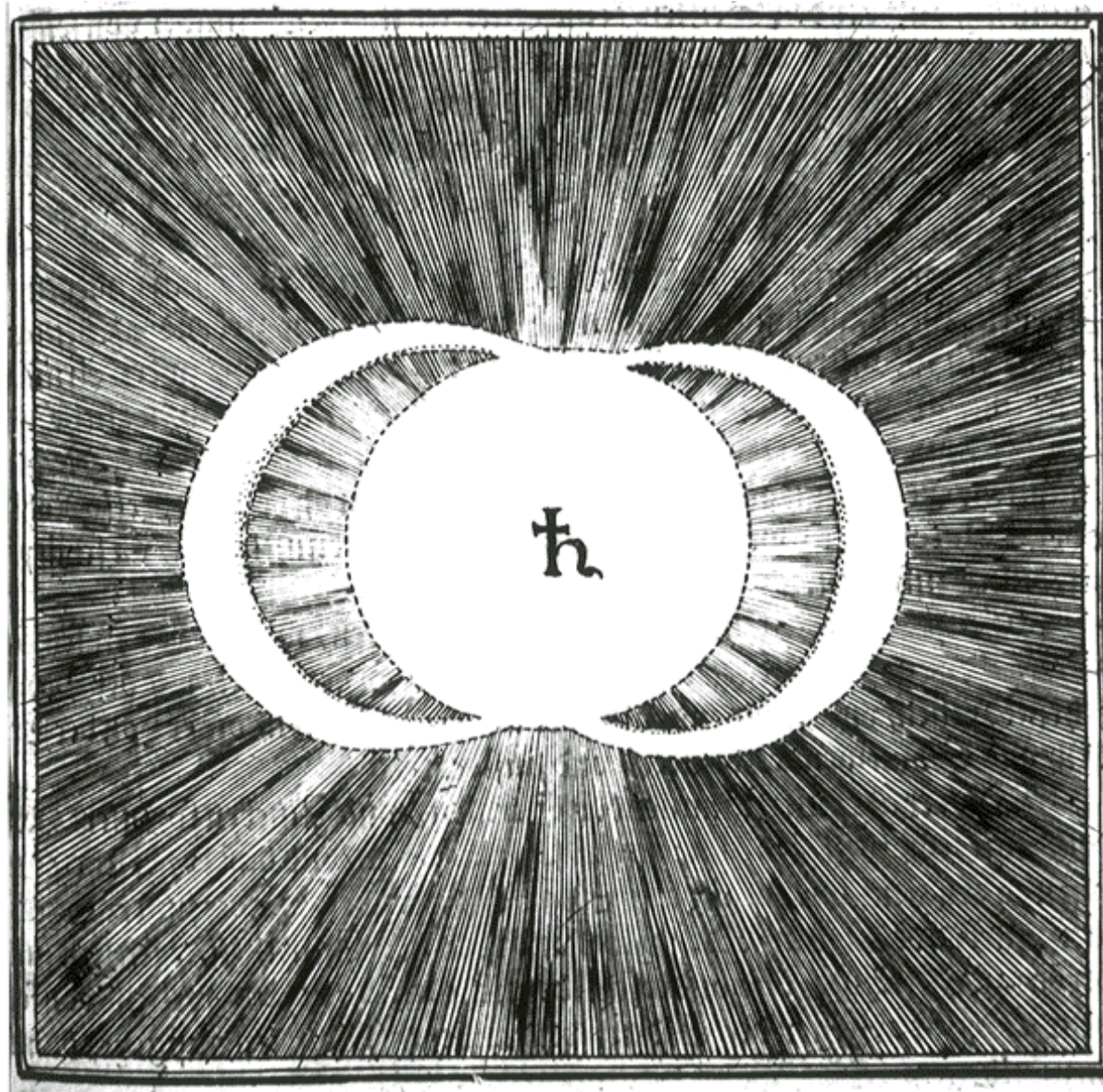
1616



Il saggiaatore, 1623



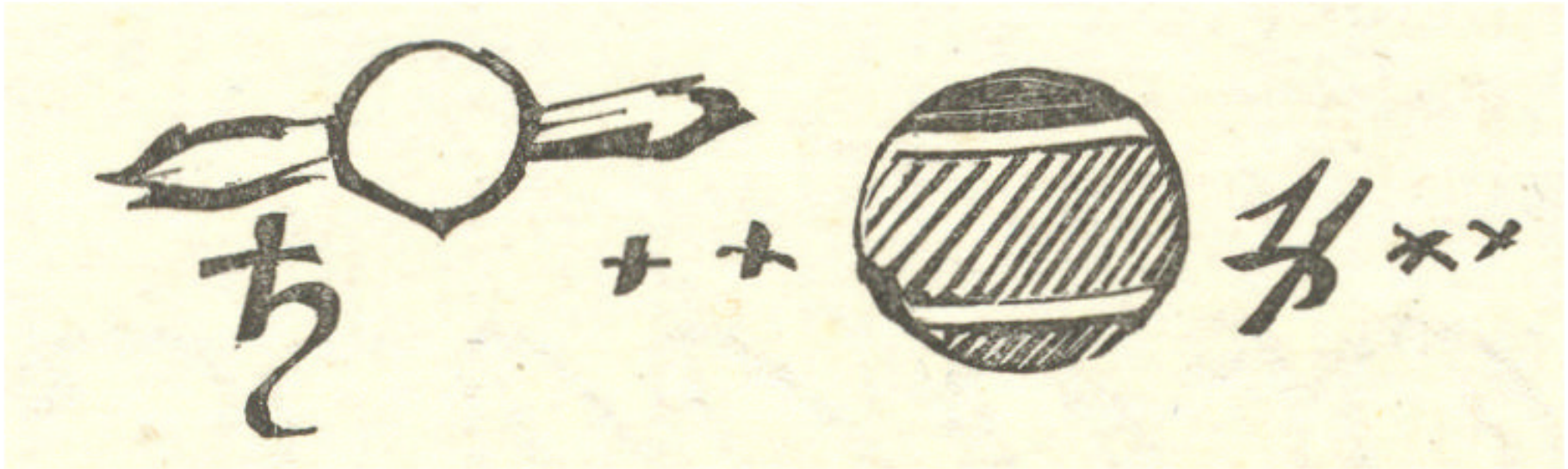
Christoph Scheiner, *De tubo optico* (c. 1616)



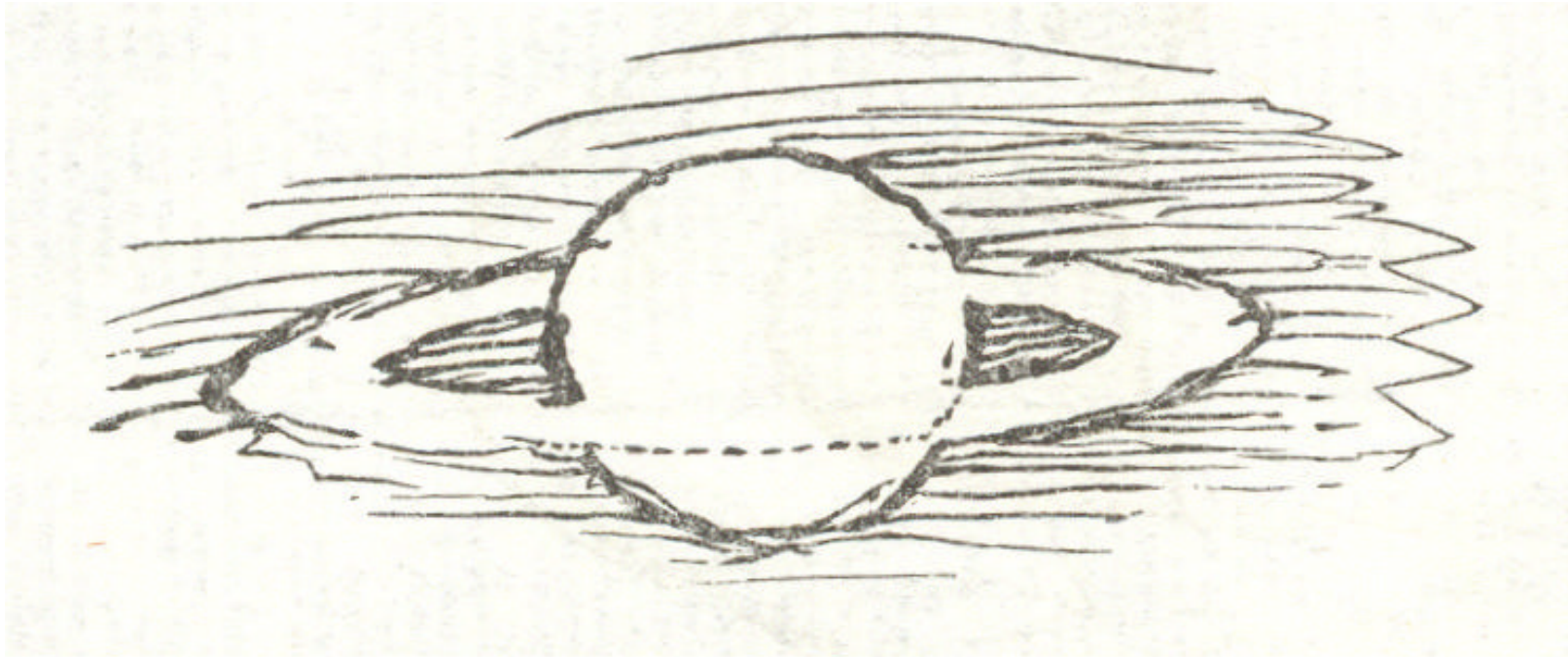
Matthias Hirzgarter, *Detectio dioptrica*, 1643



Hevelius, *Selenographia*, 1647



**Huygens's first recorded observation of Saturn,
March (?) 1655**



Observation by Huygens, September 1658

CRISTIANI HUGENII

ZVLIChemii, CONST. F.

SYSTEMA
SATVRNIVM,

Sive

De causis mirandorum SATVRNI

Phænomenon,

Et

Comite ejus

PLANETA NOVO



HAGÆ-COMITIS,

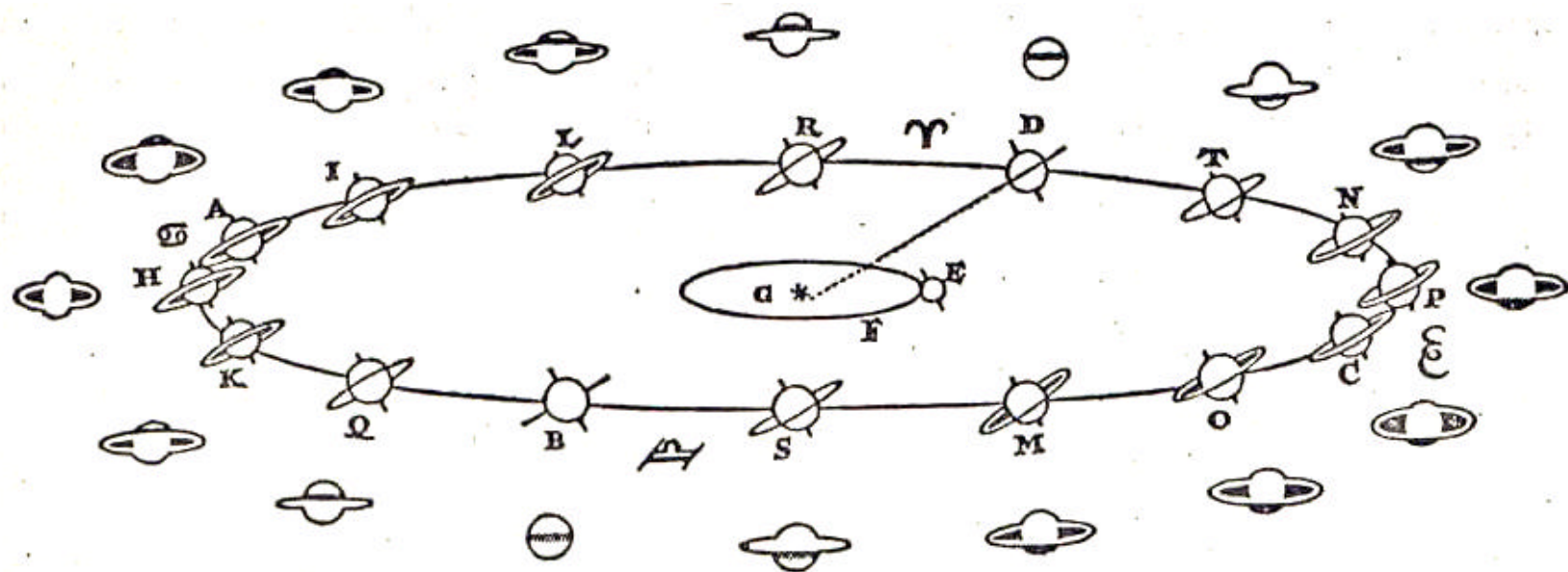
Ex Typographia ADRIANI VLACQ.

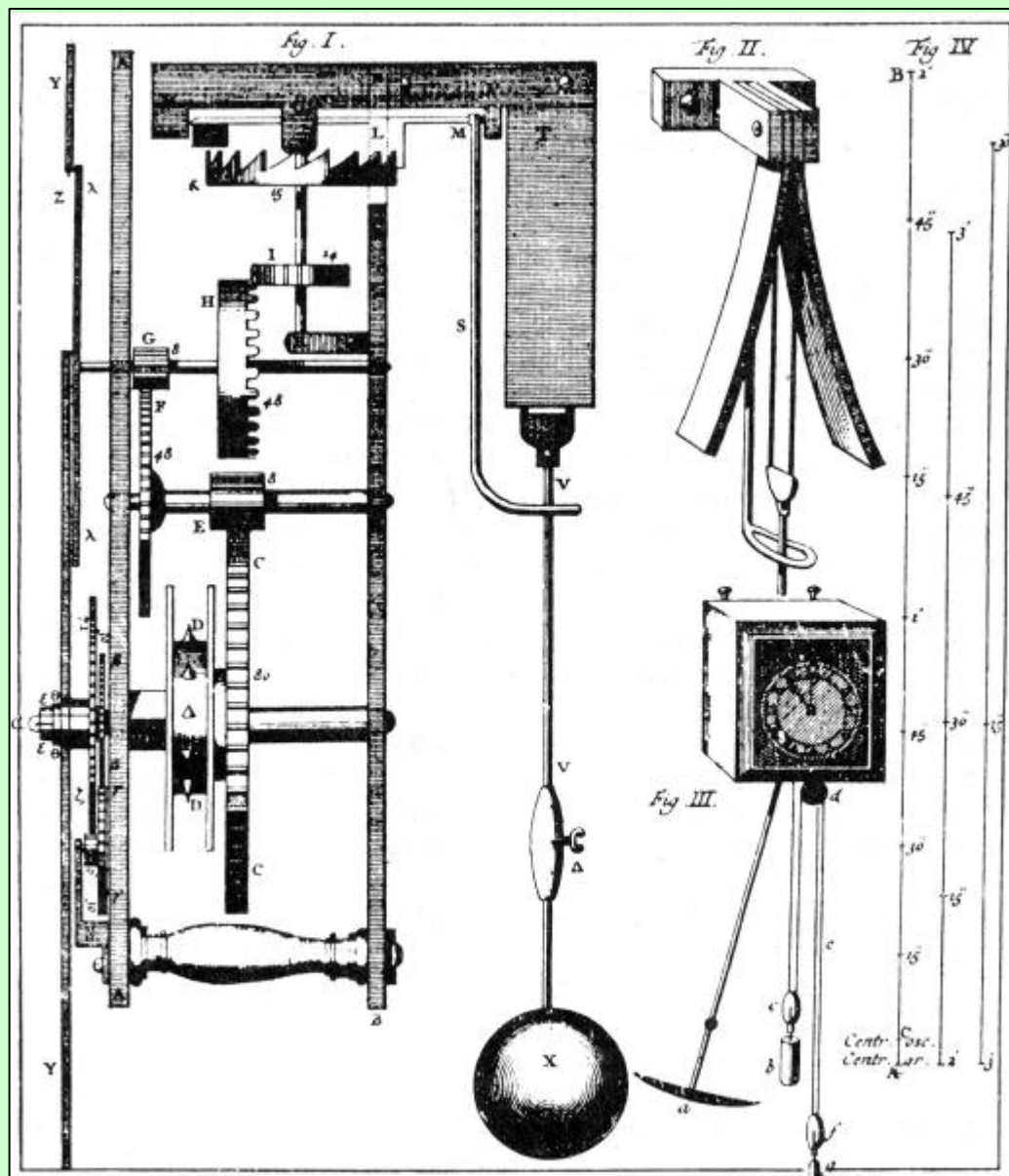
M. DC. LIX.

*Annulo cingitur,
tenui, plano,
nusquam cohærente,
ad eclipticam inclinato*

**It is surrounded by a thin flat ring, touching it
nowhere, and inclined to the ecliptic**

Systema Saturnium, 1659





Illustrazioni dallo "Horologium oscillatorium" di Huygens (1673). Con l'indicazione "Fig. II" si mostrano le ganasce cicloidali che obbligano il pendolo a oscillare in un arco cicloidale.

Horologium

1657



**Académie
Royale
des Sciences**



*Horologium
Oscillatorium*
1673

CHRISTIANI
H V G E N I I
ZVLICHEMII, CONST. F.
HOROLOGIVM
OSCILLATORIVM
SIVE
DE MOTV PENDVLORVM
AD HOROLOGIA APTATO
DEMONSTRATIONES
GEOMETRICÆ



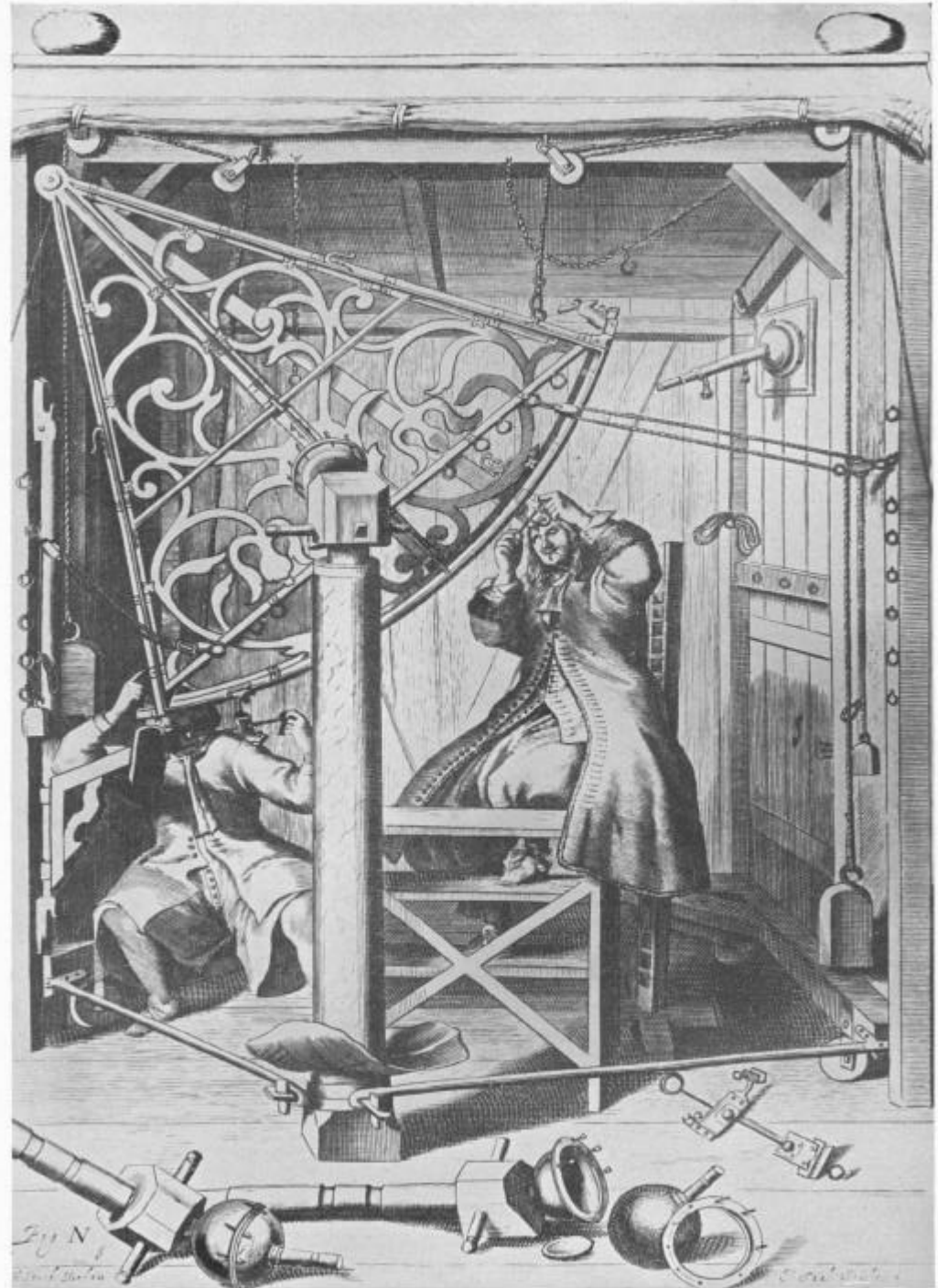
PARISIIS,
Apud F. MUGET, Regis & Illustrissimi Archiepiscopi Typographum,
viâ Citharæ, ad insigne trium Regum.

MDCLXXIII.
CVM PRIVILEGIO REGIS.

HIS CONTEMPORARIES

**Johannes Hevelius
(1611-1682)
at his sextant, ca. 1660**

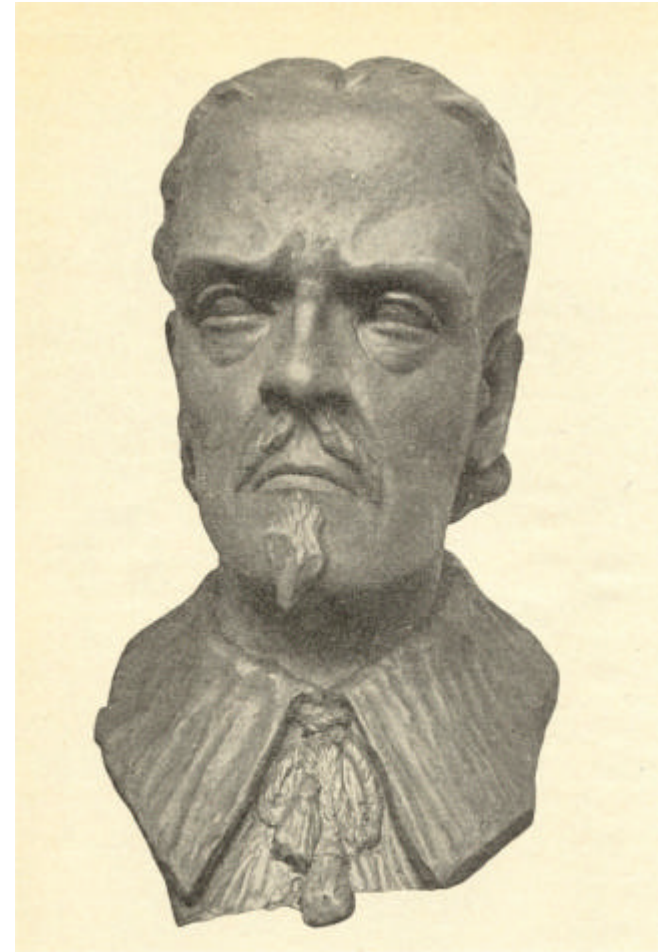
**Sextant is made entirely
of metal**





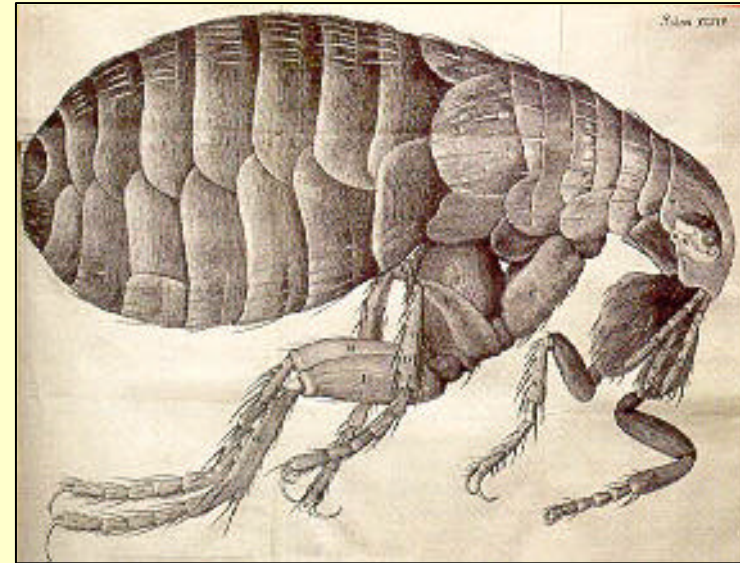
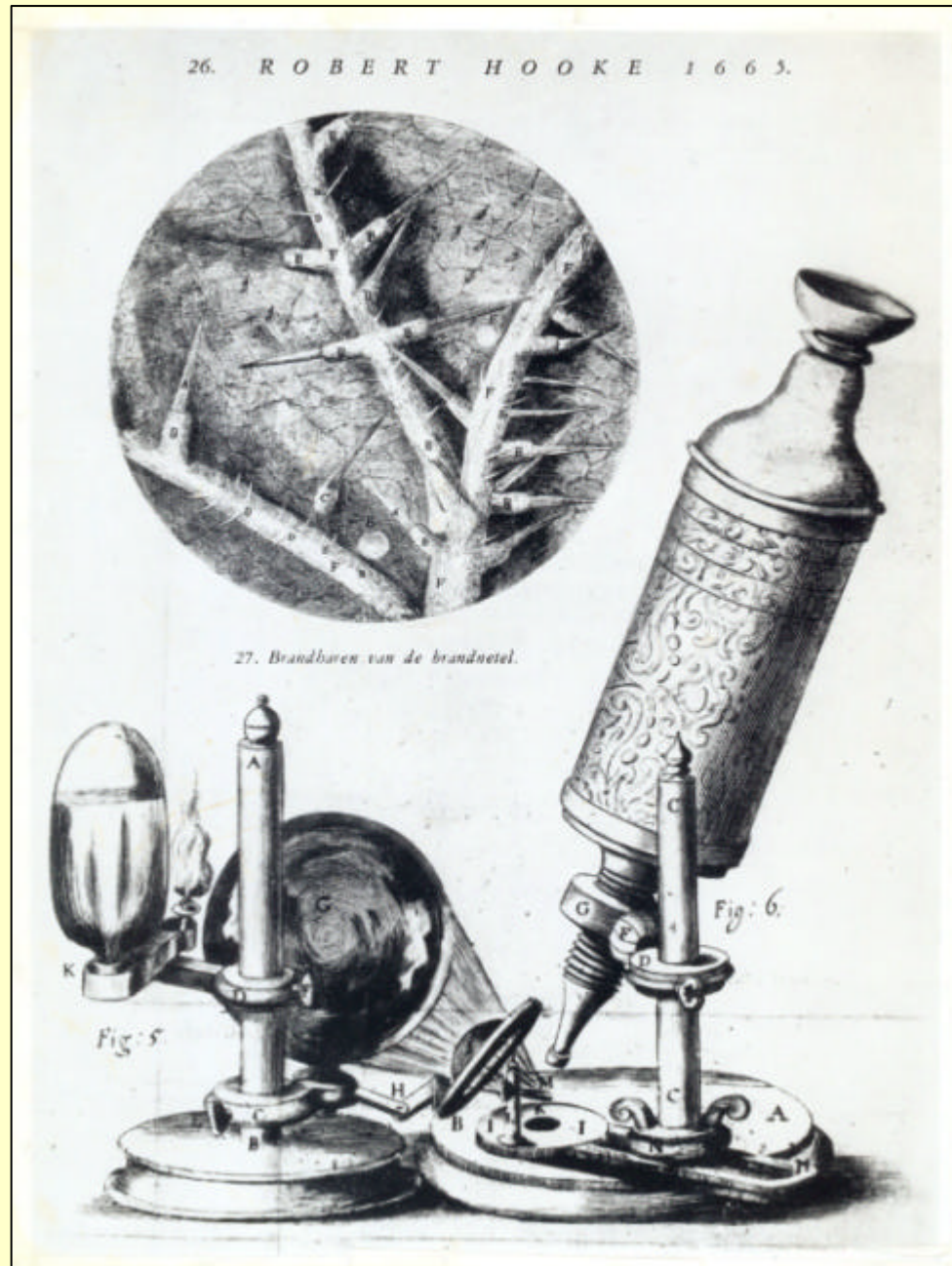
Leeuwenhoek

1632-1723



Jan Swammerdam

1637-1680



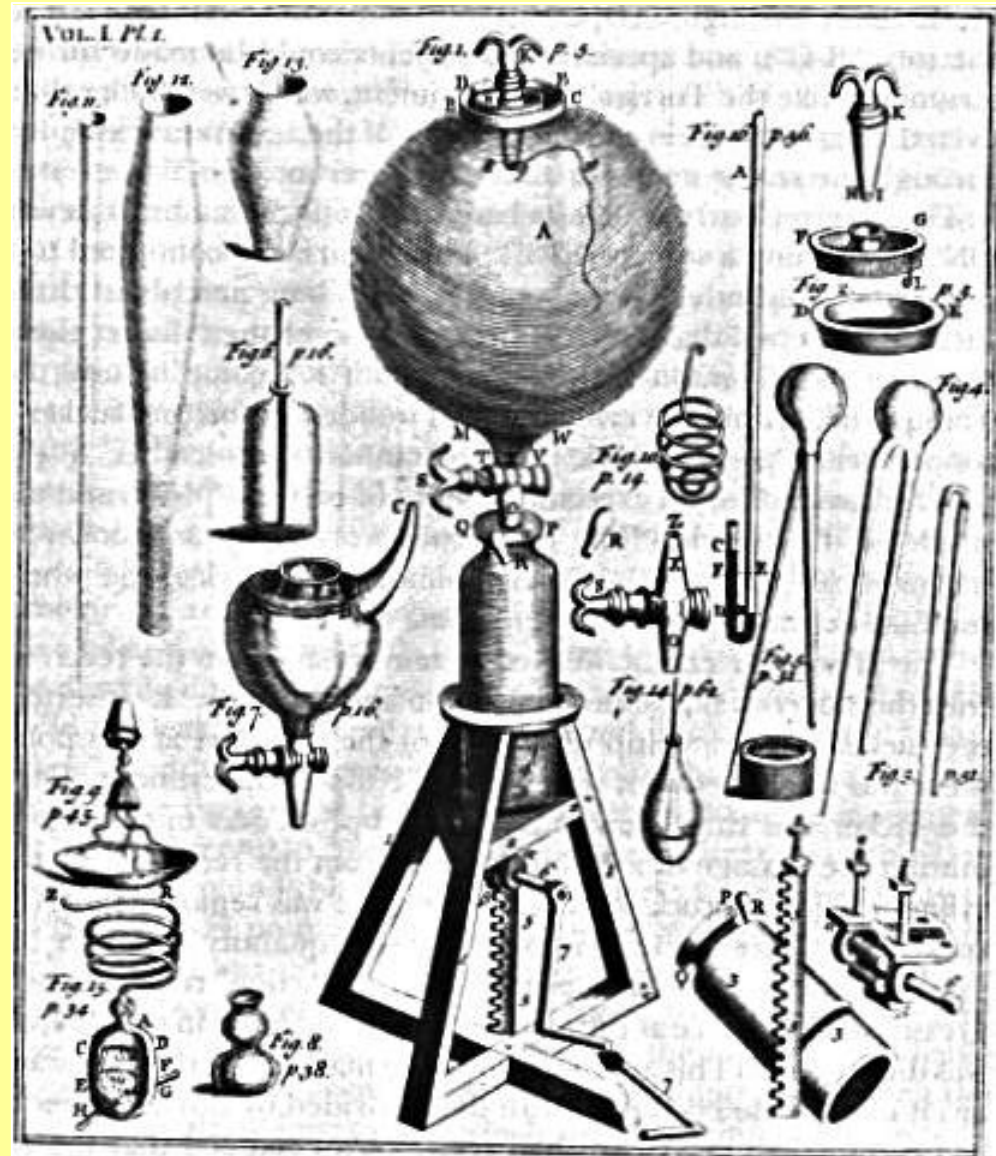
Robert Hooke

Micrographia

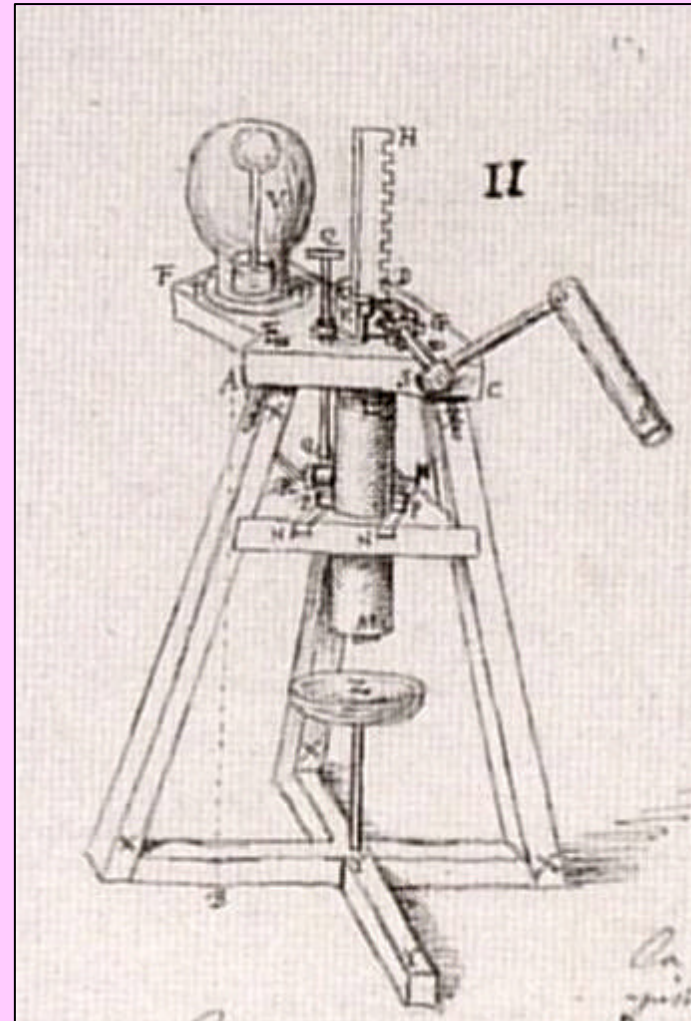
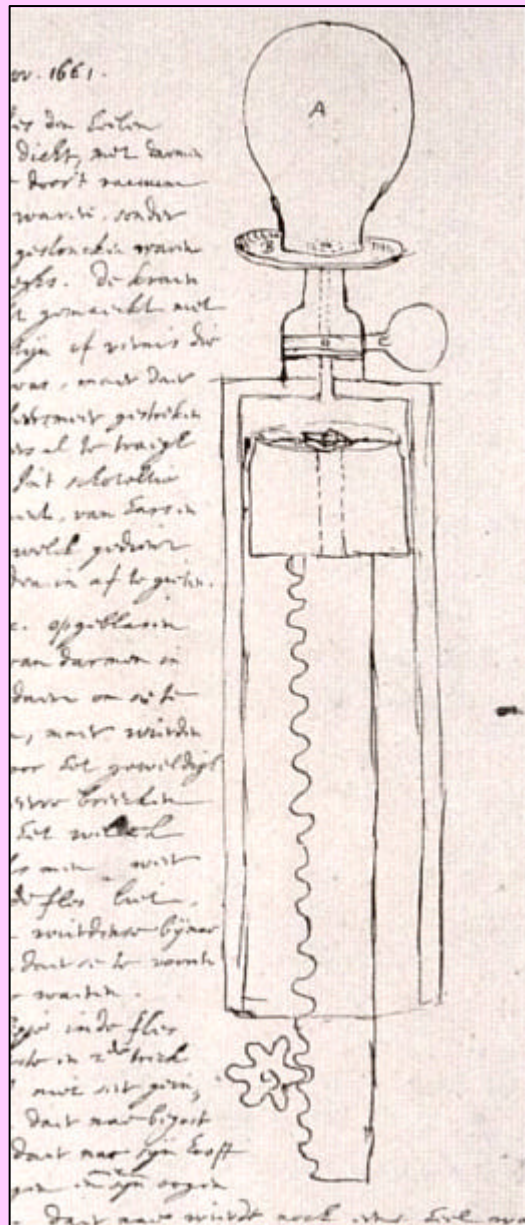
1665



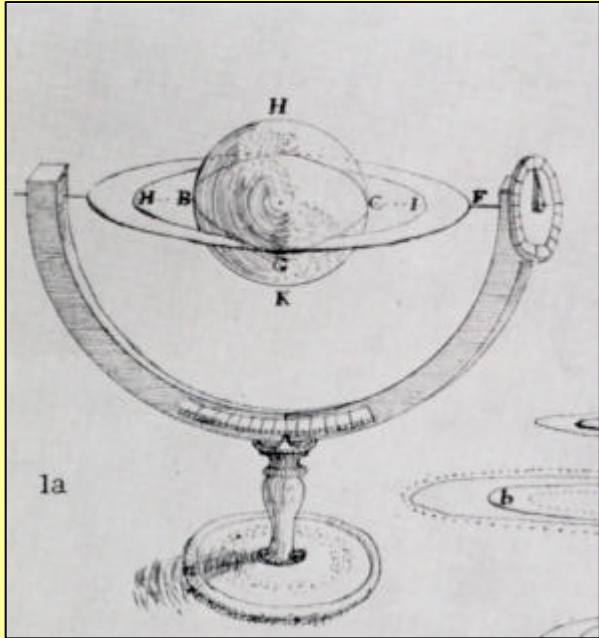
Robert Boyle,
1625-1692



air-pump

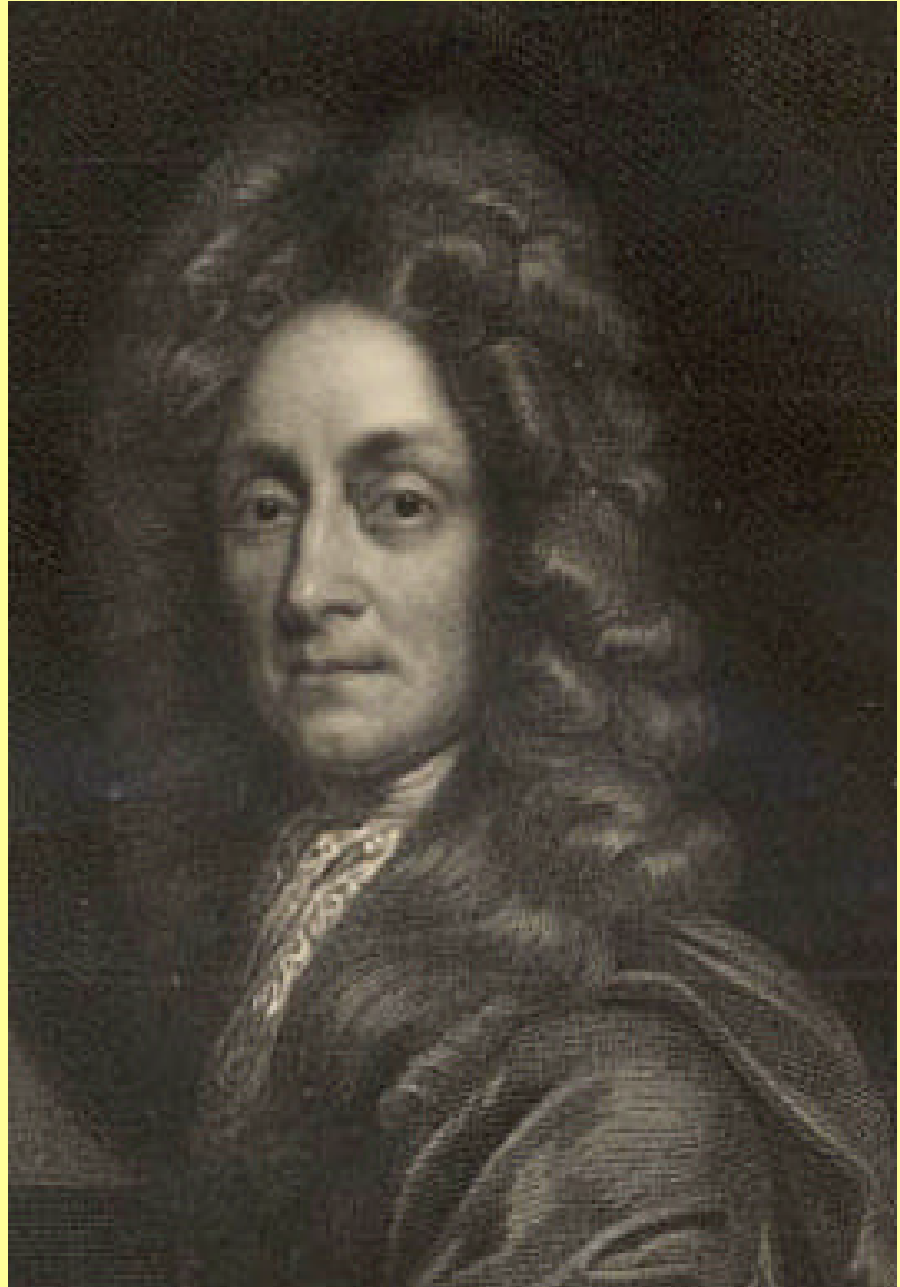


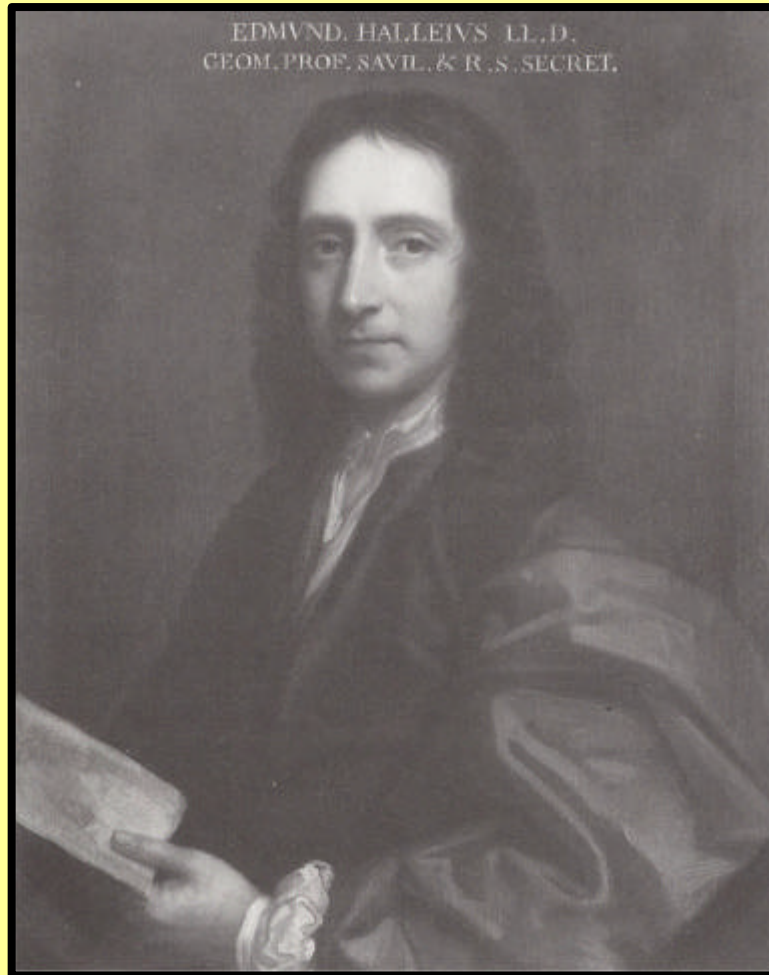
Air-pump designs by Huygens



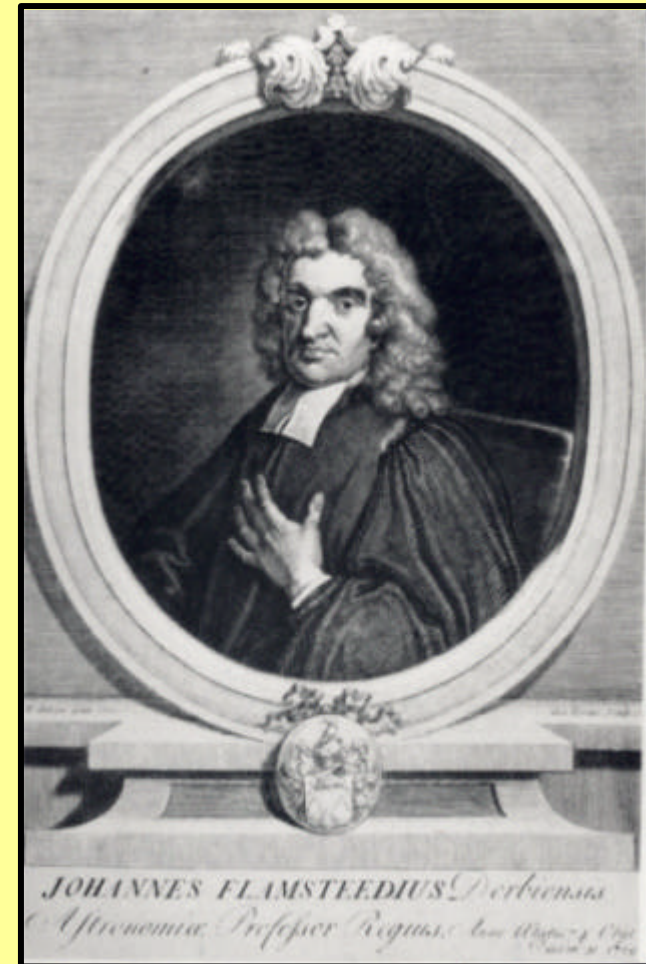
Christopher Wren

1632-1723

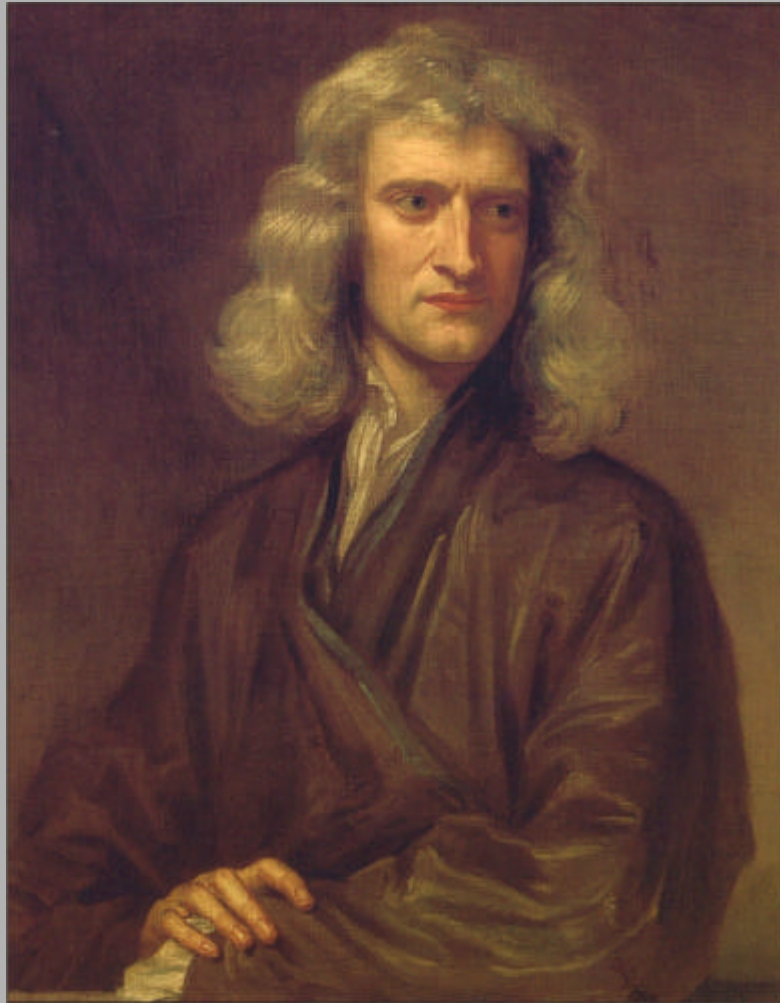




Edmond Halley
1656-1742

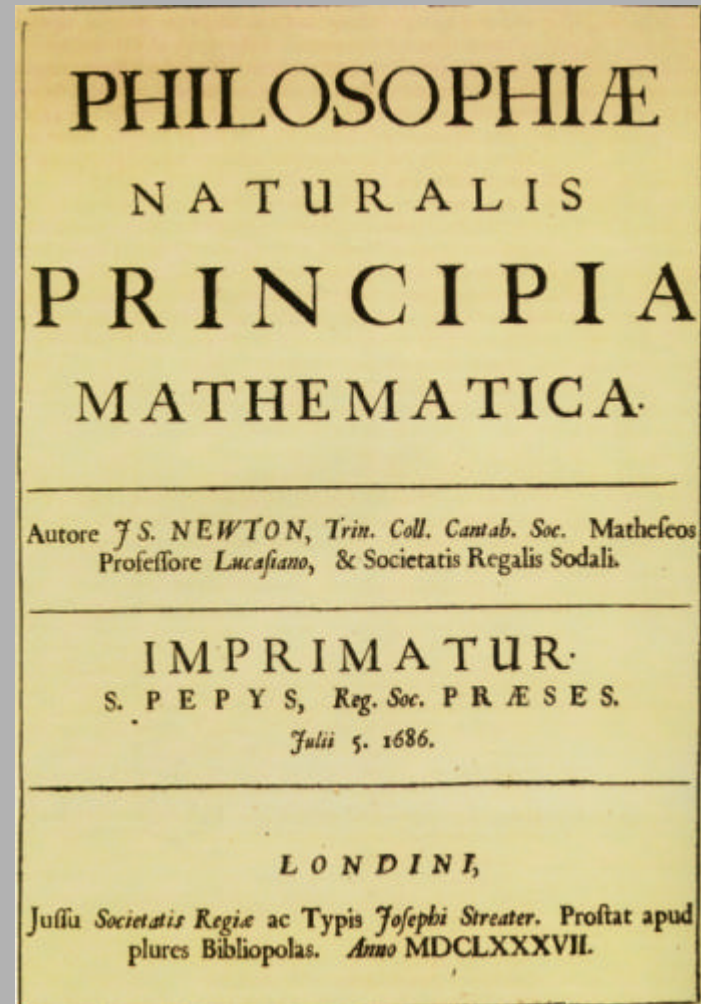


John Flamsteed
1646-1719



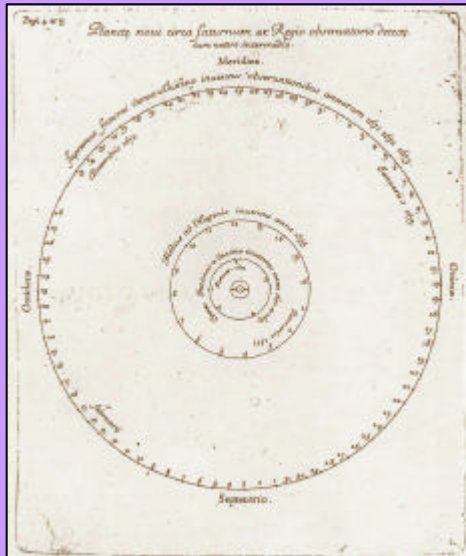
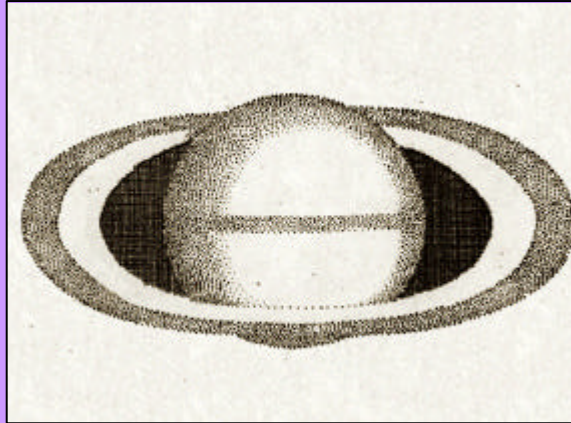
Isaac Newton

1642-1727

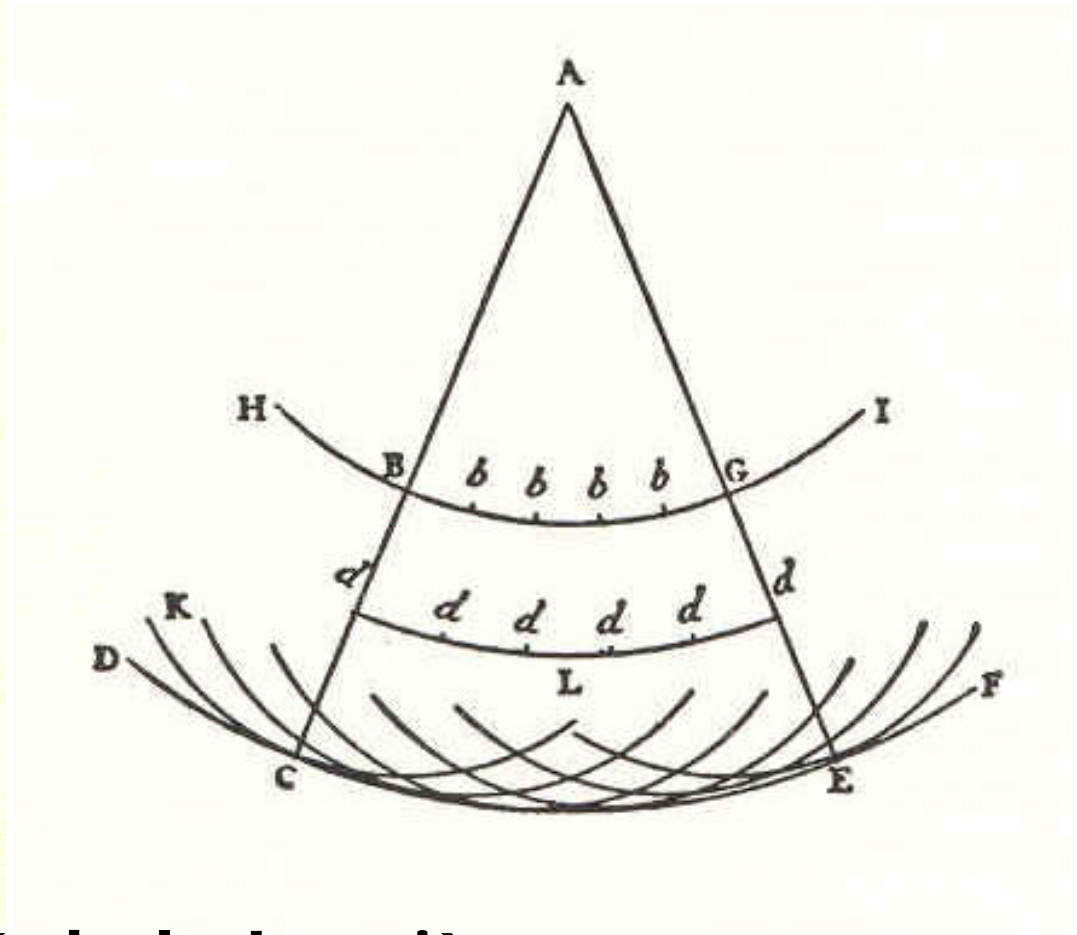
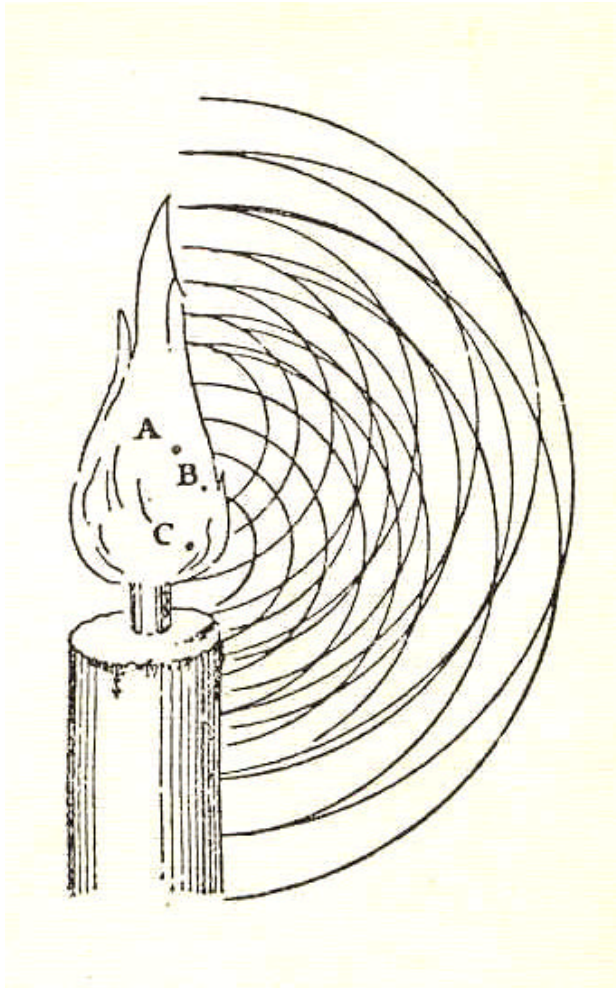


'Principia'

1687

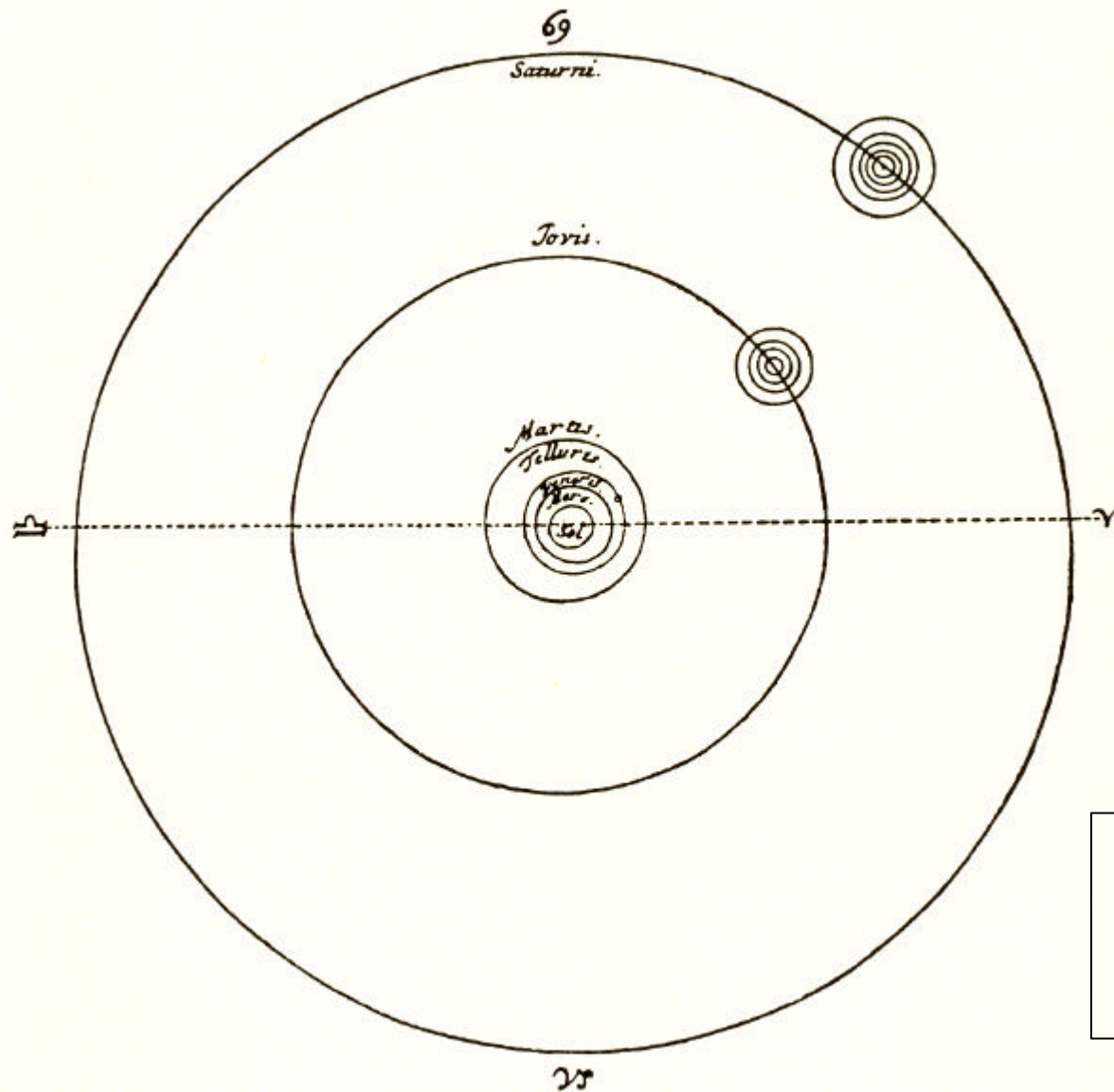


Giovanni Domenico (Jean-Dominique) Cassini
1625-1712



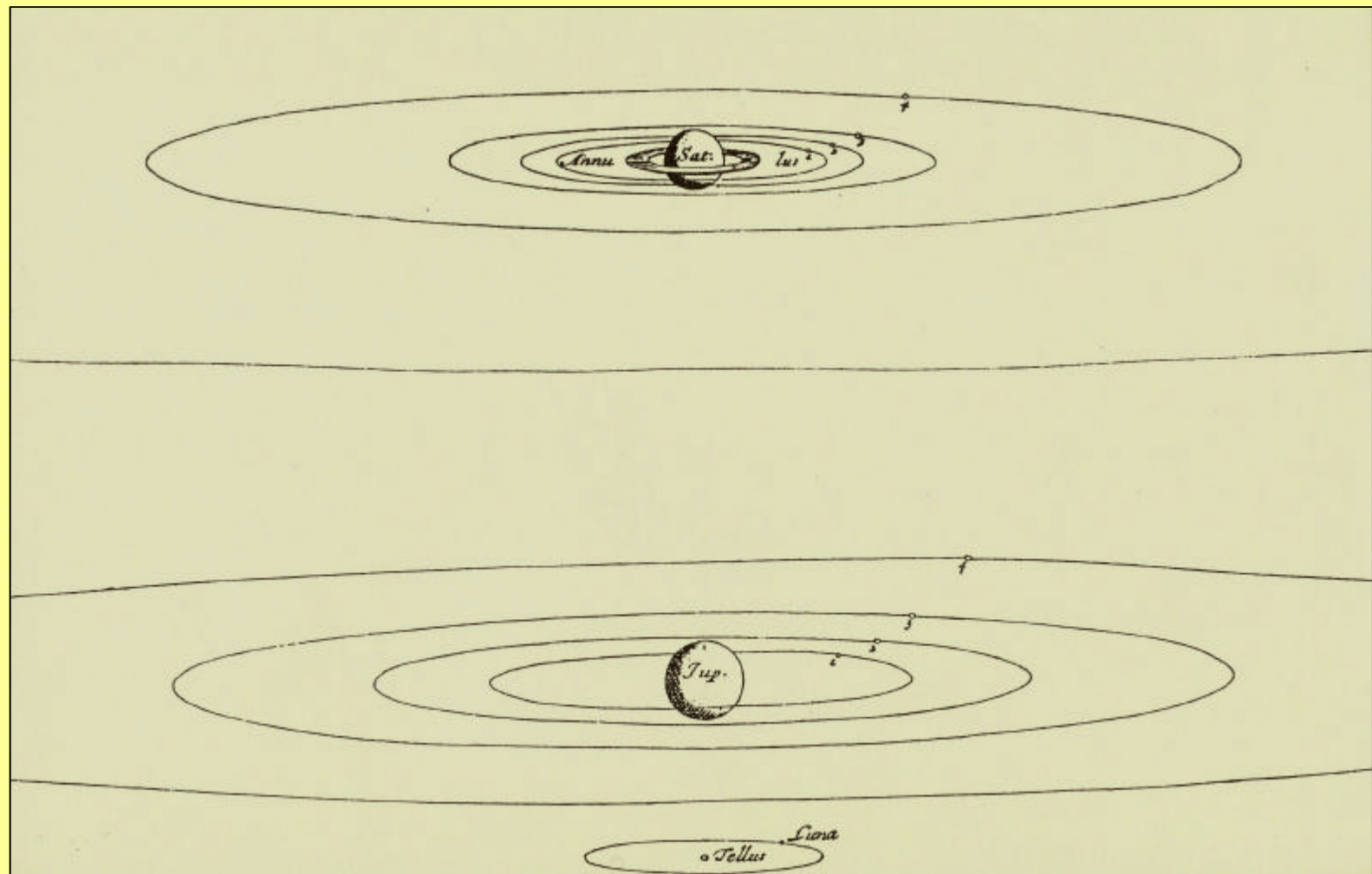
Traité de la Lumière

1690



Cosmotheoros

1698





- Pendulum clock
- Telescope & optics
- Saturn's ring(s)
- 'Wave' theory
- Probability theory
- Dynamics