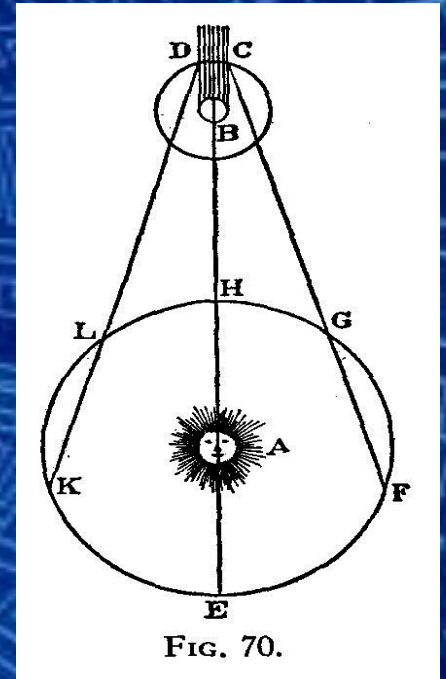


A Man, a Moon and not quite the right speed!

The Story of Ole Rømer and the speed of light.

by Tilo Hohenschläger

Overview



- The Man
- The Moon
- The Method

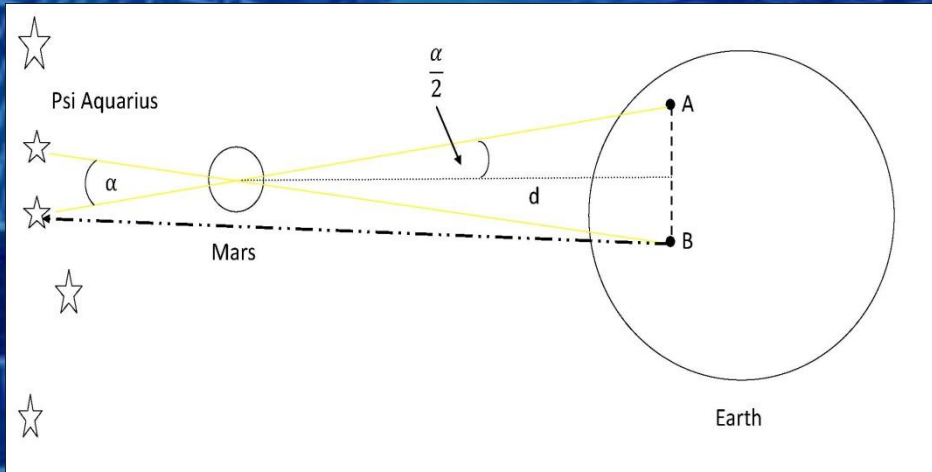
The Man

- Born 25th September 1644 in Århus, Denmark
- 1662 University of Copenhagen
- 1672 Académie des Sciences, Paris
- 1676 announced 10 min delay in eclipses of previous calculations
- 1681 Professor of Mathematics
- Died 19th September 1710 in Copenhagen

The Circumstances

- 1543 - Nicolaus Copernicus, „ On the Revolutions of the Celestial Spheres“
- 1610 - Galileo Galilei discovers the 4 largest moons of Jupiter
- 1619 - Johannes Kepler publishes his 3rd law of planetary motion, $P^2 \propto a^3$
- 1672 - Giovanni Cassini / Jean Richer Calculation of Earth-Mars distance

Rømer`s Basics

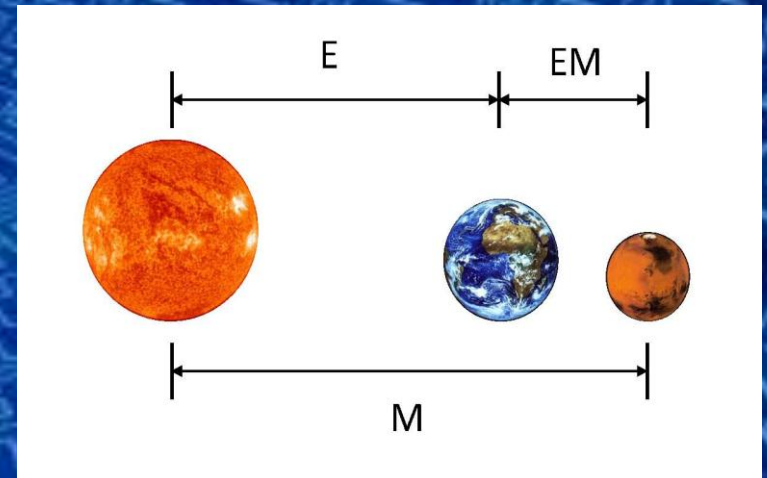


$$d = \frac{\left(\frac{1}{2} AB\right)}{\text{tangent} \left(\frac{\alpha}{2}\right)}$$

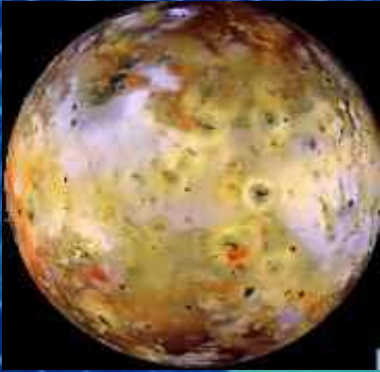
d = 72.5 million km

$$R^3 = T^2 \quad R = 1.523 \text{ AU}$$

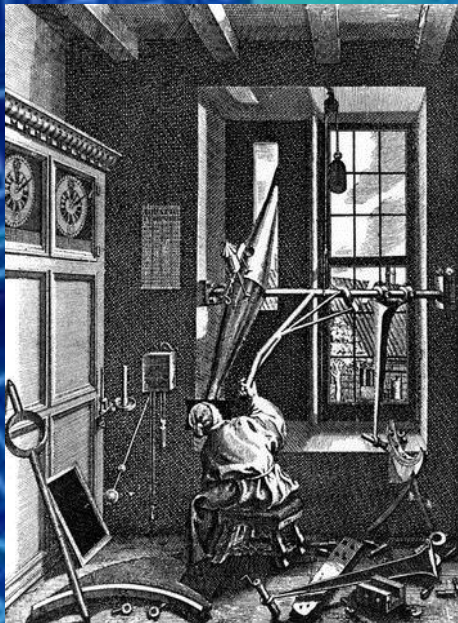
AU = 138.5 million km



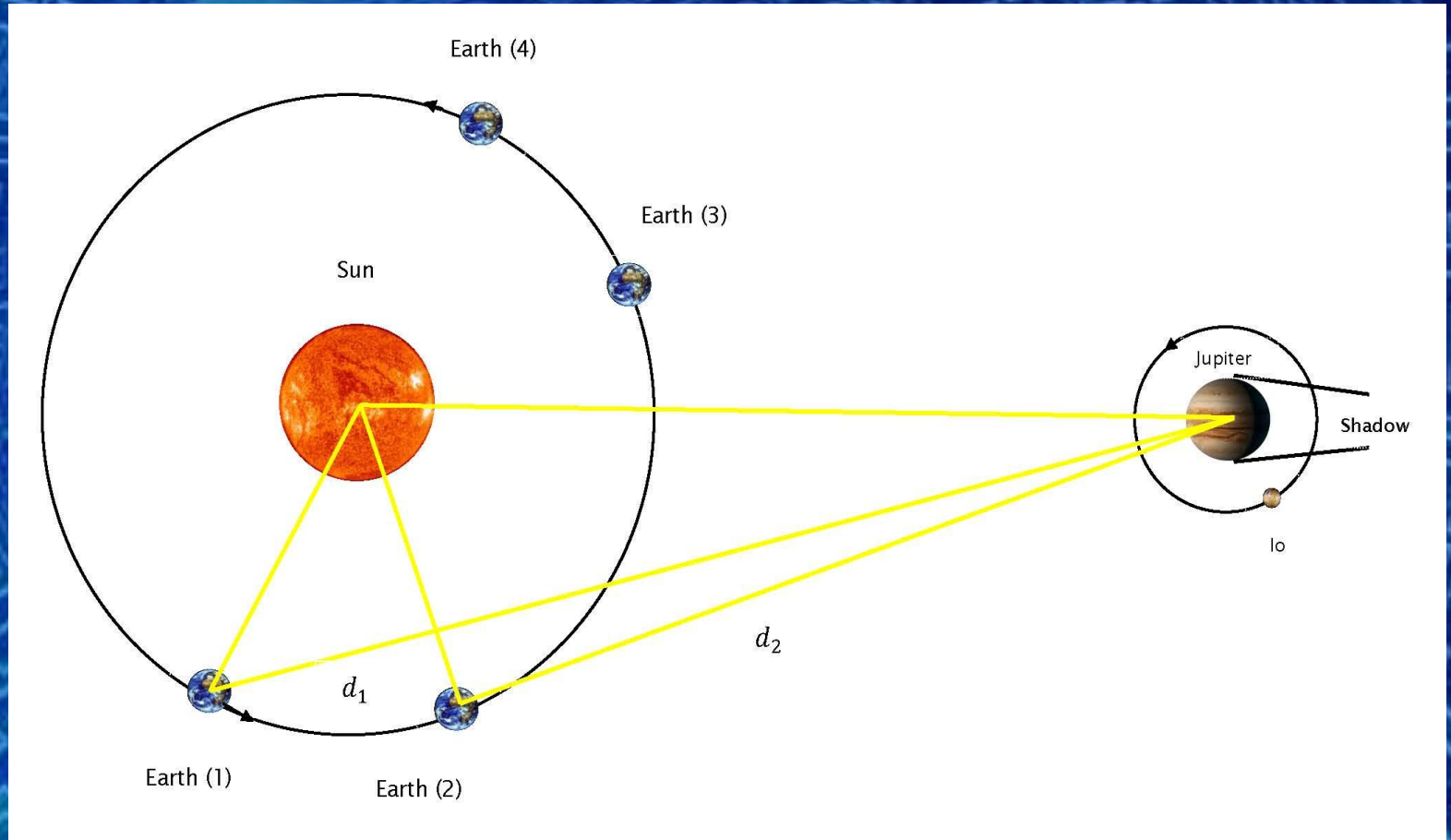
The Moon



- **Orbital Period of 42.5 hours**
- **Use of Io as World Clock**
- **Rømer noticed interval changes of Io eclipses**

[illegible]

The Method



The Method, continued

- Cosine Rule

$$a^2 = b^2 + c^2 - 2bc \cdot \cos (A)$$

- $d_2 - d_1 = 1.13 \text{ AU}$
- $v = s / t$

- Speed of light: 237000 km/s

- 1678 Christian Huygens uses data from Rømer and calculates
 $2 \text{ AU} / 22 \text{ mins} = 210000 \text{ km/s}$

Speed of Light remeasured

- 1667 Galileo at least 10x speed of sound
- 1728 James Bradley - 301000 km/s
- 1849 Armand Fizeau - 315000 km/s
- 1862 Leon Foucalt - 298000 ± 500 km/s
- 1983 CPGM - 299792.458 km/s

References

Slide 2

Picture 1: http://grafika.kopernik.pl/romer_ole/romer.jpg accessed 02/12/2010

Picture 2: <http://photojournal.jpl.nasa.gov/catalog/?IDNumber=Pla00144> accessed 02/12/2010

Picture 3: <http://de.academic.ru/pictures/dewiki/82/Roemer.jpg> accessed 02/12/2010

Slide 3

Dictionary of Scientific Biography, Volume 11, A. Pitcairn & B. Rush, New York 1975

Slide 4

Olaf Römer, die Lichtgeschwindigkeit und die Bestimmung der AE

http://gymkarthause.bildung-rp.de/fileadmin/user_upload/publikationen/astrEinheit09wow.pdf

Slide 6

Picture 1: http://apod.nasa.gov/apod/image/9703/io970321_gal_big.jpg

Picture 2: <http://www.corbisimages.com/Enlargement/BE055412.html>

Picture 3: http://upload.wikimedia.org/wikipedia/commons/c/c2/Ole_R%C3%B8mer_-_Obser._Primi_Jovialium_Parisiis_-_pp1%2B4.jpg

Slide 9

<http://www.speed-light.info/measurement.htm>

The little big book of metrology, National Physical Laboratory 2008

The End

Any Questions

