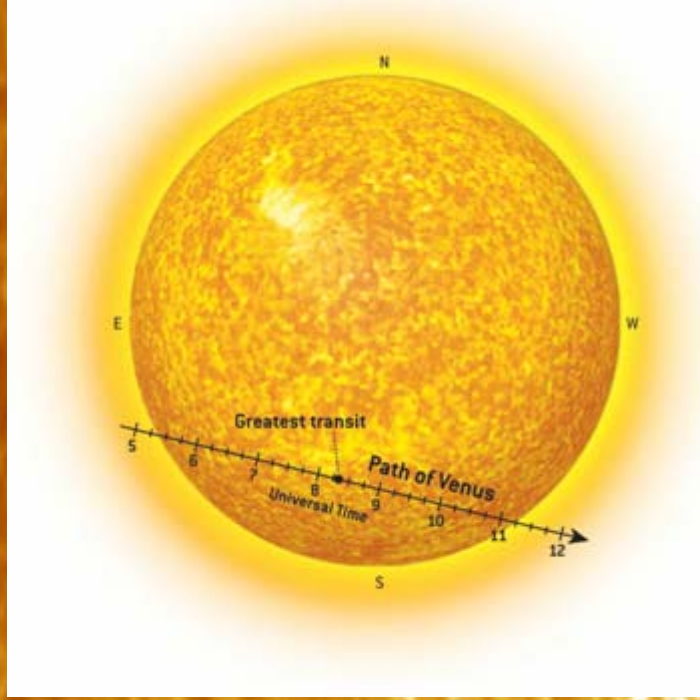
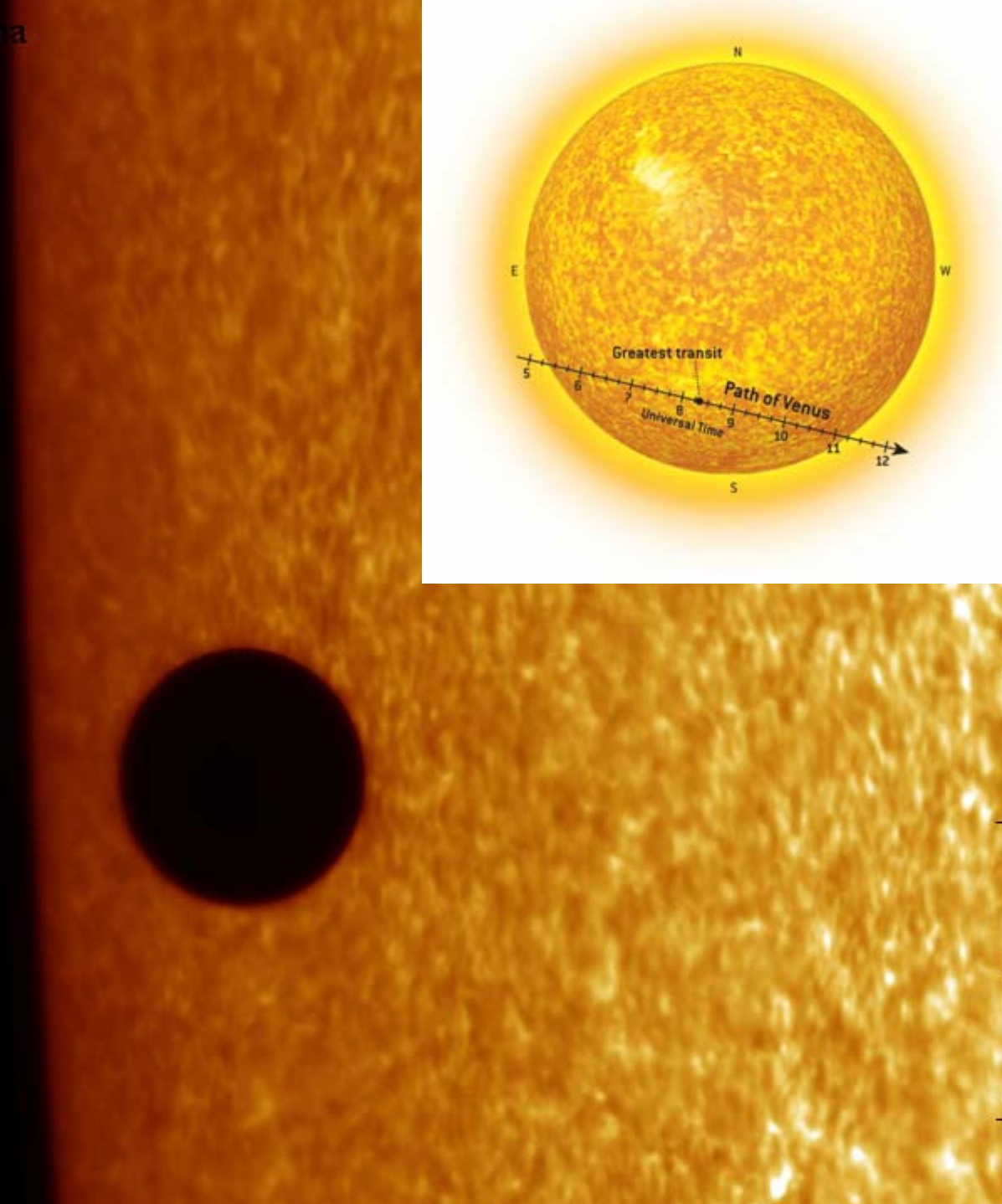
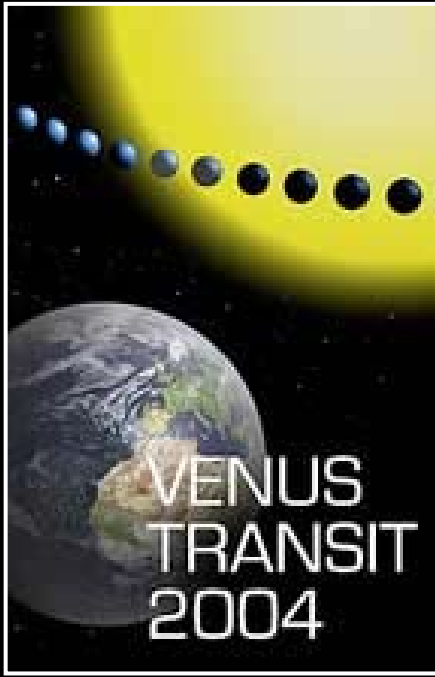


Venus transits – What for?

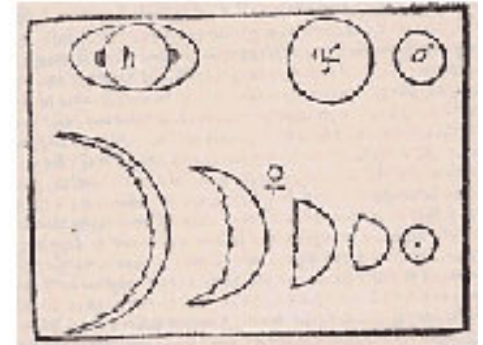


Venus transits in telescopic times

1608: invention of the telescope

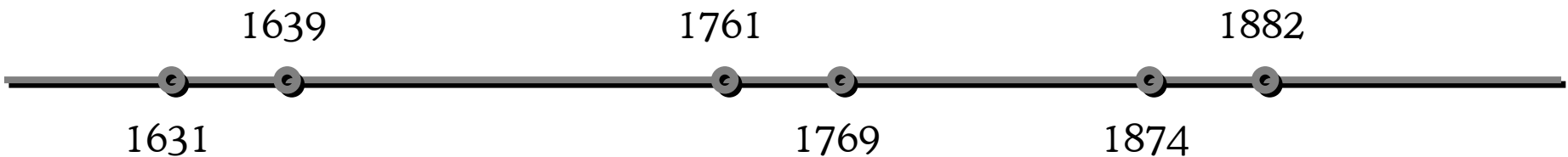
1610: Galileo Galilei observes the phases of Venus

since then: only 6 Venus transits
5 of which were definitely observed



Galileo's drawings of Saturn and the phases of Venus

Is there any scientific return from observing a transit ?



1631: Kepler's prediction

1609 & 1619:

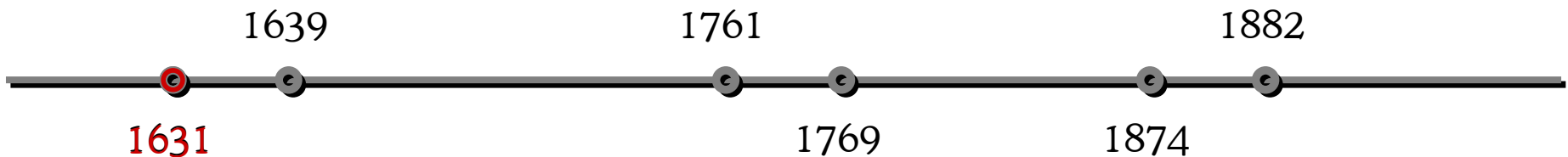


Based on Tycho Brahe's observations, Johannes Kepler comes up with his famous three [laws of planetary motion](#)

He predicts a Mercury transit for Nov. 7th, 1631 and a Venus transit for Dec. 6th, 1631

Mercury transit: observed by Pierre Gassendi in Aix en Provence

Venus transit: unobserved (not visible from Europe)



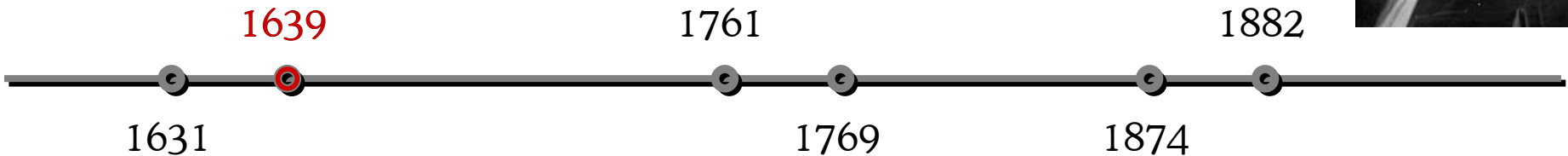
1639: a first sighting

this Venus transit was observed by
Jeremiah Horrocks in Toxteth and
William Crabtree in Manchester



1663: James Gregory suggests that transits
allow to measure the [Astronomical Unit](#) (AU)

1677: Edmund Halley observes a Mercury transit
and independently draws the same conclusion
(published in 1716)



AU: how distant is the Sun?

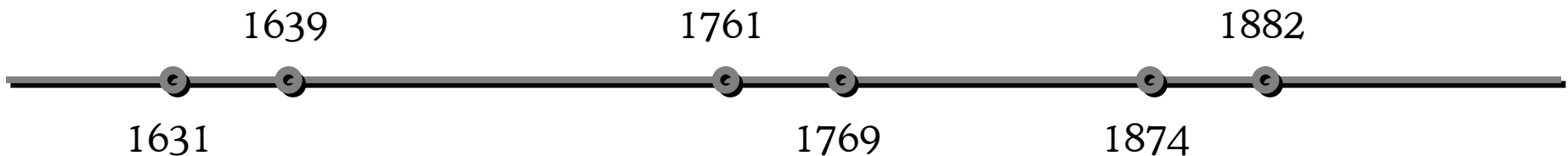
~ 250 BC: Aristarchos of Samos calculates $AU \approx 7$ million km

16th century: Tycho Brahe measures $AU \approx 8$ million km

17 century: Johannes Kepler estimates $AU \approx 24$ million km
Vendelinus measures $AU \approx 88$ million km

1672 Giovanni Cassini measures $AU \approx 140$ million km

1677 Edmund Halley measures $AU \approx 29$ million km



1761: Expeditions I

British expeditions to: Sumatra and St. Helena

French expeditions to: Sibiria, Vienna, Rodriguez (Indian Ocean) and Pondicherry/India (detoured to Mauritius)

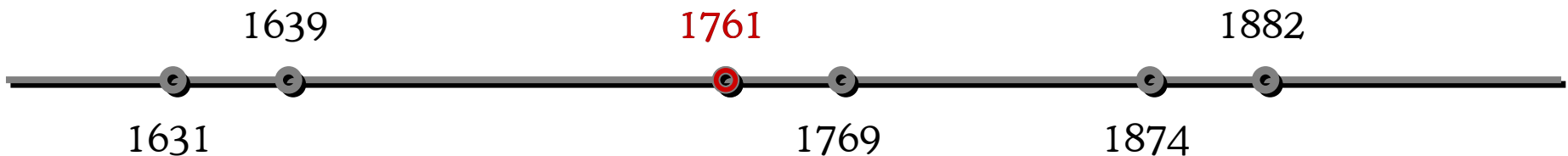
American expedition: Prof. Winthrop (Harvard) to Newfoundland

Swedish observations: Uppsala, Kajaneborg, Stockholm, Härnösand, Åbo, Kalmar, Karlskrona, Lund, ...

Mikhail V. Lomonosov in St. Petersburg: “ring of light” around Venus



result: **125.000.000 km < 1 AU < 155.000.000 km**



1769: Expeditions II

176 observers in 117 locations

first international astronomical collaboration

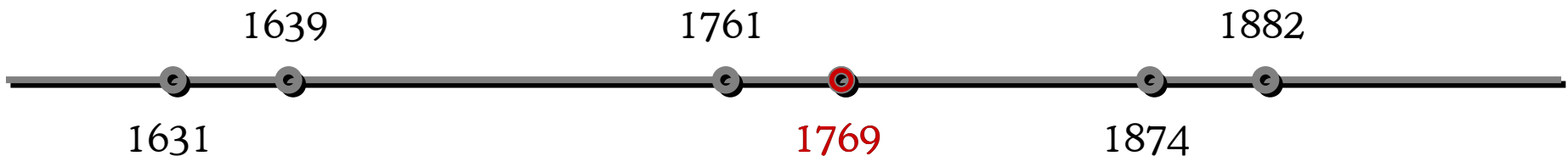
Zarina Katharina Alexejewna invites astronomers to Sibiria

King George III. of England: Observatory in Kew

most famous expedition: Captain James Cook on the “Endeavour” to Tahiti



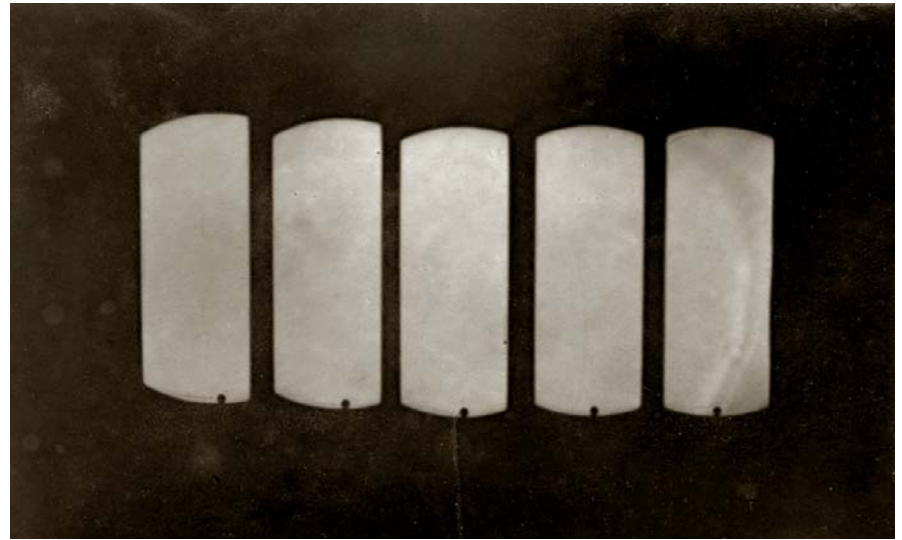
result: **148.000.000 km < 1 AU < 155.000.000 km**



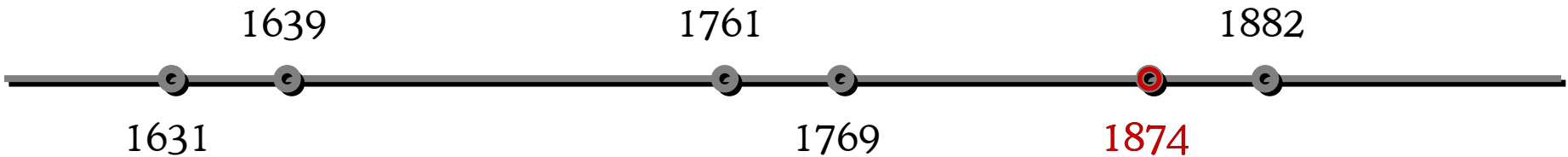
1874: public hype

December 9th: Venus transit headline on all newspapers

novel technique: photography



result: $148.977.000 \text{ km} < 1 \text{ AU} < 149.669.000 \text{ km}$

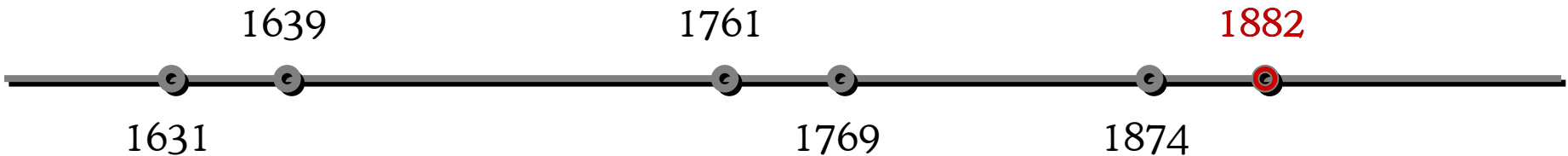
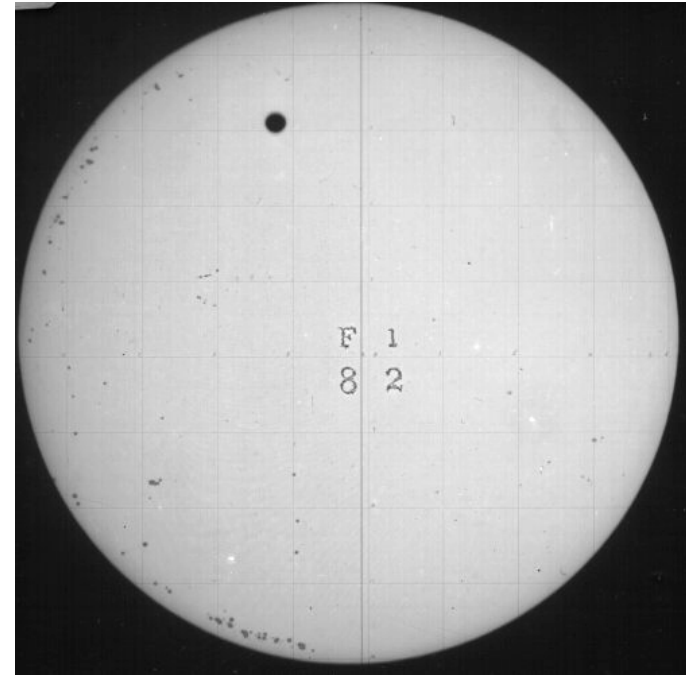


1882: Now or never...

Simon Newcomb/American Nautical Almanac Office:
expedition to Wellington/South Africa

He collects all data and publishes a new
standard value for the AU in 1890:

$$1 \text{ AU} = 149.595.000 \pm 90.000 \text{ km}$$



since 1882

since 1900: measurements using Eros

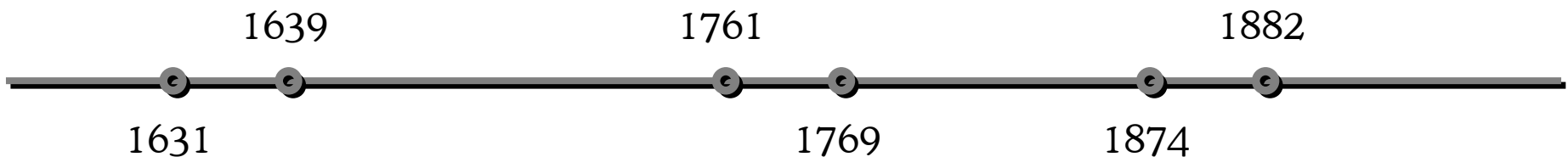
since 1960s: radar echos off Venus

$$1 \text{ AU} = 149\,597\,892.3 \pm 1.5 \text{ km}$$

1970s: new definition of the AU by the IAU

1 AU is the radius of a Keplerian circular orbit of a point-mass having an orbital period of $2\pi/k$ days (k: Gaussian gravitational constant)

$$1 \text{ AU} \equiv 149\,597\,870.691 \text{ km}$$



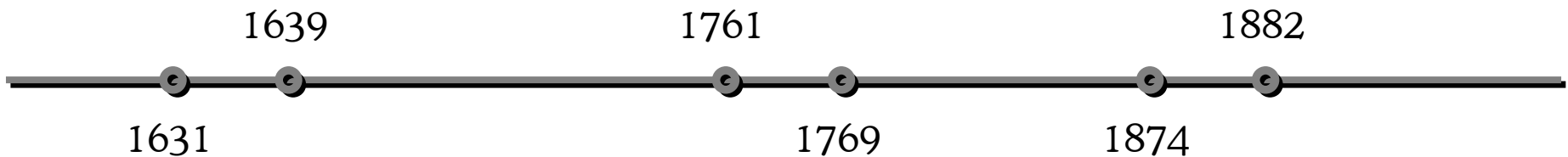
VT in 2004

“... there will be no other till the twenty-first century of our era has dawned upon the earth, and the June flowers are blooming in 2004.”

William Harkness (1882)

inauguration of Venus at KTH
as part of the Swedish Solar System (SSS)

Swedish Solar Telescope on La Palma:
attempt to “detect” Venus spectroscopically
by analysing the sunlight that passes through
its atmosphere (input for exoplanet research)



as for the future...

6th of June, 2012 & 11th of December, 2117: non visible from Europe

next chance from Europe: 8th of December, 2125

