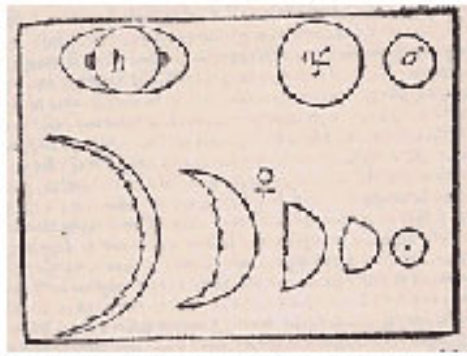
Venus transits – What for?

Venus transits in telescopic times

1608: invention of the telescope

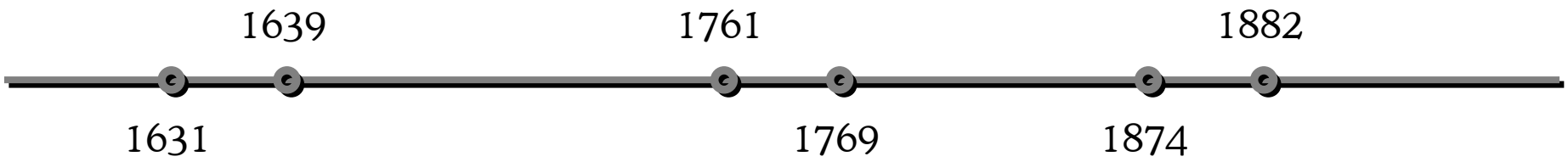
1610: Galileo Galilei observes the phases of Venus



Galileo's drawings of Saturn and the phases of Venus

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

Is there any scientific return from observing a transit ?

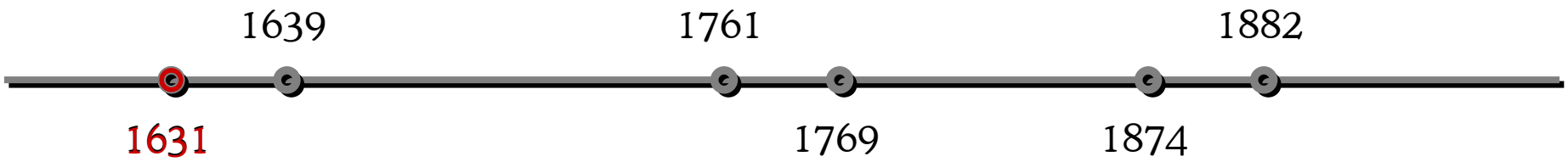


1631: Kepler's prediction

1609 & 1619: Based on Tycho Brahe's observations, Johannes Kepler comes up with his famous three laws of planetary motion

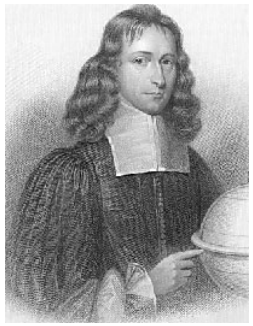
He predicts a Mercury transit for Nov. 7th, 1631 and a Venus transit for Dec. 6th, 1631

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)

1631 1639 1761 1769 1874 1882

AU: how distant is the Sun?

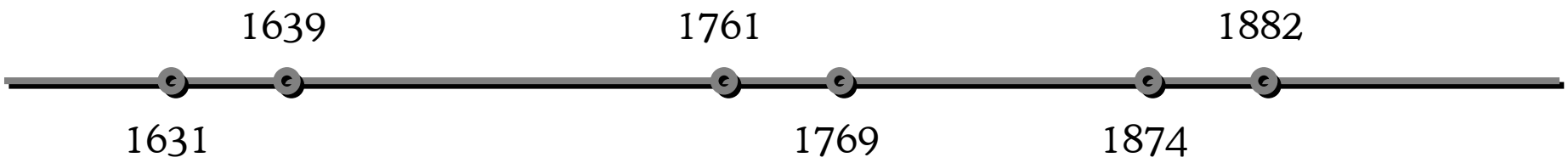
~ 250 BC: Aristarchos of Samos calculates AU ≈ 7 million km

16th century: Tycho Brahe measures AU ≈ 8 million km

17 century: Johannes Kepler estimates AU ≈ 24 million km
Vendelinus measures AU ≈ 88 million km

1672 Giovanni Cassini measures AU ≈ 140 million km

1677 Edmund Halley measures AU ≈ 29 million km



1761: Expeditions I

British expeditions to: Sumartra and St. Helena

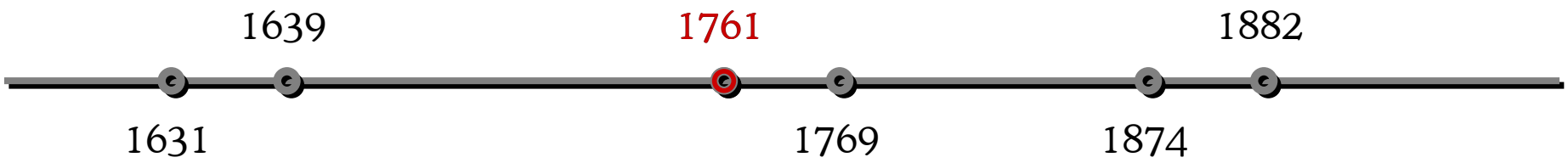
French expeditions to: Sibiria, Vienna, Rodriguez (Indian Ocean) and Pondicherry/India (detoured to Mauritius)

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

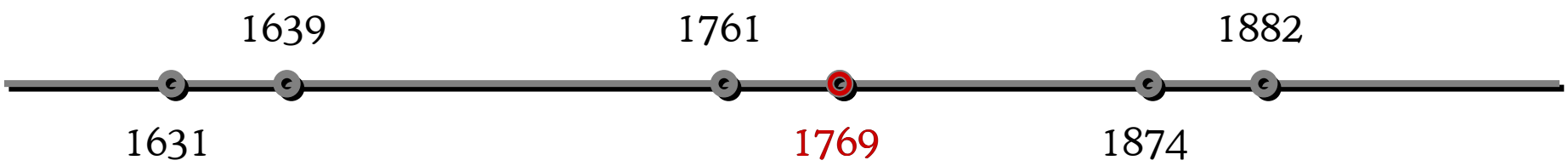
176 observers in 117 locations
first international astronomical collaboration

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

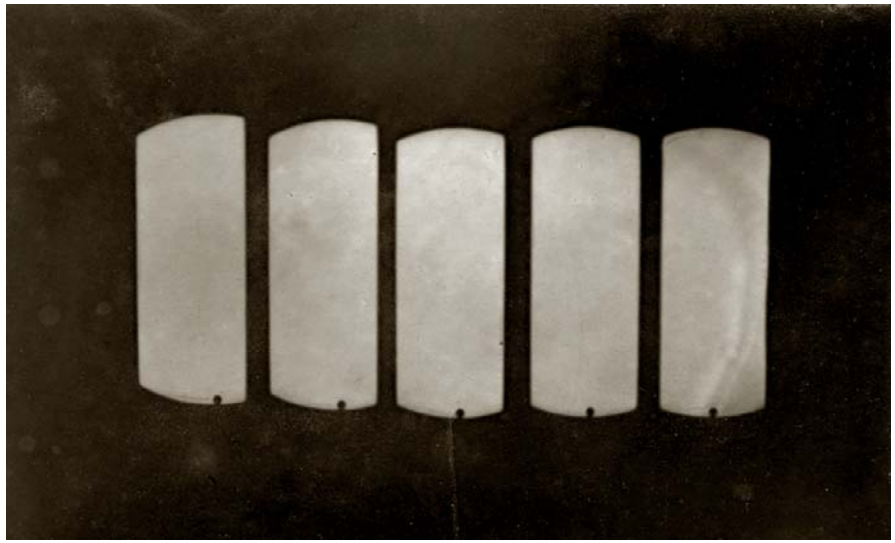
result: **148.000.000 km < 1 AU < 155.000.000 km**



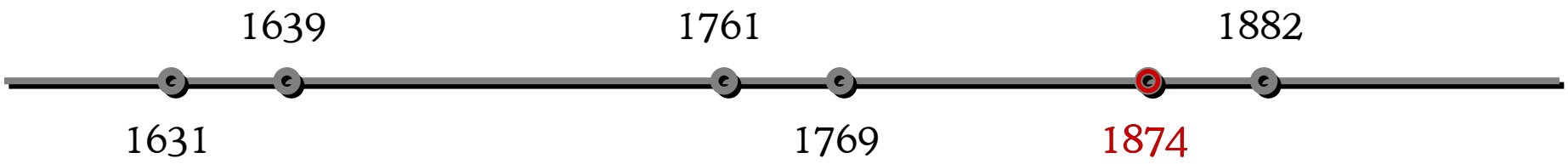
1874: public hype

December 9th: Venus transit headline on all newspapers

novel technique: photography



result: **148.977.000 km < 1 AU < 149.669.000 km**

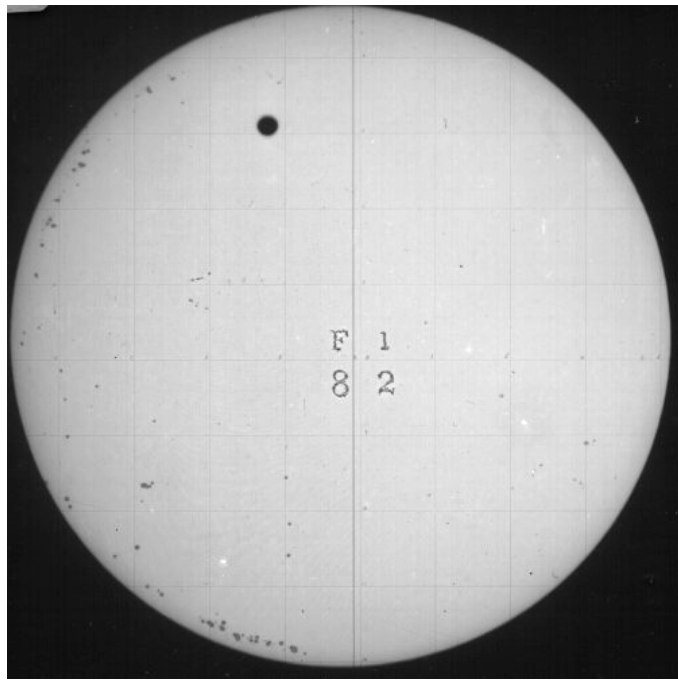


1882: Now or never…

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

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

1 AU = 149.595.000 ± 90.000 km



1639 1761 1882

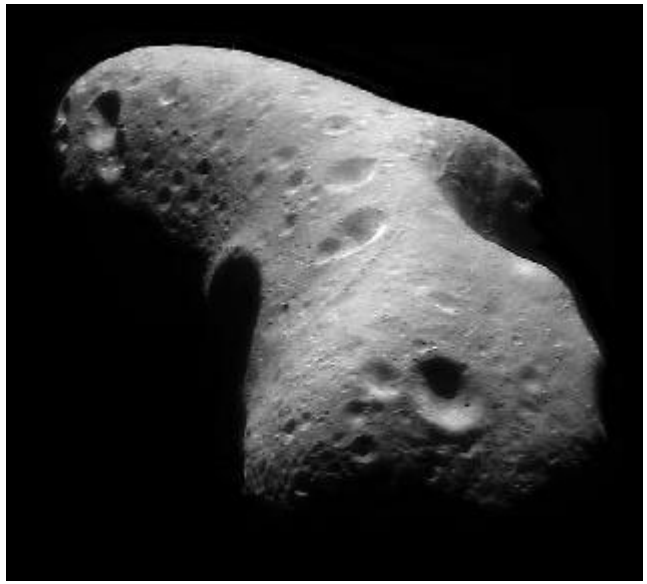
1631 1769 1874

since 1882

since 1900: measurements using Eros

since 1960s: radar echos off Venus

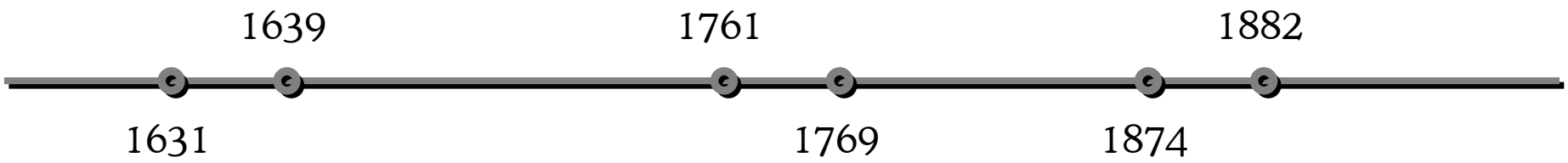
1 AU = 149 597 892.3 ± 1.5 km



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 AU ≡ 149 597 870.691 km



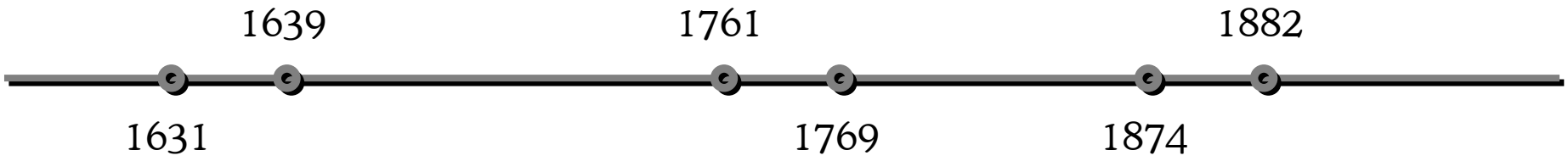
VT in 2004

"… 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)

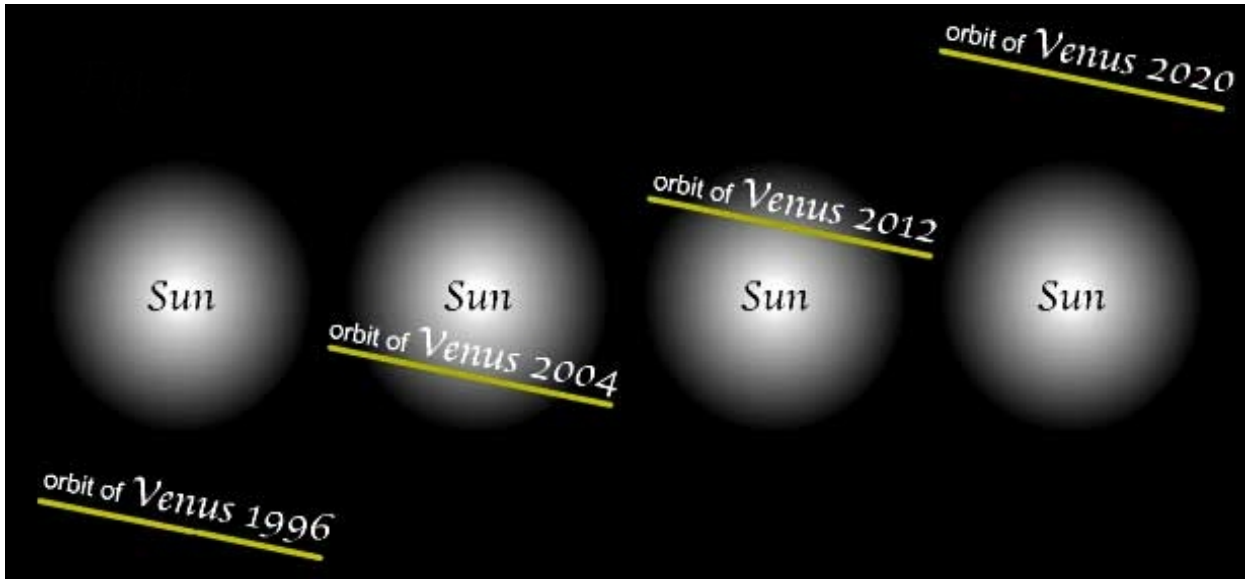
Swedish Solar Telescope on La Palma:
attempt to "detect" Venus spectroscopically by analysing the sunlight that passes through its atmosphere (input for exoplanet research)



as for the future…

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

next chance from Europe: 8th of December, 2125



1639 1761 1882

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