

The transit of Venus and the measure of Solar diameter

Costantino Sigismondi

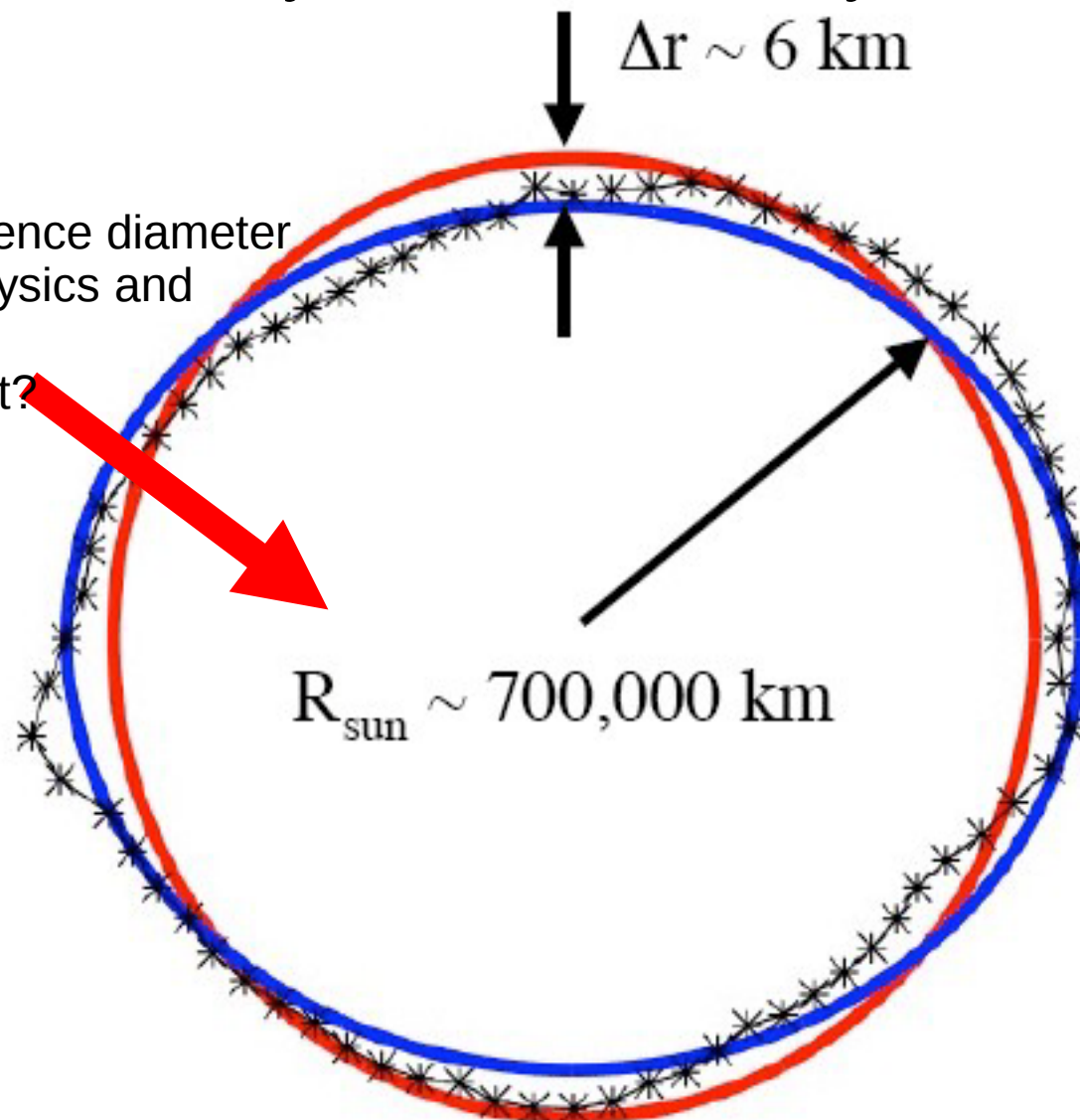
sigismondi@icra.it

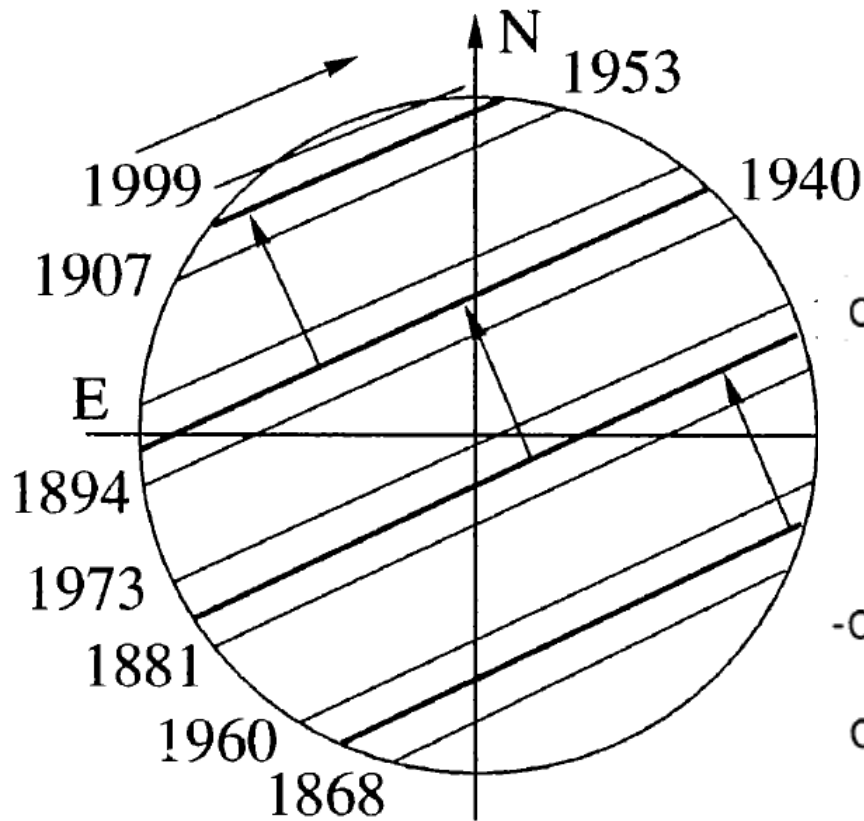


ESOPXXXI and Clavius 4th Centennial Meeting
Pescara, ICRANet Coordinating Center
August 25th 2012

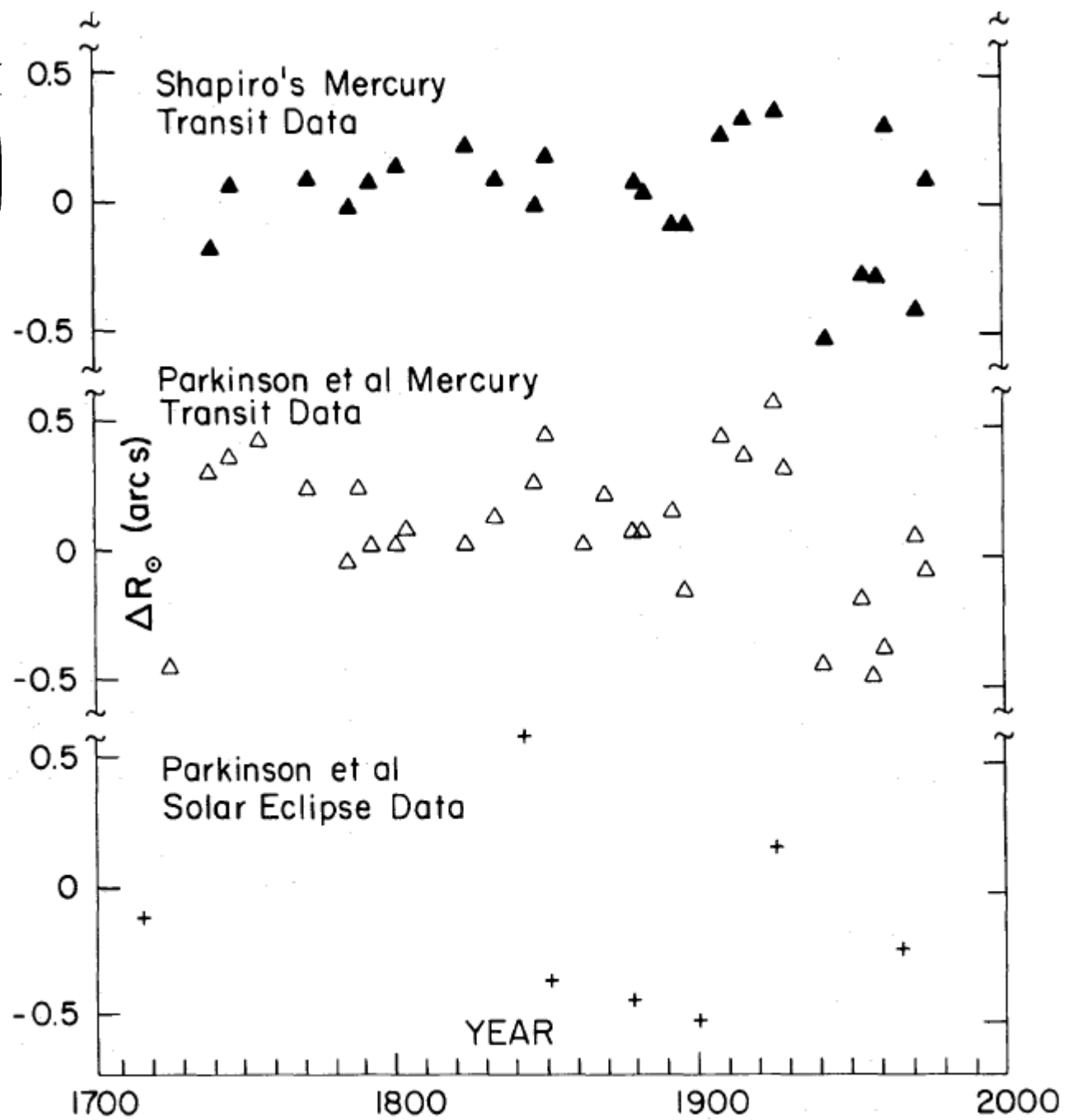
Solar oblateness: better measurement from RHESSI
(2008) correspondant to $J_2=10^{-7} \rightarrow$ Mercury perihelion
 $\delta\theta = 0.02$ arcsec/cy; 42.98 arcsec/cy are all relativistic.

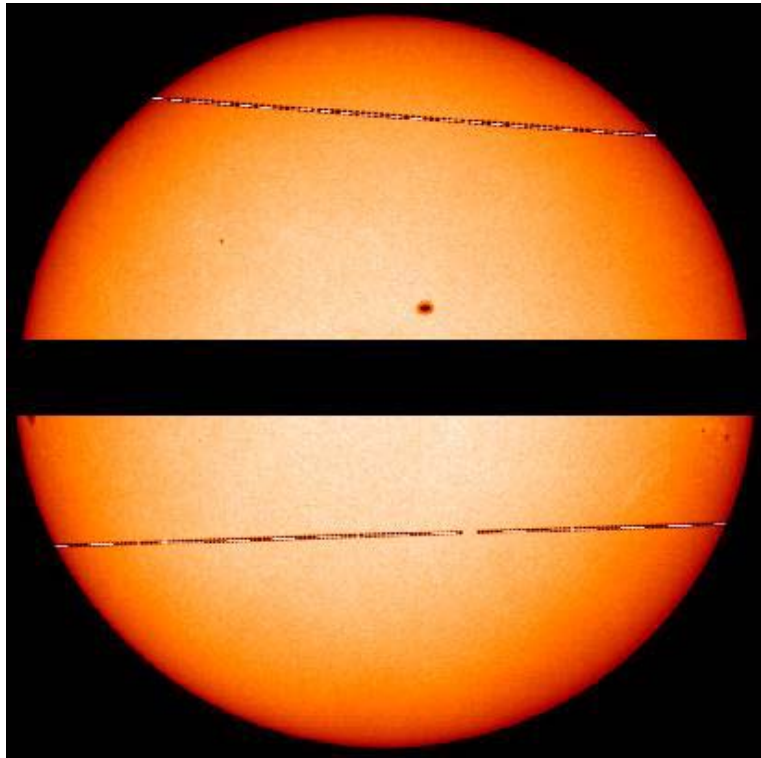
The problem of reference diameter
is crucial for solar physics and
Earth's climate:
Does it change or not?



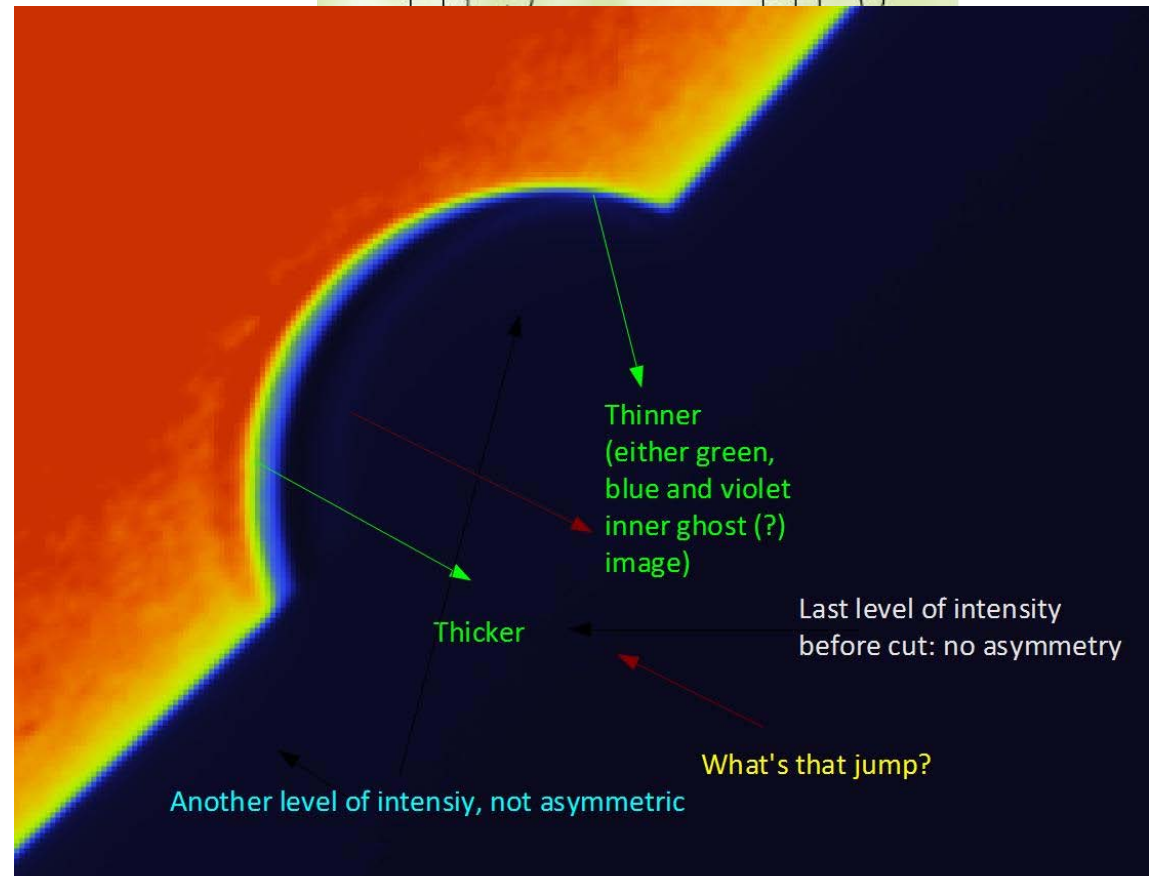
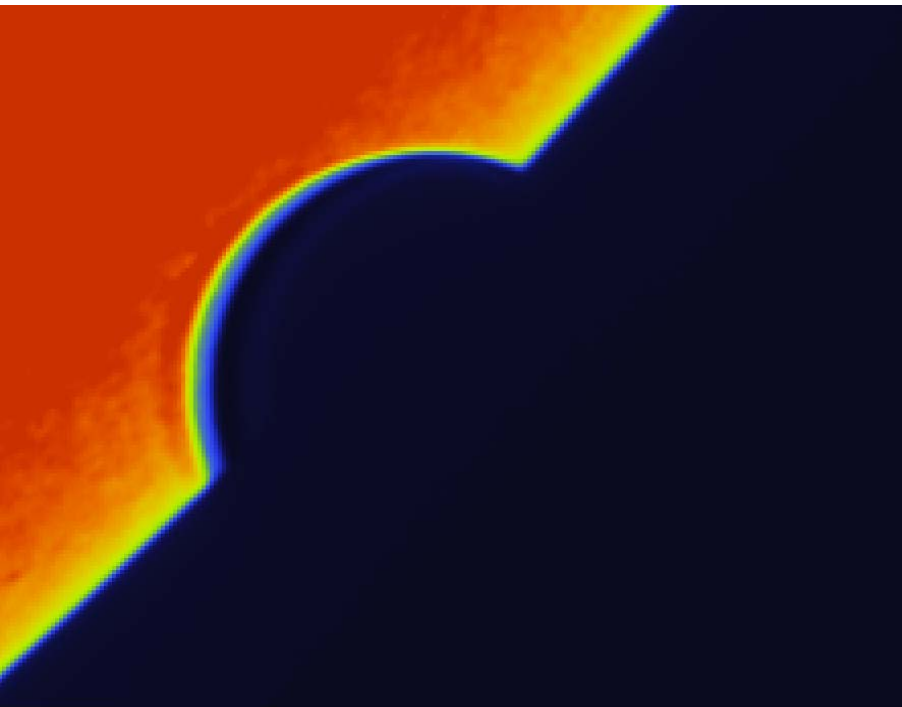
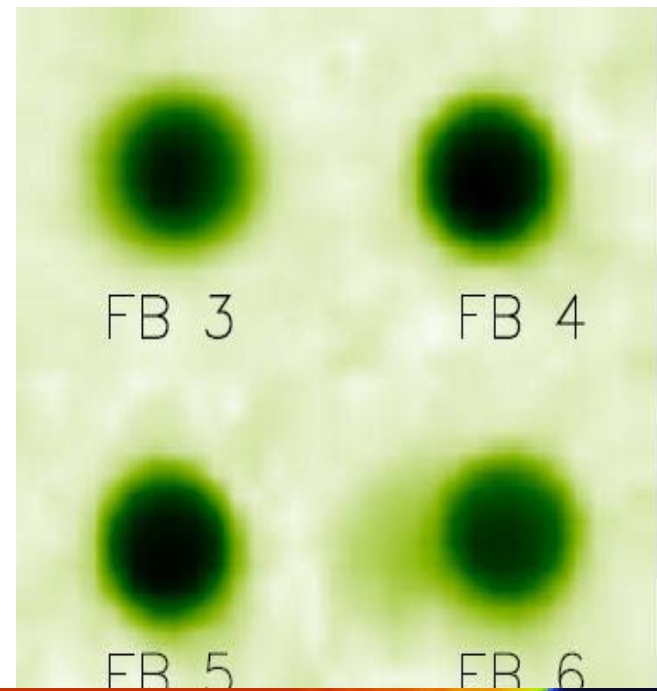


Mercury transits and solar diameter
from Gilliland 1981

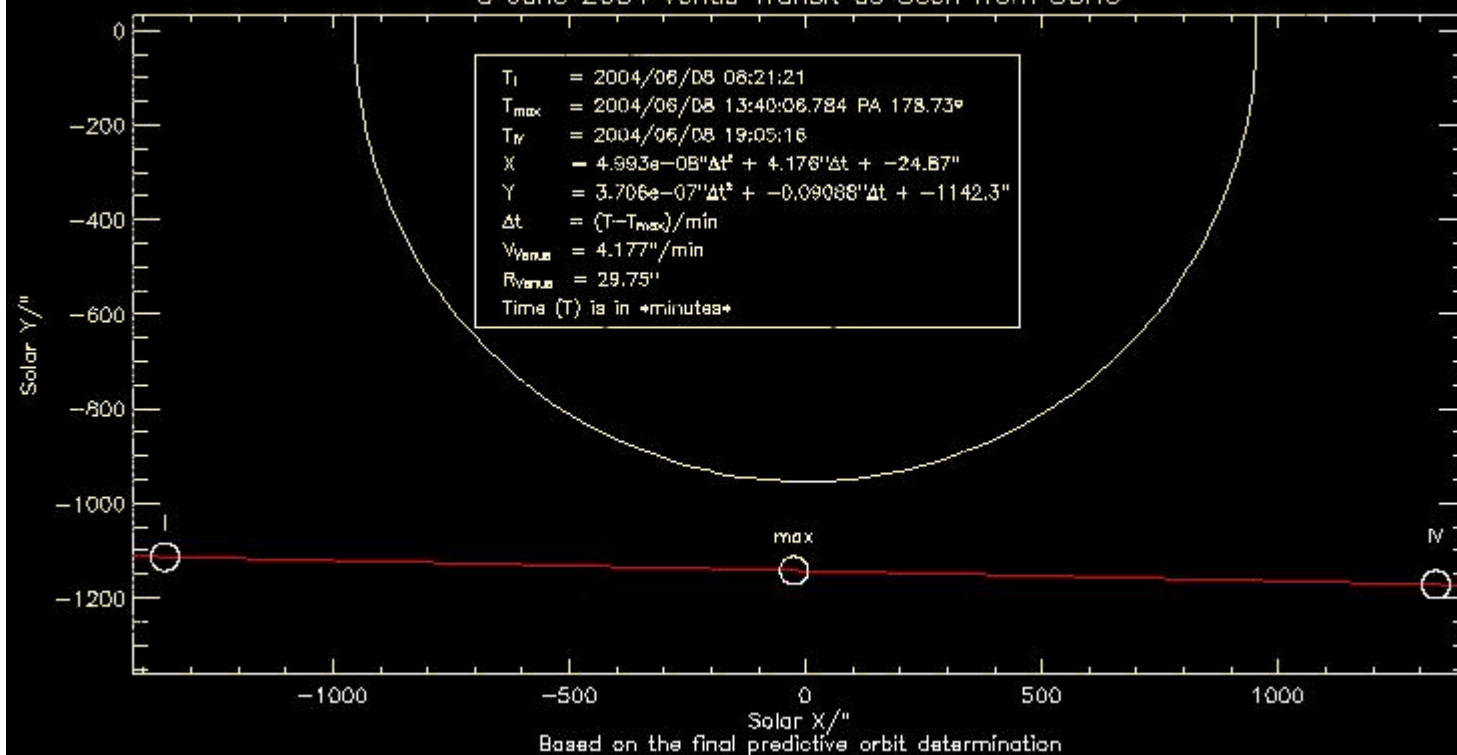




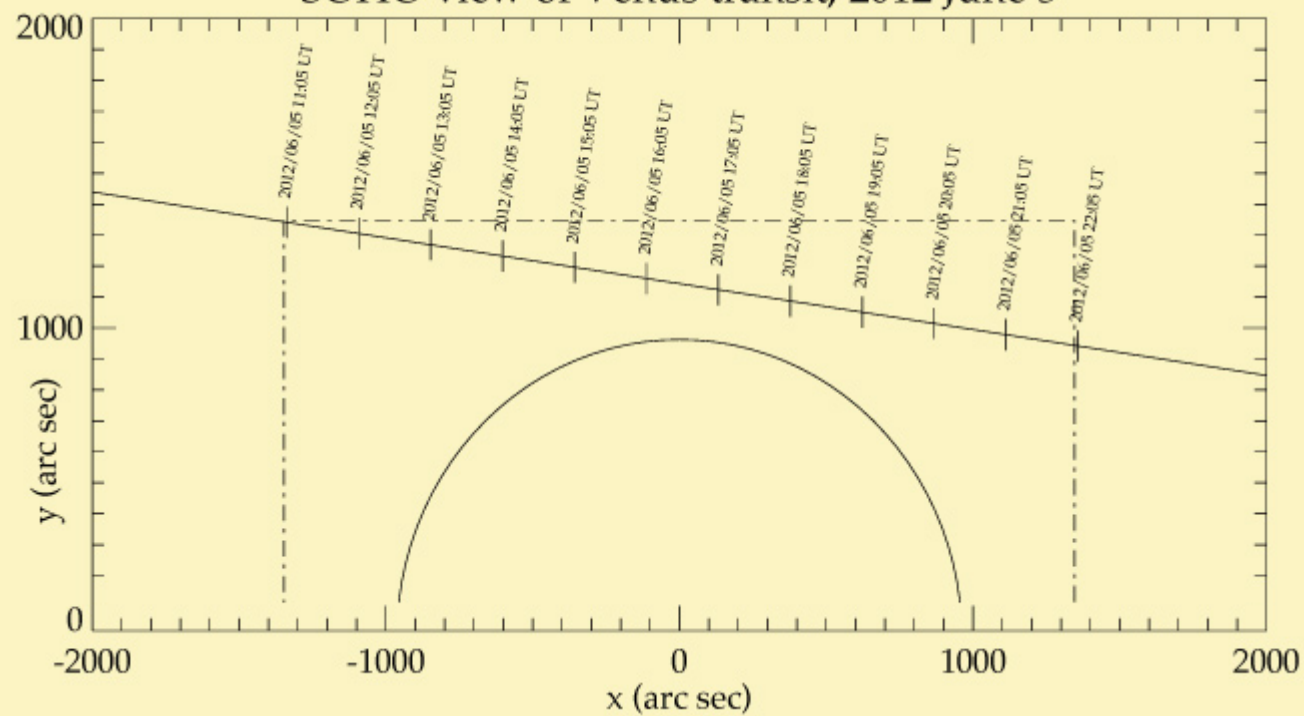
SOHO
2003/2006
and
SDO 2012

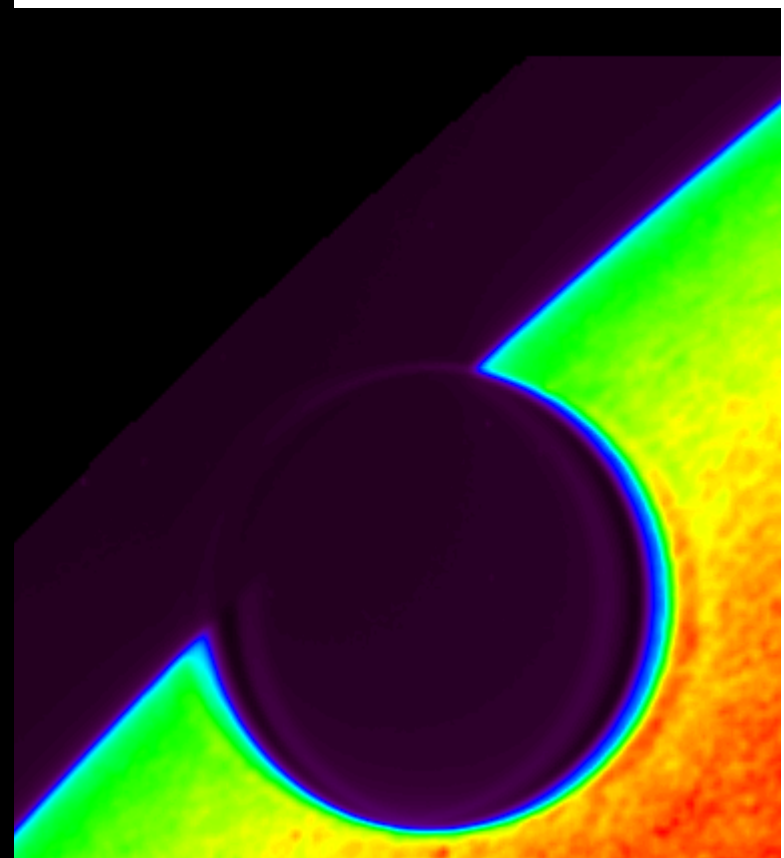
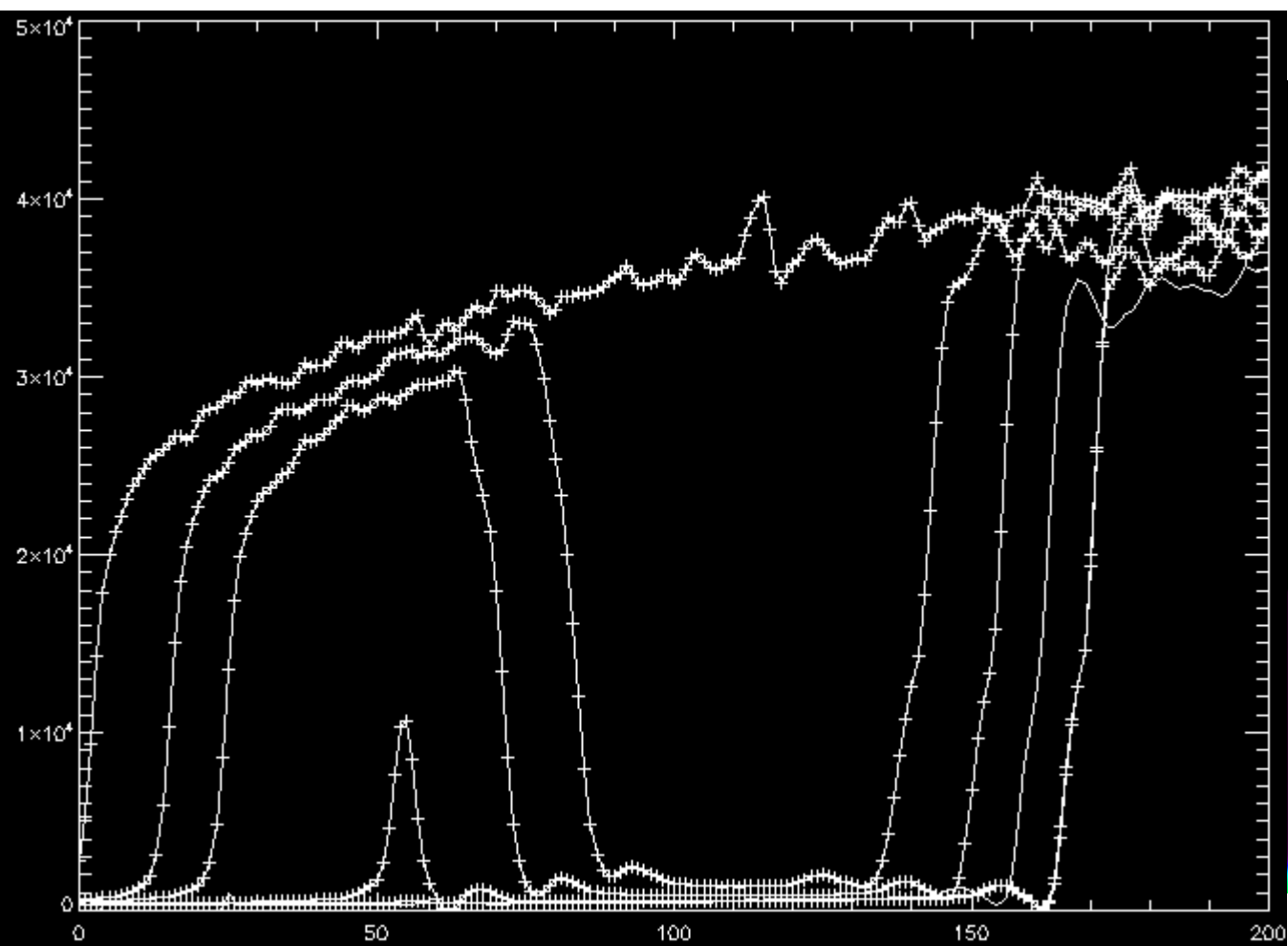


8 June 2004 Venus Transit as Seen from SOHO



SOHO view of Venus transit, 2012 June 5

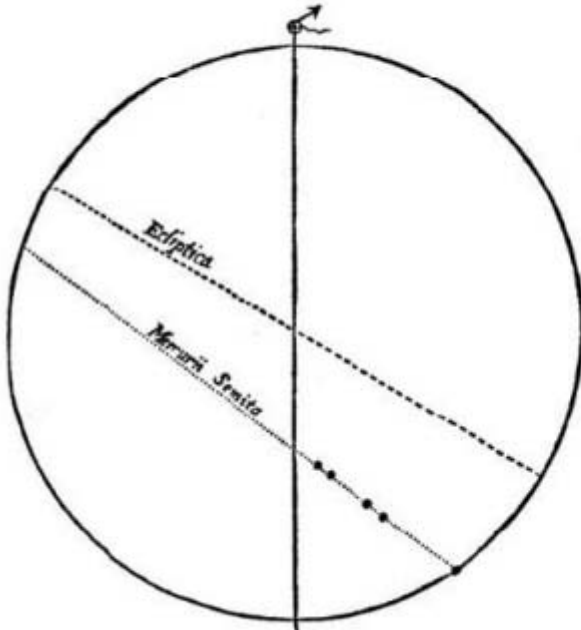




SDO radial PSF

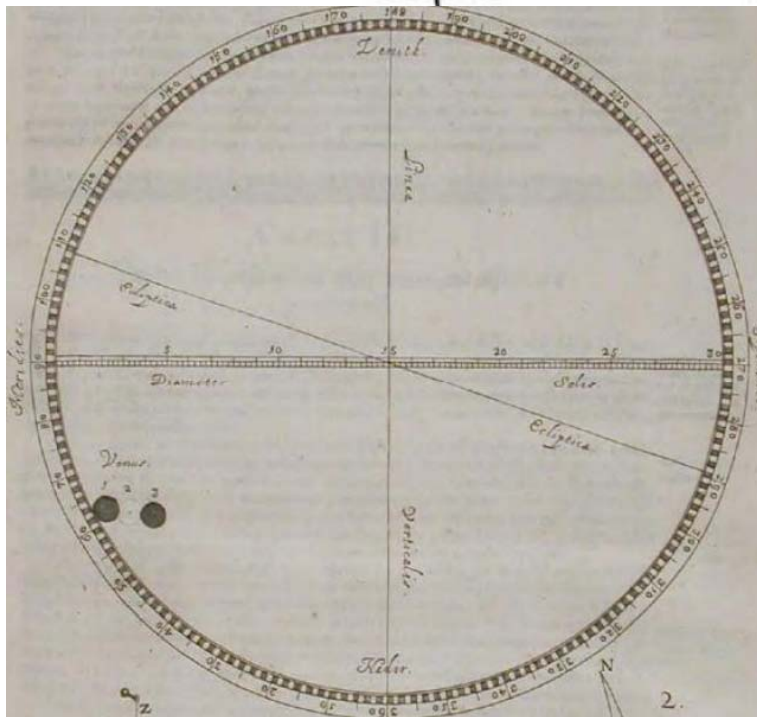
1631-1639: test for ephemerides

Discus Solis cum transiente Mercurio, prout intra obscuram Scenam se innexit in Circulo citra Telescopium obiecto exhibuit.

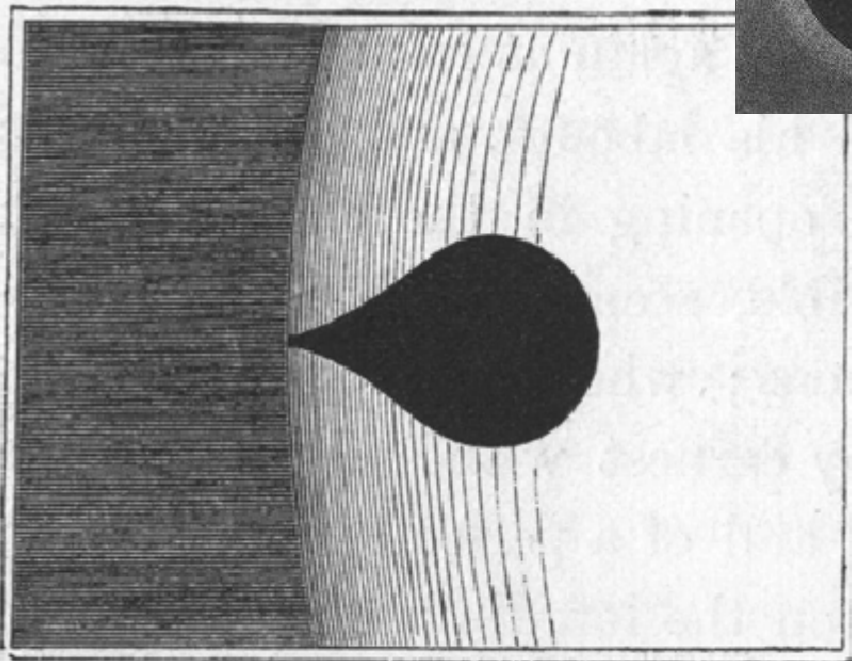
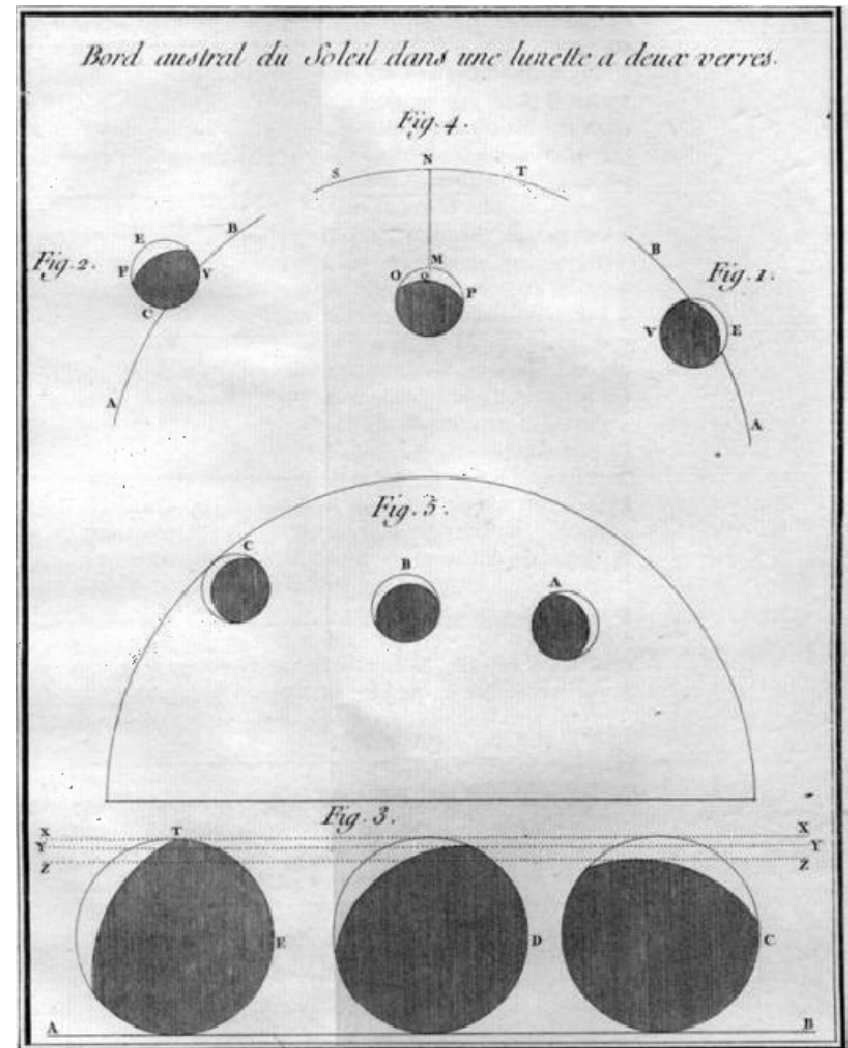
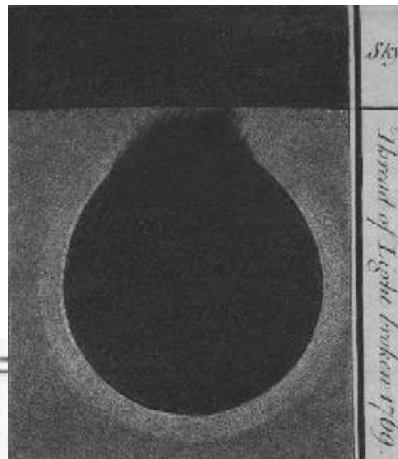
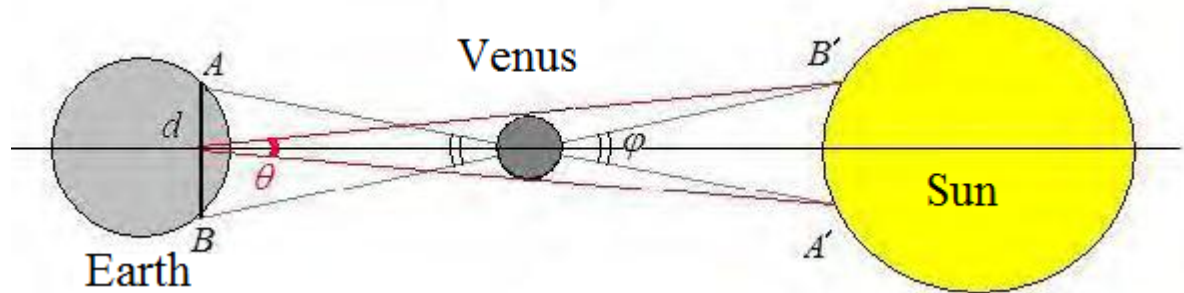


1631: Gassendi sees the first transit of Mercury, but not Venus

1639: Horrocks and Crabtree observed the last phase of the first transit of Venus

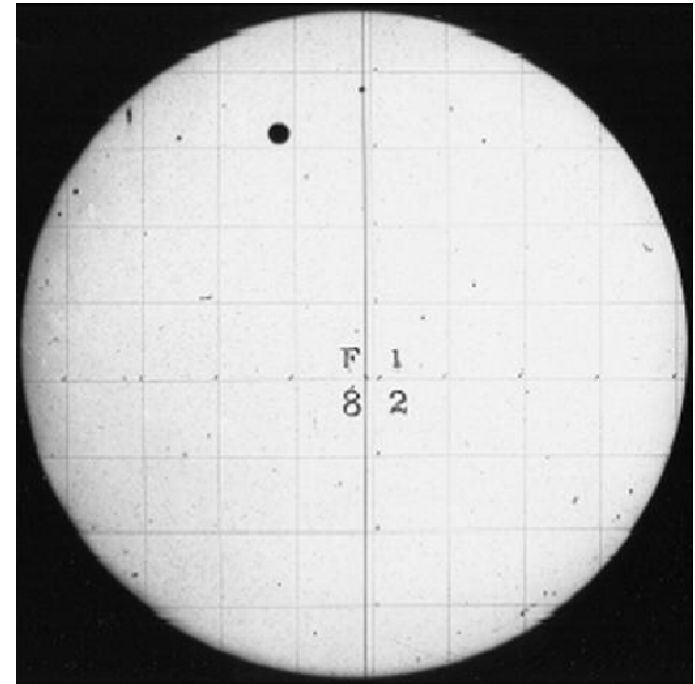
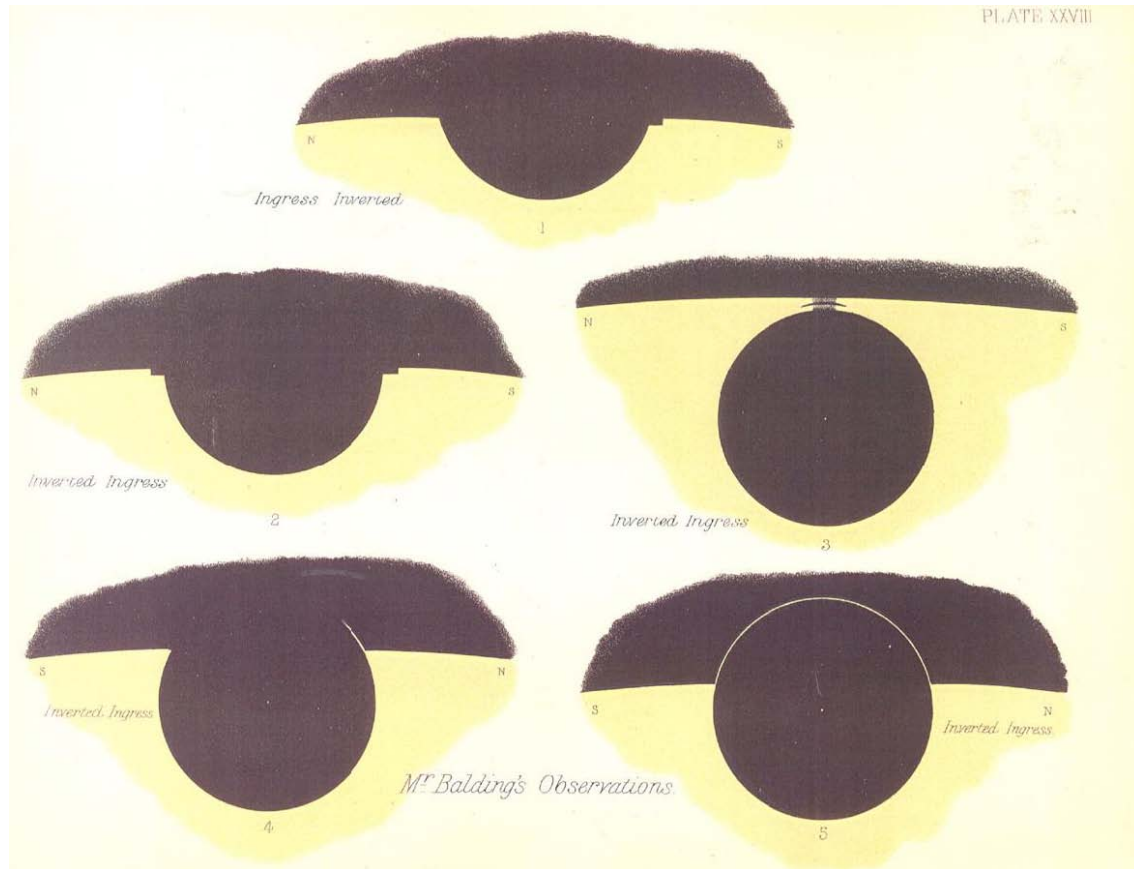


1761-1769 AU, black drop & white arc: first global science project

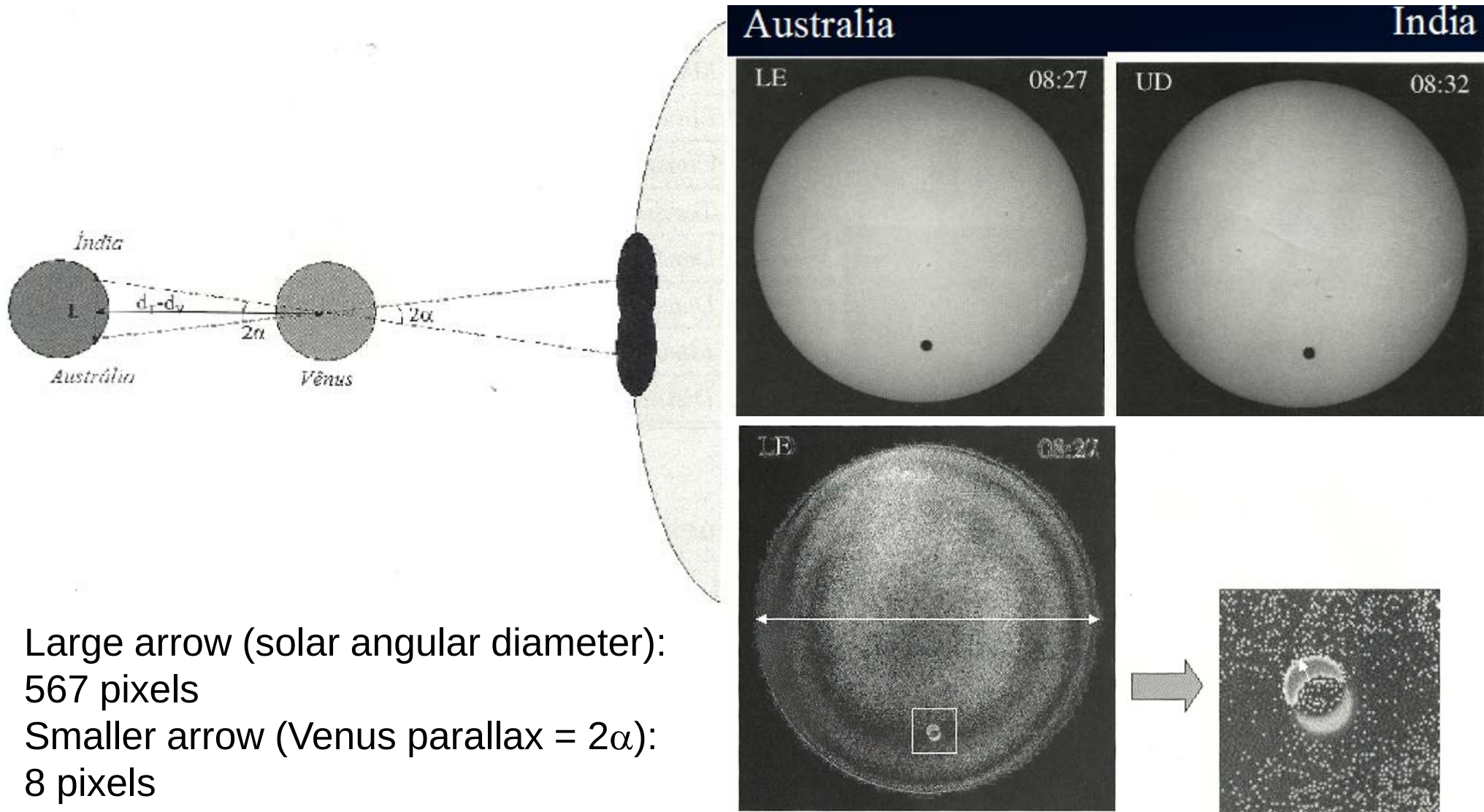


VENUS DURING ITS TRANSIT IN 1769.

1874-1882 at the dawn of photography era



2004: educational transit

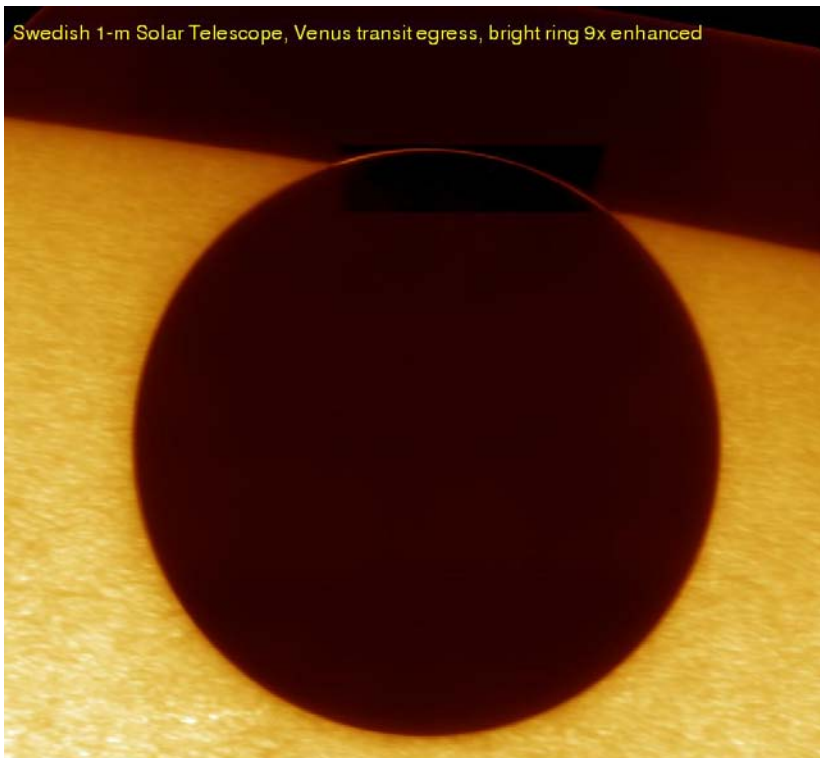


567 px $\rightarrow$ $0,53^\circ$ (08/06/2004)

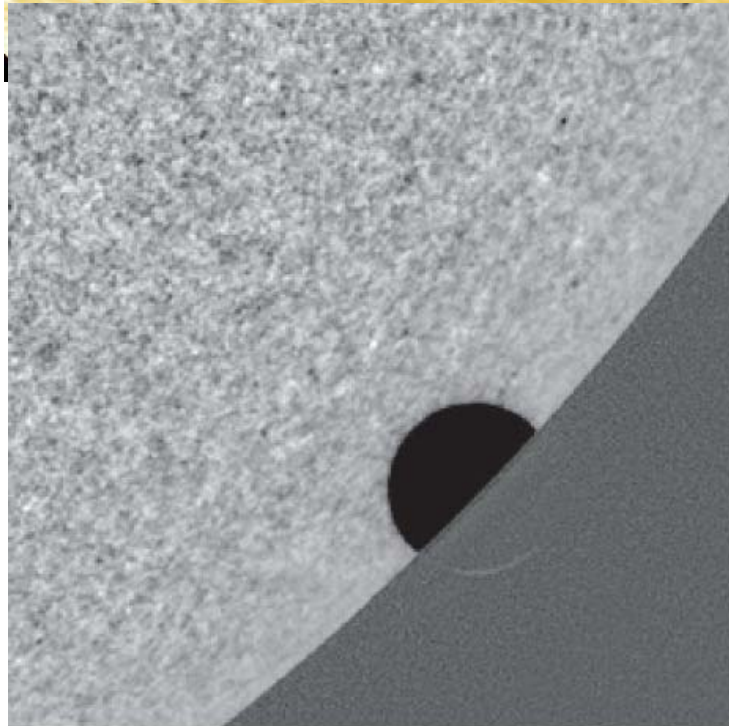
8 px $\rightarrow$ $2\alpha = 0,0035^\circ$ (12,6")

$$\tan \alpha = \frac{L/2}{d_T - d_V} = \frac{L}{2 \cdot 0,277 d_T} \leftrightarrow d_T = \frac{L}{\tan \alpha \cdot 2 \cdot 0,277}$$

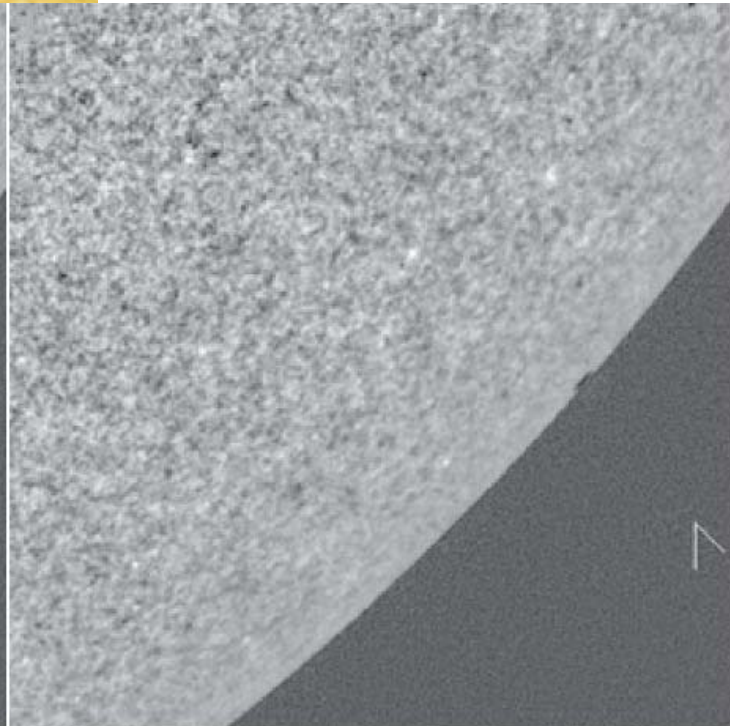
Swedish 1-m Solar Telescope, Venus transit egress, bright ring 9x enhanced



2004: science

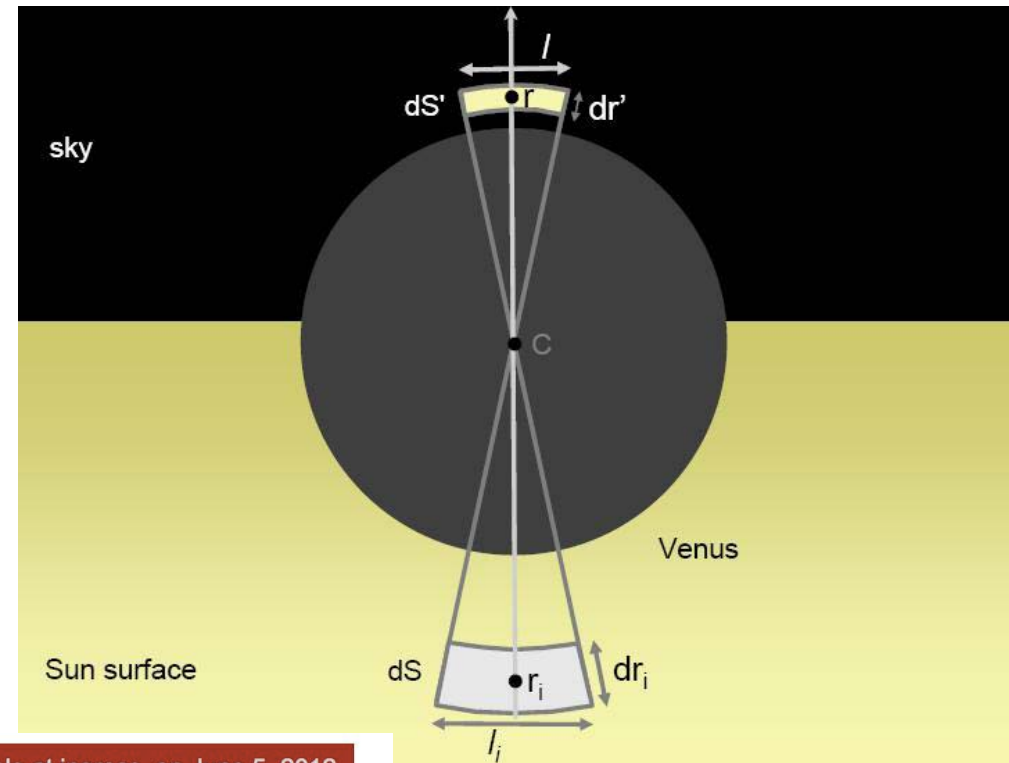
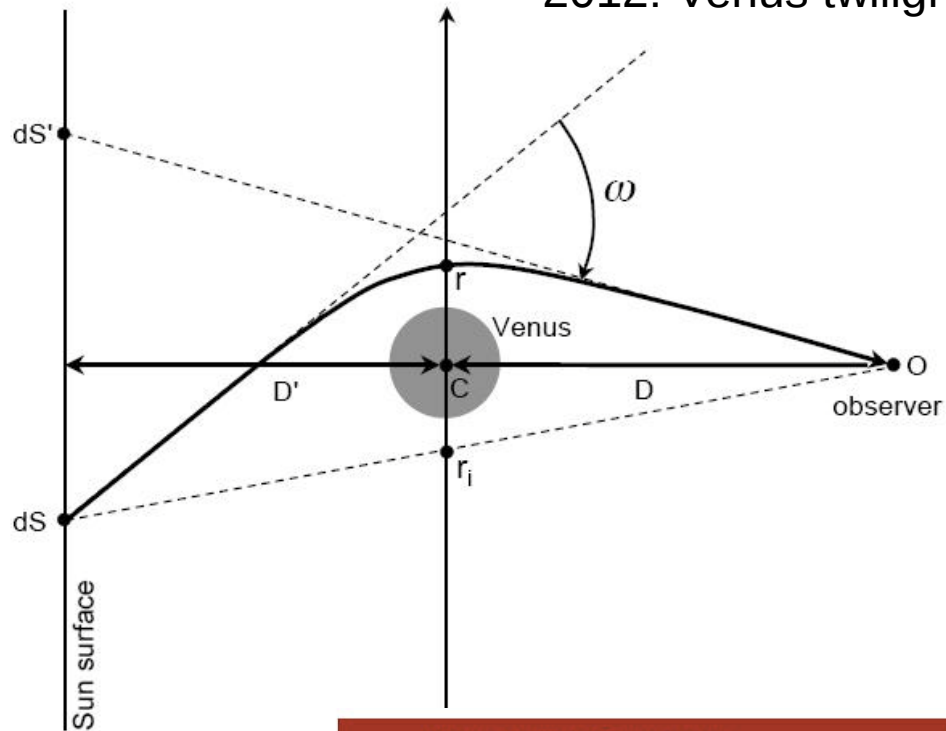


110823 UT - Halfway through egress, *half* the arc remains



112239 UT - Contact IV and a small piece of the arc is still visible (see movie)

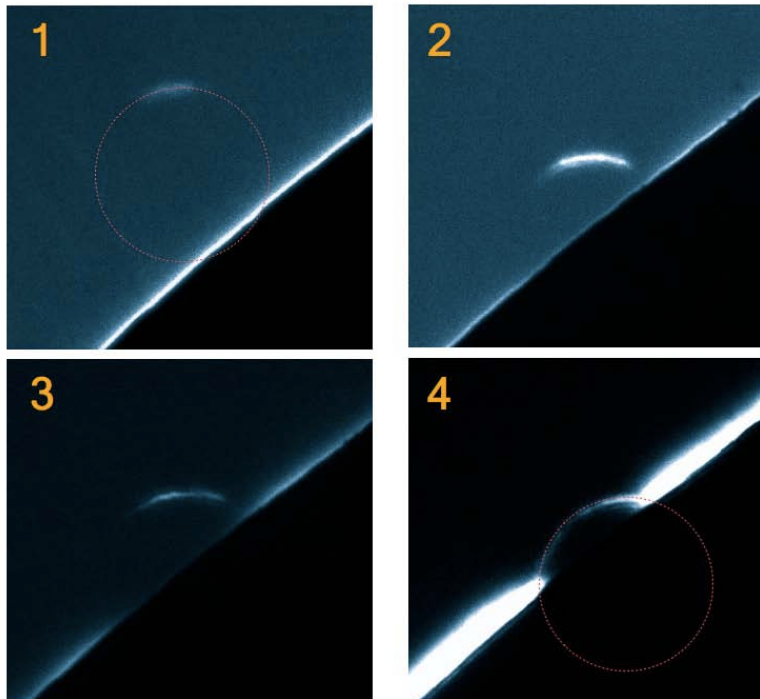
2012: Venus twilight



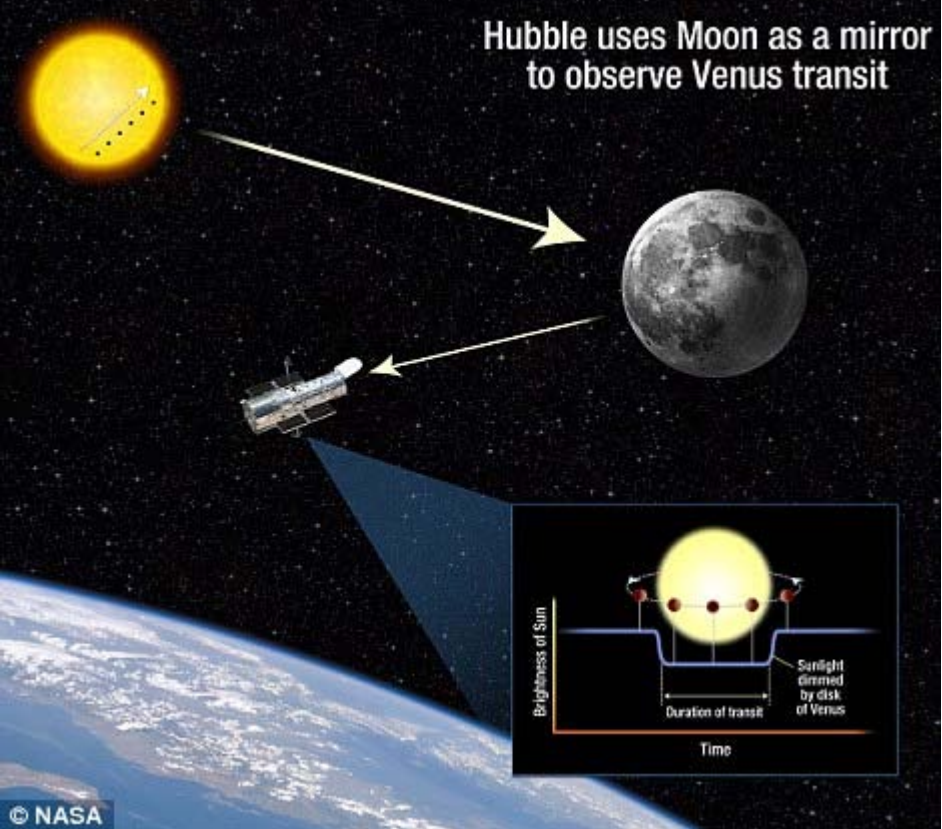
Venus Twilight Experiment

Aureole at ingress, on June 5, 2012

P. Tanga, Laboratoire Lagrange, Obs. de la Côte d'Azur, Th. Widemann, LESIA, Obs. de Paris - Venus Twilight Experiment



P. Tanga, Venus Twilight Coronagraph at Lowell Observatory, Arizona, USA

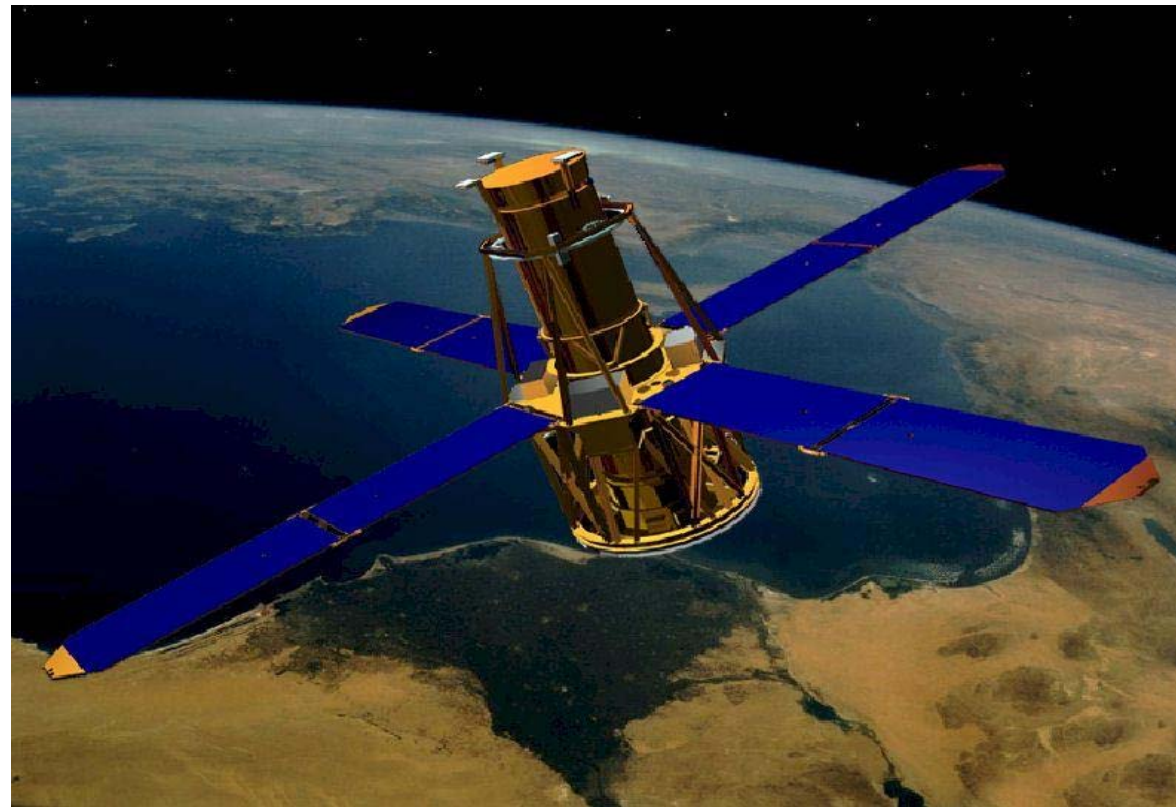


Kepler

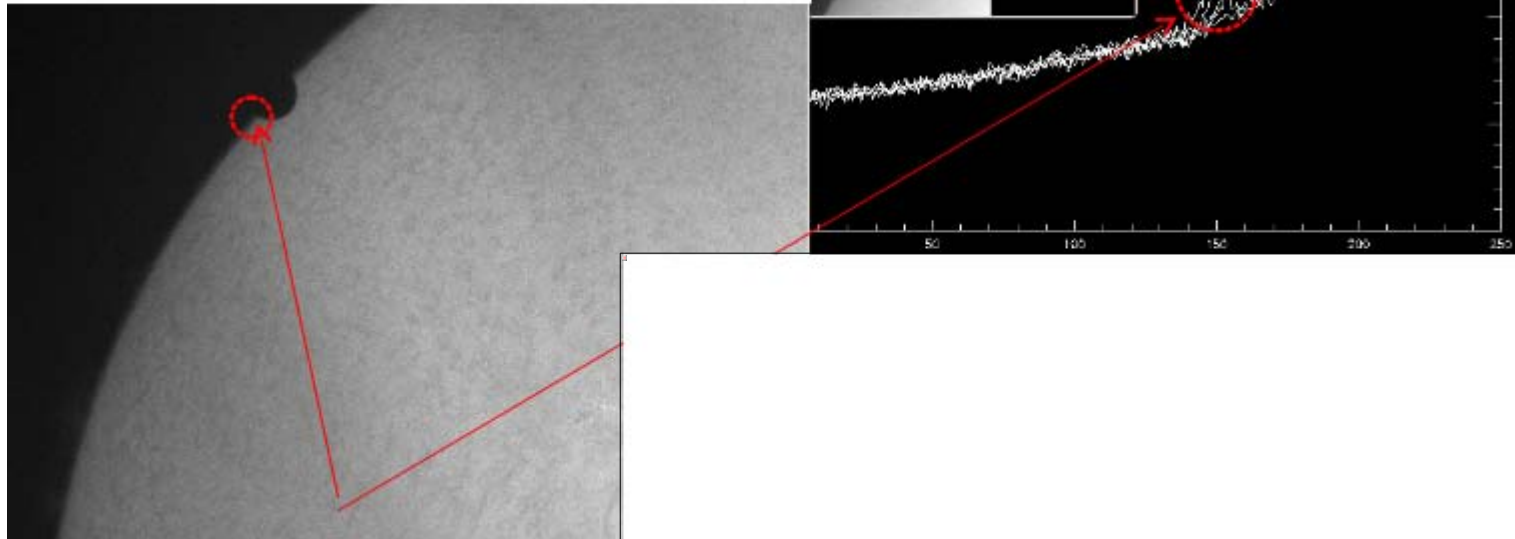


HST

RHESSI
(solar diameter)



2012: Venus transit and solar diameter
Italia-China-France collaboration
Huairou Solar Observing Station



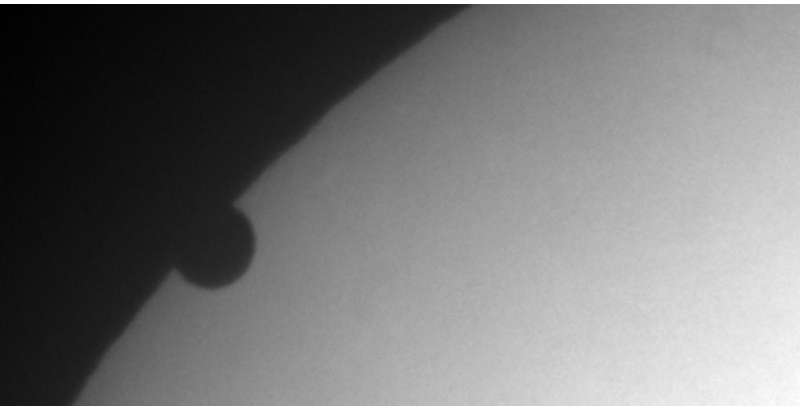
2004, Athens: 50 images H α , 256 level of intensity

Internal contacts:

2nd @ 7 am $\pm$ 8 s (low Sun, turbulence)

3rd @ 1 pm $\pm$ 1 s

$\Delta R = 0.69 \pm 0.38$ arcsec



2012, HSOS: 2000 images, 4096 levels @ 630 $\pm$ 10nm, photosphere; 2000 images H α at 256 levels

$\Delta R = ??? \pm 0.01$ arcsec