



Mercury Transit 2006

Patrick P. Murphy, Ph.D.

National Radio Astronomy Observatory

(and long-time Amateur Astronomer)

TUNA Presentation 2006.11.07

Re-presentation of a talk given to the

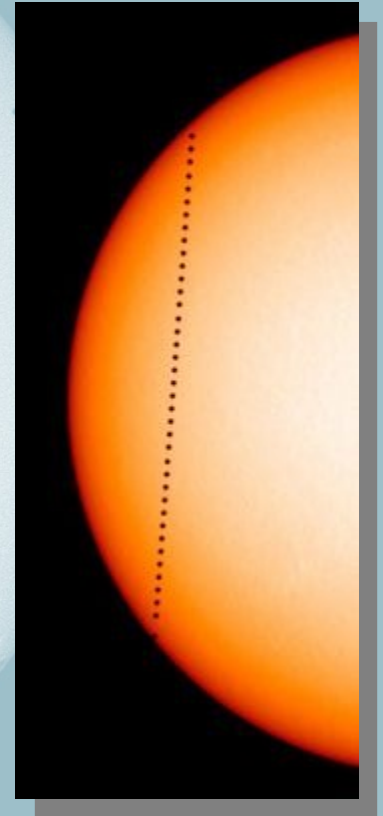
Blue Ridge Astronomy Club, Lynchburg, VA, 2006.10.24

Overview

- The Basics — What's happening?
- History of Mercury Transits (inc. my 1973 obs)
- What is this transit good for?
- Observing (some of) the transit from Virginia
 - handouts with "how to", times, more.
- Safety!!!!
- Questions, comments, *etc.*

The Basics

- Orbits not perfect
 - Mercury's orbit inclined at 7°
 - Also highly eccentric
 - Sun subtends < 2 degrees at aphelion
 - Sun subtends > 3 degrees at perihelion!
 - Compare to $\frac{1}{2}$ degree from Earth
- Transits infrequent
- On average, only 13 per century
- Occur in May and November
 - due to resonance between orbits



History of Mercury Transits


- 1st known: Nov. 7, 1631 Pierre Gassendi
- 14 Transits in 20th Century
 - including 1973, Author's first!
 - See next slide for log book entry
- 21st Cent.: 2003, 2006, 2016, 2019, 2032...
 - Total of 12 after this upcoming transit.
- Venus: 6th June 2012, then not till 2117.
 - This will be more impressive (weather permitting!)



Sat. 10/11/1973.

Me-2-73

Transit

Mercury: Observed latter half of Transit of Mercury
at Eddie Cassidy's observatory. (10" Schmidt-Cass.)
Telescope Stopped down to 4", and heliostat-mounted transmits 3% of
light with Zeiss filters + camera, also Projection. - Dia
of Sun 3 ft. in diam - mercury  Duration of exposure
- 1 min. 25 sec. ultra. Observed also (By Tom King, & myself)
with 60mm (30x; Projection) Telescope - we used it to the limit
- made out $\frac{1}{2}$ of dia of Mercury at exposure! i.e. 3" - absolute
limit of Resolution! Took some photos afterwards thru telescope.

(5)
Eddie Cassidy's
10" Celestron (Schmidt
Cass. f2-f135) with
Camera In Observatory
on Stepladder 3 Rocks
Mtn. 10th Nov. 1973

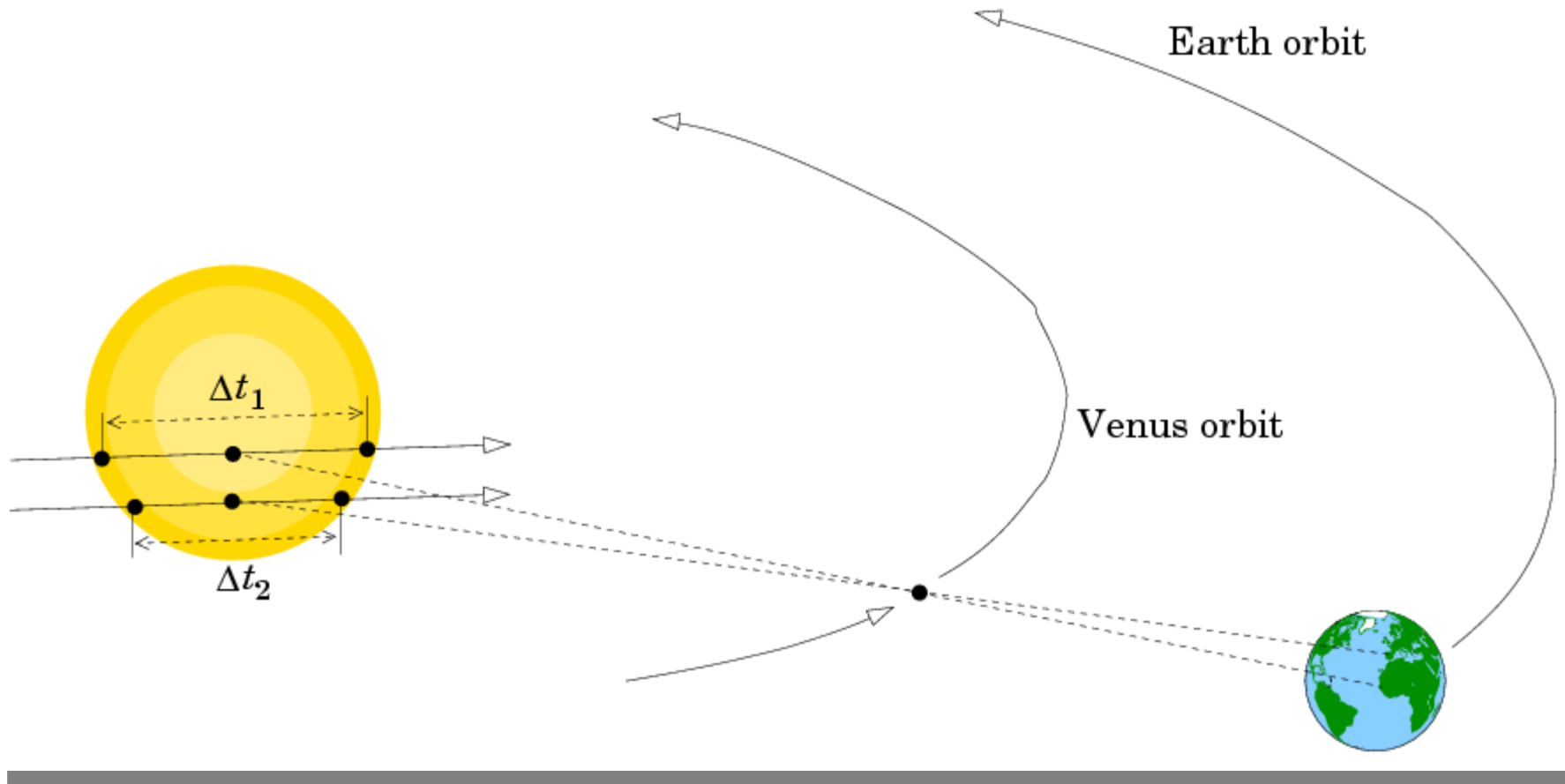


What is the Transit Good For?

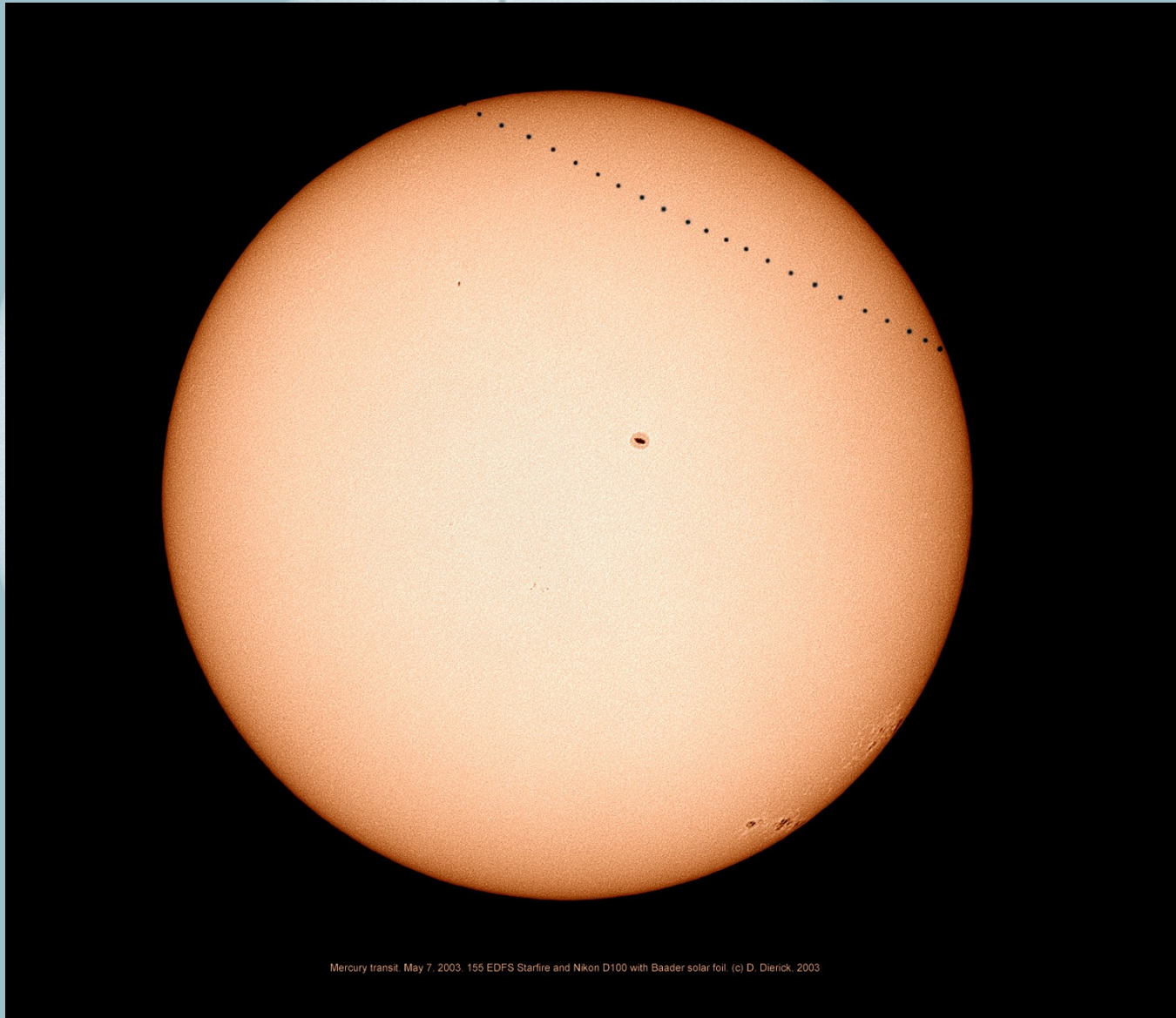
- At one time: determine scale of solar system
 - use parallax and triangulation (see next slide)
- Now: other techniques better (*e.g.*, radar)
- Rare event: not many lifetime opportunities
 - so take advantage of this one!
- Great way to envision size of the Sun!
- Timing is still useful (more later...)

Parallax / Triangulation for a Venus transit

- Principle applies to Mercury Transits also.
- Different locations on Earth observe duration of transit
- Timing used to calculate ingress, egress points



What does it look like?



Mercury transit, May 7, 2003. 155 EDFS Starfire and Nikon D100 with Baader solar foil. (c) D. Dierick, 2003

SOHO Movie

November 8, 2006: Virginia

Details for Richmond:

External Ingress:	2:12pm
Sun Altitude at Ingress:	27°
Internal Ingress:	2:14pm
Mid Transit:	4:41pm
Sun Altitude at mid:	4°
Internal Egress:	After sunset



Source: <http://sunearth.gsfc.nasa.gov/eclipse/transit/transit.html>

November 8, 2006: Virginia (2)

Details for Charlottesville:

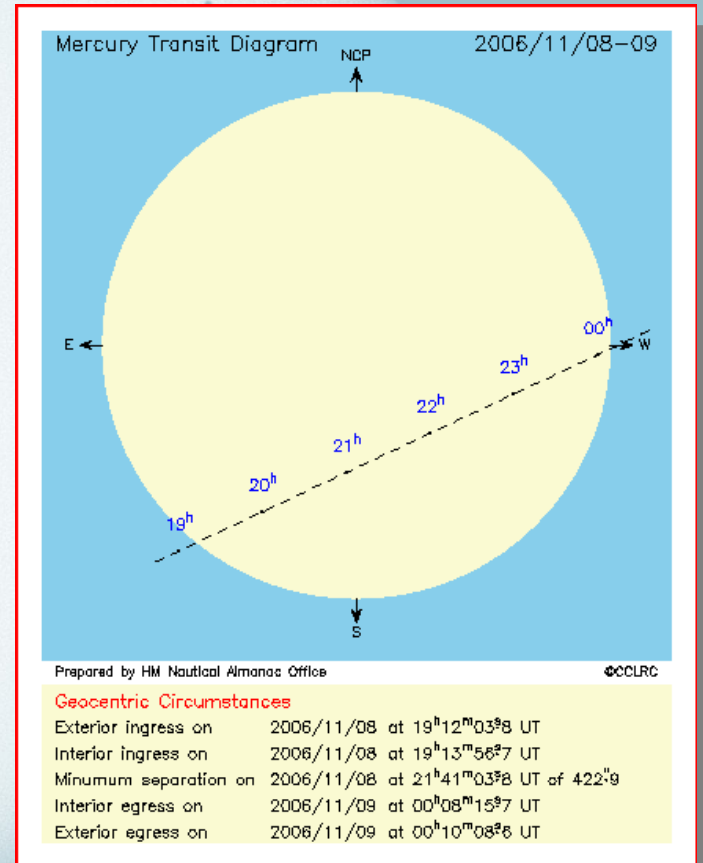
External Ingress:	2:12:19pm
Sun Altitude at Ingress:	26°.8
Internal Ingress:	2:14:12pm
Position Angle:	+141°
Minimum Separation:	4:40:48pm
Sun Altitude at mid:	4°.0
Internal Egress:	After sunset



Source: <http://home.hetnet.nl/~smvanroode/mercury.html>

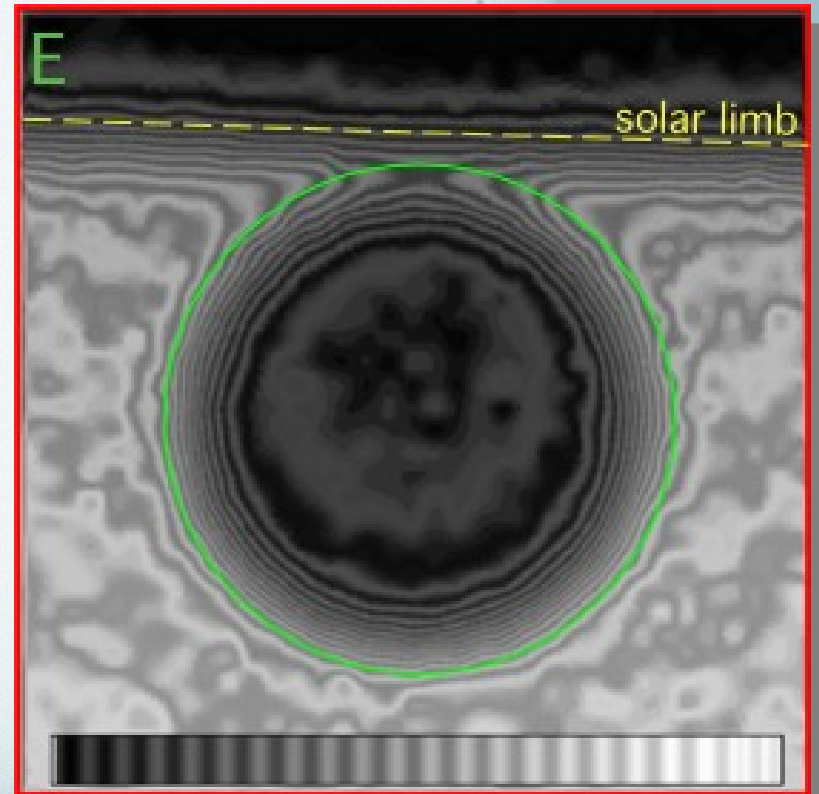
Orientation, Angles...

- See **first handout**
- NCP (North Celestial Pole) will be at an **Angle**
- With Astronomical refractor or reflector, image will be upside down!



The "Black Drop" Effect

- Ingress and Egress
- Seems to "connect" with Sun's edge
- Limb Darkening
- Not Earthbound
- Seen from space too



Source: Schneider, Pasachoff, Golub: AAS New Orleans, 2001
<http://nicmosis.as.arizona.edu:8000/POSTERS>

Web Links: Safety, Equipment...

- List of some vendors of safe solar filters
 - http://www.mreclipse.com/Totality/TotalityApC.html#Solar_Filters
- Eye Safety during Solar Eclipses (good for transits too)
 - <http://sunearth.gsfc.nasa.gov/eclipse/SEhelp/safety2.html>
- A Solar Observing Refresher Course (from S&T)
 - <http://skytonight.com/observing/objects/sun/3304286.html?page=1&c=y>
- Observing the Sun by Projection (also from S&T)
 - <http://skytonight.com/observing/objects/sun/3304766.html?page=1&c=y>
- Avoid "blind date" with the Sun!
 - <http://www.transitofvenus.org/safety.htm>

What can YOU do?

"Amateurs can make a useful contribution by timing the four contacts at ingress and egress. Observing techniques and equipment are similar to those used for lunar occultations. Since poor seeing often increases the uncertainty in contact timings, an estimate of the possible error associated with each timing should be included. Transit timings and geographic coordinates of the observing site (measured from a topographic map or GPS) should be sent to Dr. John Westfall (johnwestfall@comcast.net), A.L.P.O. Mercury/Venus Transit Section, P.O. Box 2447, Antioch, CA 94531-2447".

Source: NASA Eclipse Home page

<http://sunearth.gsfc.nasa.gov/eclipse/0H/transit06.html>

Conclusions

- Mercury transits: only 13 per century
- Safety (can't emphasize this enough!)
- Scale of solar system

Questions?

<http://www.cv.nrao.edu/~pmurphy/Talks/Mercury-Transit-2006>