

# Mercury Transit 2019

*An overview of Mercury transits and the details for the  
Monday Nov 11<sup>th</sup> 2019 transit*

Recorded Sunday Nov 10<sup>th</sup> .. As “Plan B” in case  
we (in Detroit) gets snowed out for the transit!

Dr. Scott Schneider  
**sschneide@ltu.edu**

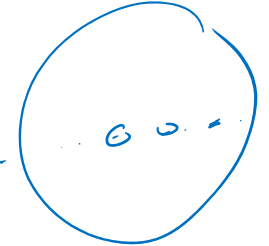


# Mercury “Transit” .. Wut?

- Inner planet crosses the face of the Sun
- Mercury and Venus = closer to the Sun
  - occasionally pass between Earth + Sun
- Transit of Earth seen from the Moon?
  - Lunar eclipse (for us on Earth)
- Transit of Venus – 2004 and 2012
  - Next one ... 2117 – doh!

2004 -  
2012 -

2117?



# Features of Mercury Transits

- Occurs in **May** or **November**
  - Twice as often in **November**?
    - Quirk of the eccentricity of Mercury's orbit
- Only seen from part of the Earth
  - Usually a hemisphere (such as with Lunar Eclipses!)
  - Sometimes “grazing” such as 1999 (just inside the edge)
  - This one is very near the center – long duration!
    - Longest for Nov (middle) = 5.5 hours    May (middle) = 7.9 hours
- Many different **periodicities** (cycles)
- New York Times Interactive page – very nice!! <https://tinyurl.com/y66wgku7>

Fred  
Espanak –  
*expert on  
transits/  
eclipses*

<http://www.eclipsewise.com/oh/tm2019.html>

Has tables for US times and Canada times!

## Transit of Mercury: 2019 Nov 11

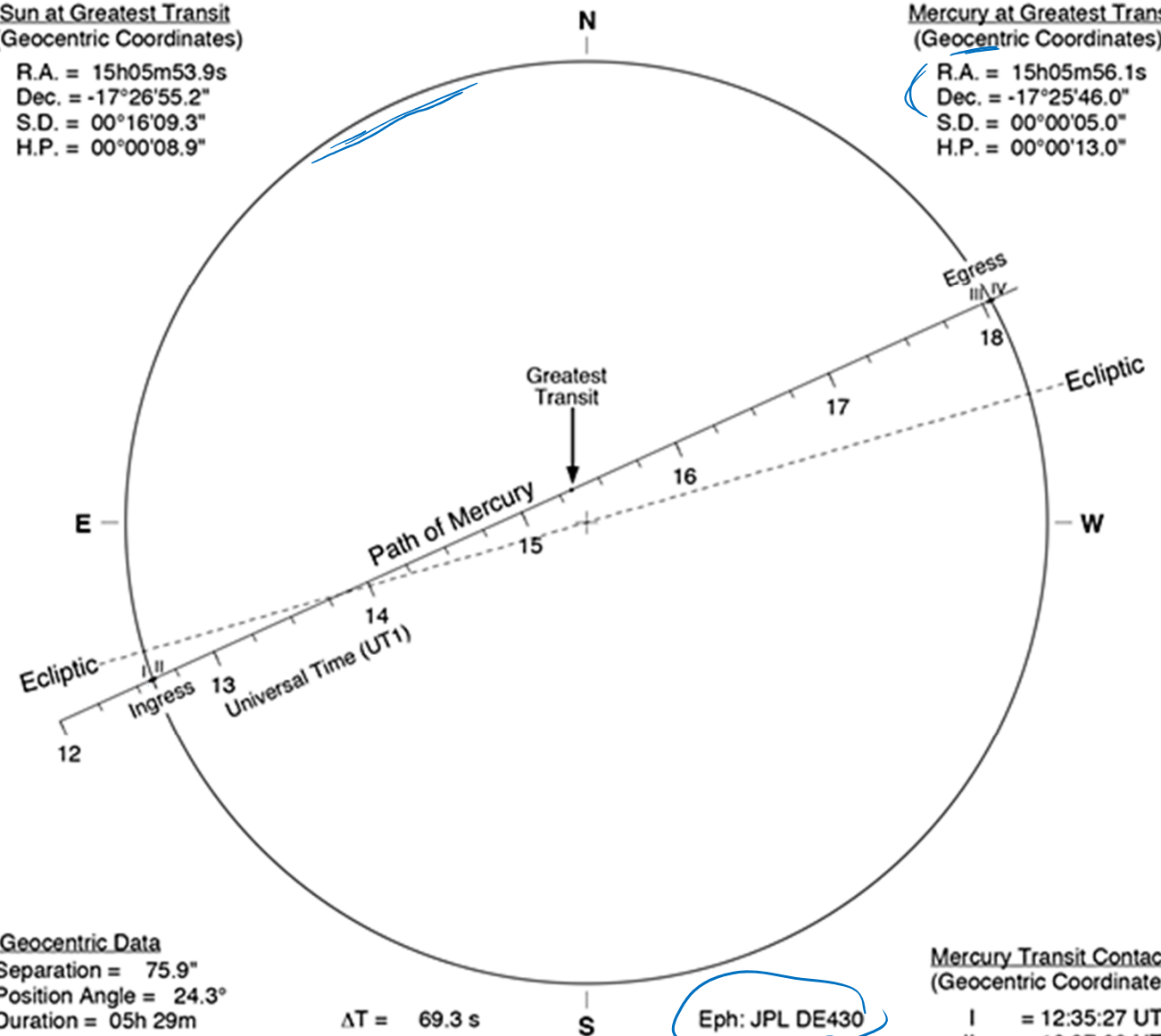
Greatest Transit = 15:19:47.7 UT1

Sun at Greatest Transit  
(Geocentric Coordinates)

R.A. = 15h05m53.9s  
Dec. = -17°26'55.2"  
S.D. = 00°16'09.3"  
H.P. = 00°00'08.9"

Mercury at Greatest Transit  
(Geocentric Coordinates)

R.A. = 15h05m56.1s  
Dec. = -17°25'46.0"  
S.D. = 00°00'05.0"  
H.P. = 00°00'13.0"



Geocentric Data

Separation = 75.9"  
Position Angle = 24.3°  
Duration = 05h 29m

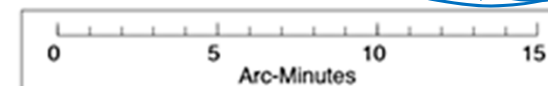
Ascending Node

Transit Series = 247  
Sequence No. = 11 of 19

$\Delta T = 69.3$  s

S

Eph: JPL DE430



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Mercury Transit Contacts  
(Geocentric Coordinates)

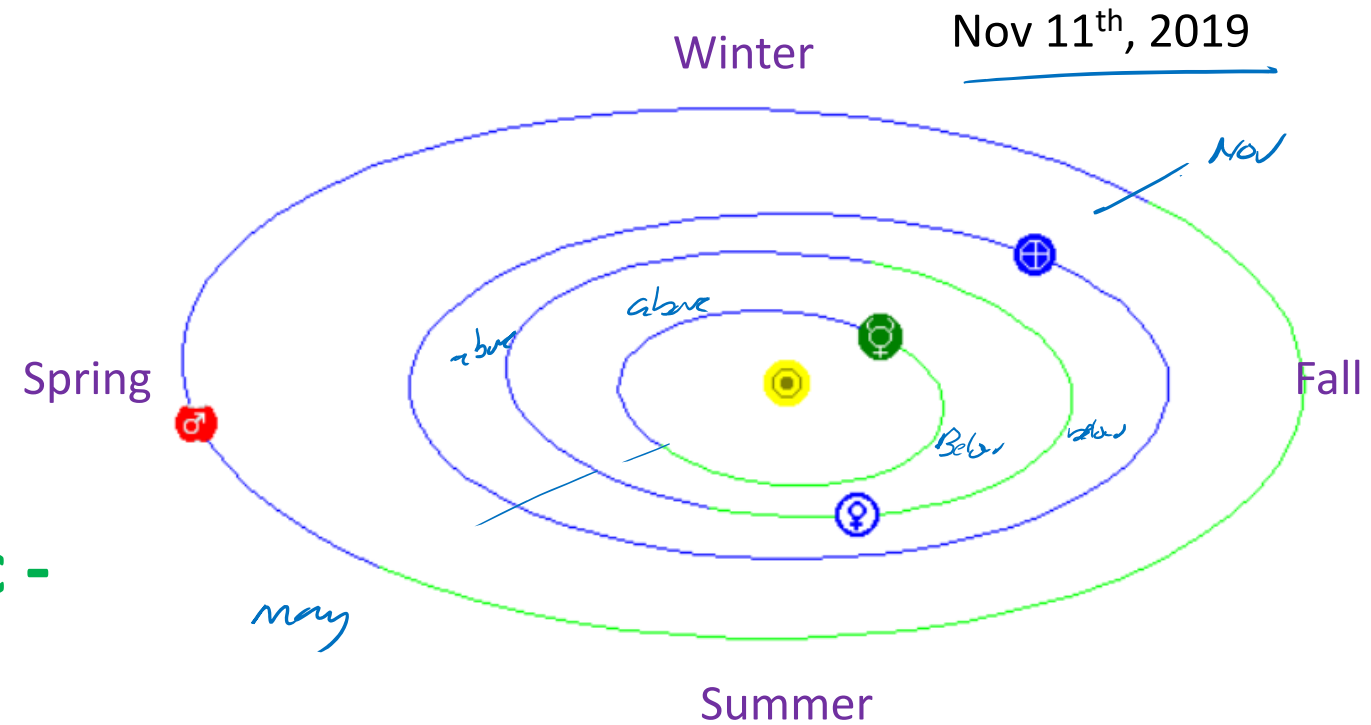
I = 12:35:27 UT1  
II = 12:37:08 UT1  
Greatest = 15:19:48 UT1  
III = 18:02:33 UT1  
IV = 18:04:14 UT1

# Orienting ourselves .. Ecliptic plane - add Mercury

- All planets go around the Sun
  - CCW looking down from above
- Earth-Sun plane (ecliptic) – other planet orbits tilted slightly
- Mercury has an orbit tilt of about  $8^\circ$

- **Mercury “rises” above ecliptic - between our Fall and Winter (Nov)**

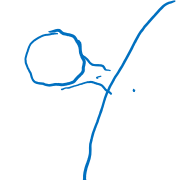


- Mercury “sinks” below ecliptic - between our Spring and Summer (May)



So, graphics look a little janky .. Hey, this is HomePlanet, a DOS program that was free and awesome and gave me \*just\* the view I wanted – so, shut up, haters!

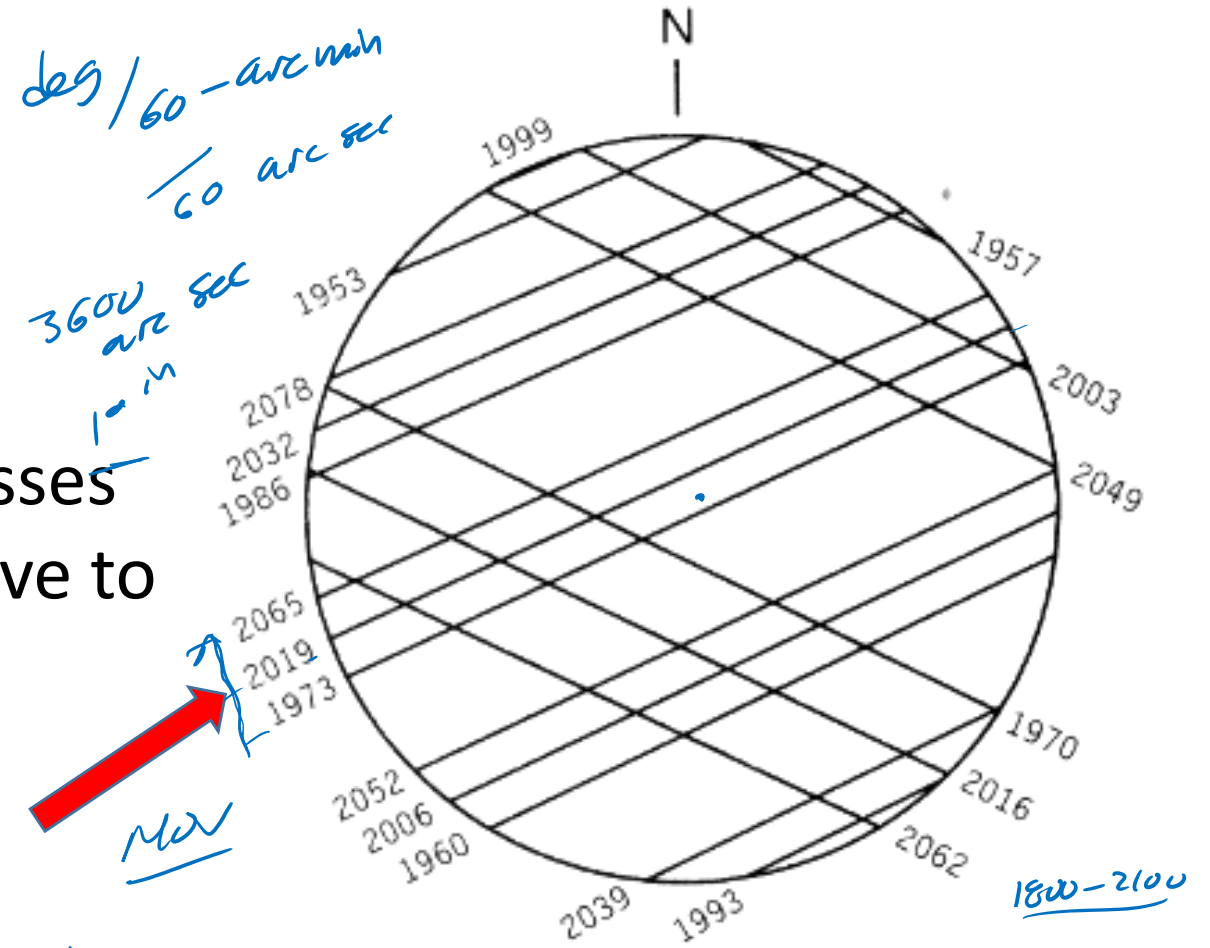
<https://www.fourmilab.ch/homeplanet/>

# Need to be in Right place - Right time!

- 13-14 times in a Century
- 1999 was a “grazing” transit - first since the invention of the telescope!
  - Don't expect another like that until 22nd Century!
- Can determine features of Sun/Mercury – with careful timing
- Mercury makes more orbits than Earth
- Often passes those crossing points
  - Earth isn't always there to see it!
- One “face” of the Earth gets best view
- Over a short time scale - not a good match (1 to 4.15 orbits)
  - But, wait many years, orbits match nicely!

# Periods vs passes?

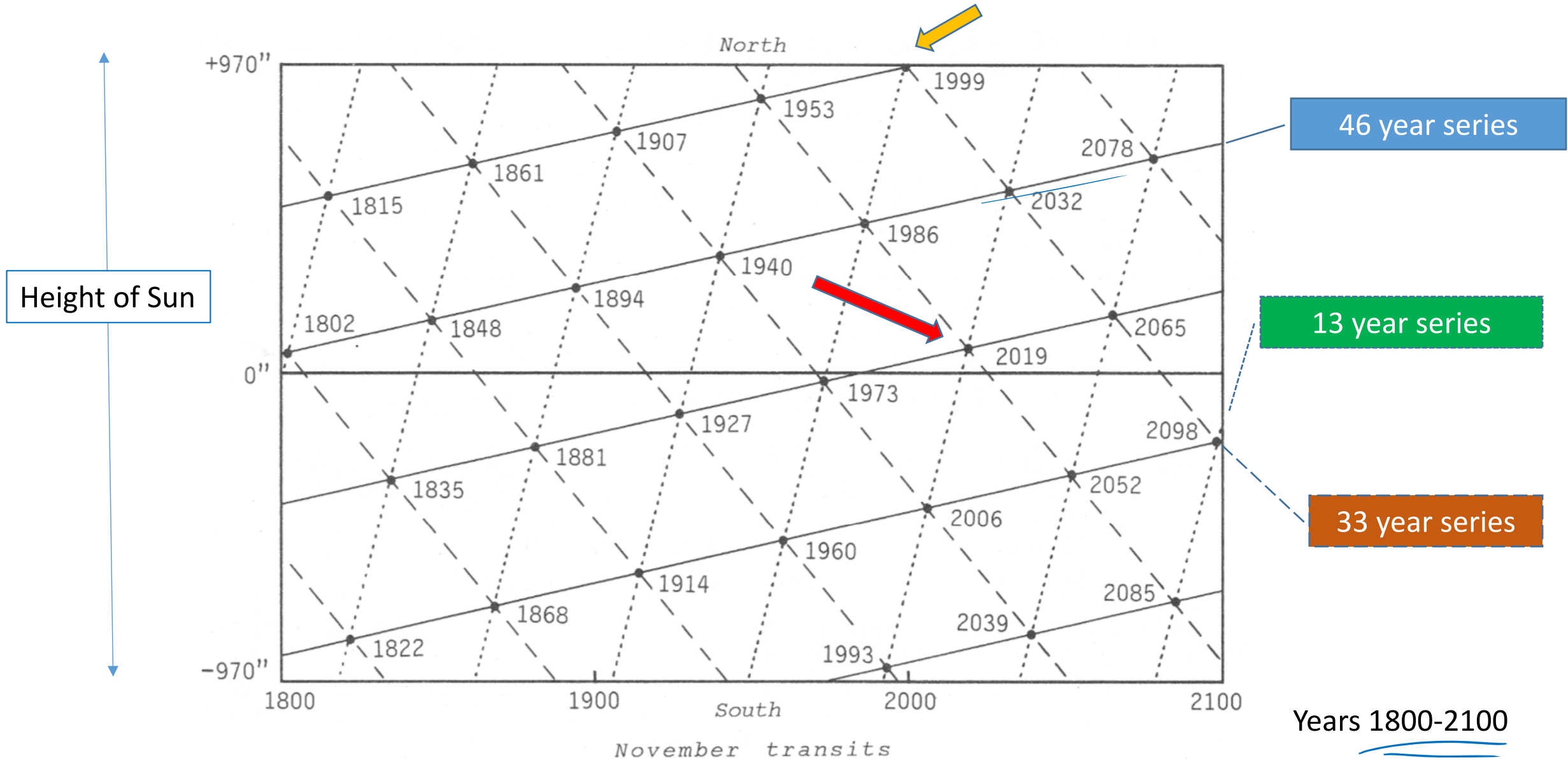
- **Nov** transits - lower left to upper right
- **May** transits – UL to LR
- As the “cycle” advances, individual passes will move either “up” or “down” relative to the center of the sun
- A “series” would be a set of passes
- Every 46 years is a good matchup



Date	Dur hrs	Min sep arc sec	Earth Orbits	Mercury Orbits	Match?	
1999 Nov	15	0:52	963	1	4.152	3.8023%
1927 Nov	10	5:27	128.7	13	53.977	0.0423%
1973 Nov	10	5:30	26.4	33	137.019	0.0139%
2019 Nov	11	5:29	75.9	46	190.996	0.0020% (46=13+33!)
2065 Nov	11	5:24	180.7	217	901.004	0.0004%

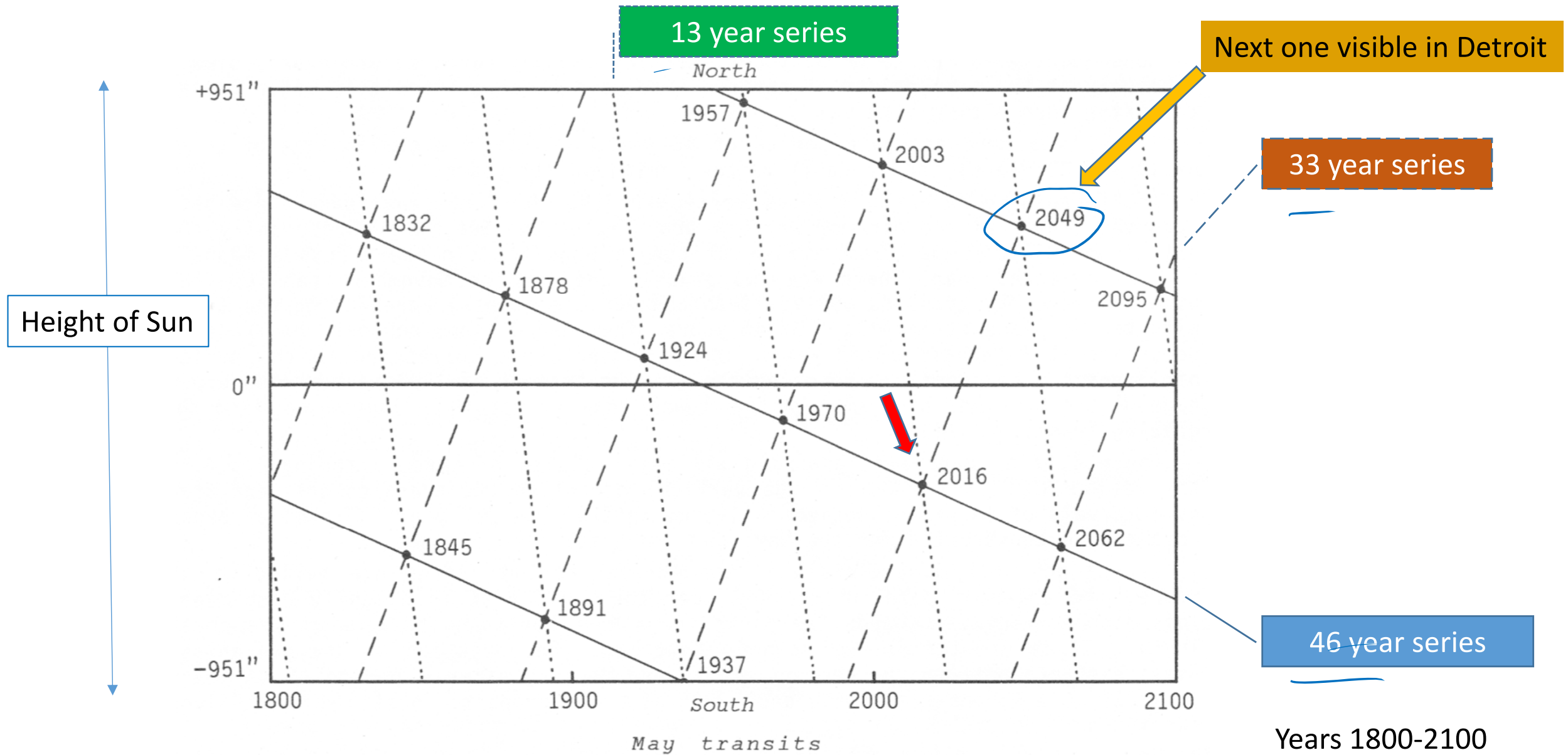
Can see 46 year periods!  
 1999 grazing transit at top edge  
 2019 – straight through middle!

# Cycles of Nov Transits – minimum distance to center



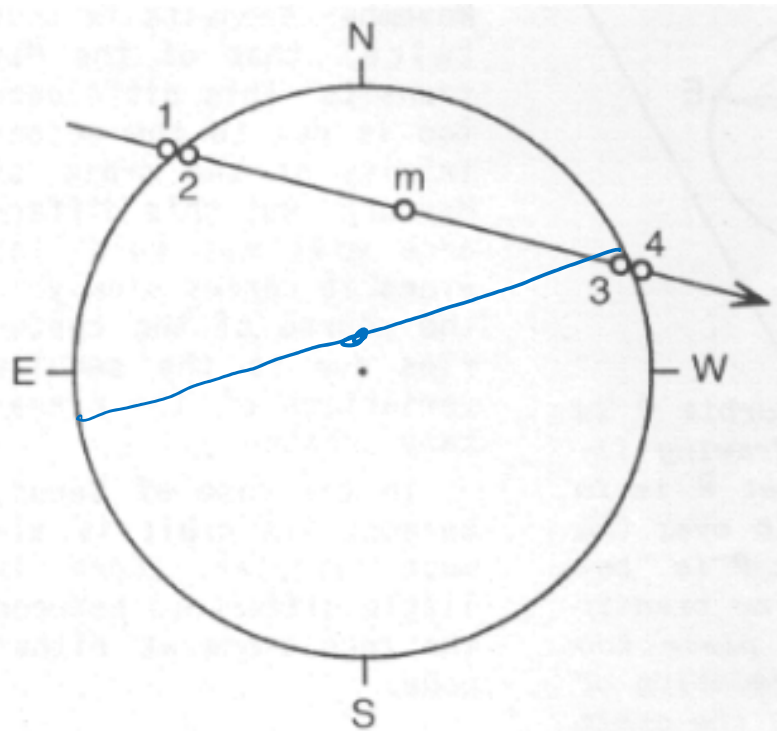


# Cycles of May Transits – minimum distance to center



# Timing of transits – and Detroit angles

- T1= ingress, exterior contact
- T2= ingress, interior contact
- T3= closest to center
- T4= egress, interior contact
- T5= egress, exterior contact



Date	Series	Detroit Altitude of Sun at each Contact				
		I	II	max	III	IV
1999 Nov 15	2	8	6	4	2	0
2003 May 07	9	-31	-31	-22	0	1
2006 Nov 08	8	25	25	5	-21	-21
2016 May 09	7	9	9	49	61	61
2019 Nov 11	6	2	2	25	29	29
2032 Nov 13	4	-60	-60	-38	-14	-14
2039 Nov 07	10	-53	-53	-38	-23	-22
2049 May 07	9	7	7	43	65	65

**Table 1: Geocentric Phases of the 2019 Transit of Mercury**

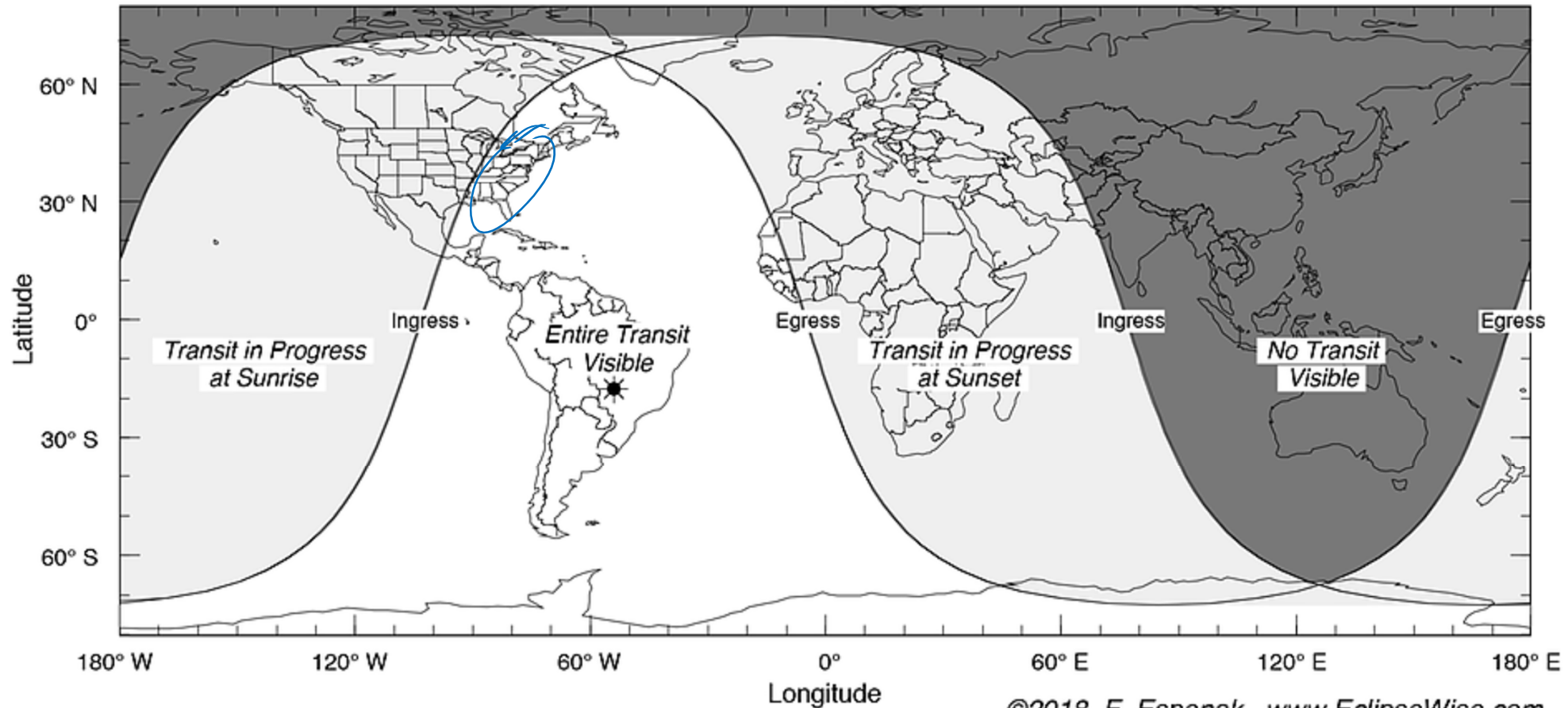
Event	Universal Time	Position Angle
Contact I	12:35:27 <span style="color: red;">7:35 am</span>	109.8°
Contact II	12:37:08 <span style="color: red;">7:37 am</span>	109.8°
Greatest Transit	15:19:48 <span style="color: red;">12:19 pm</span>	24.3°
Contact III	18:02:33 <span style="color: red;">1:02 pm</span>	298.8°
Contact IV	18:04:14 <span style="color: red;">1:04 pm</span>	298.7°

*Detroit*  
~~( )~~

# Who can see the 2019 Transit?

- Need filtered telescope or binocs <sup>*projected*</sup> <sup>*web cams*</sup>
- (Venus could be seen with eclipse glasses and no telescope – closer/bigger!)

## Transit of Mercury: 2019 Nov 11



Monday Nov 11<sup>th</sup> – 7:36 AM – 1:05 PM (Detroit)

- We (in Detroit) have several problems ..
  - Sun doesn't rise until 7:57 pm
  - And .... still has to climb high enough over the buildings
  - We have strong predictions for rain or snow!
- If clear .. Will set up telescopes about 9:30 AM – solar filters
- Weather permitting!!
- Otherwise – links for live webcasts from other unclouded sites!
- <https://www.facebook.com/LTUAstroEvents/> (info for local LTU astro events)

quad

x

cell adapter

email list

# Webcasts of the Transit (from spaceweather.com)

## **Transit of Mercury webcasts:**

- (1) [Royal Observatory Greenwich, UK on Facebook](#)
  - <https://www.facebook.com/royalmuseumsgreenwich/posts/2655277881189689>
- (2) [Timeanddate.com from Stavanger, Norway](#)
  - <https://www.youtube.com/watch?v=GNvZHR91e4s&feature=youtu.be>
- (3) [Griffiths Observatory TV from Los Angeles](#)
  - <https://livestream.com/GriffithObservatoryTV/MercuryTransit2019>

Thank you,  
drive safely,  
tip your servers!

Questions?



Dr. Scott  
sschneide@ltu.edu

(first initial last name,  
but no R at the end ..)

Did you know that a day on  
Mercury is longer than its year?

Oops, out of time, maybe that is  
a story for another broadcast!!