

Retrogrades, Marvin the Martian, and the Universe, oh my!

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Friday April 23rd, 2004

[Presentation for National Astronomy Day](#) (technically 04/24/04)

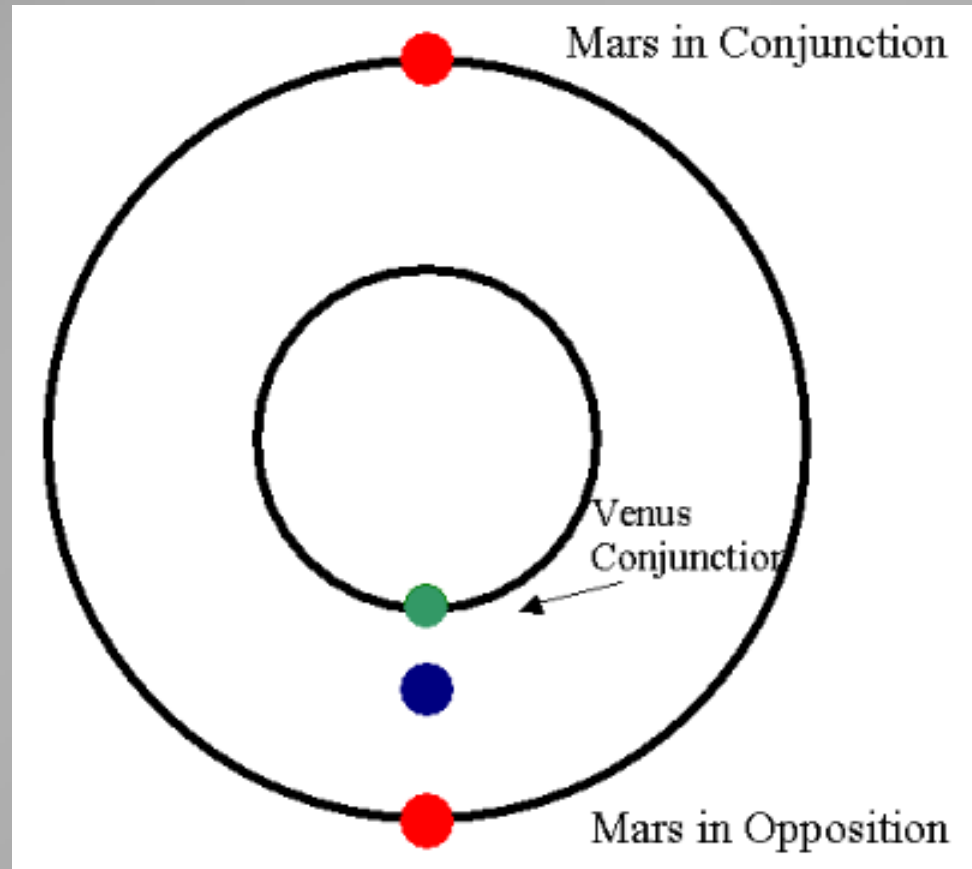
Webpage : http://www3.ltu.edu/~s_schneider/astro/astroday_2004.shtml

How to find your way in the Solar system :

- **All planets go around the Sun**
 - also, in the same “direction”
- **Define reference plane as Earth-Sun**
 - Called the **ECLIPTIC**
 - All other planet orbits tilted, relatively
- **Venus has an orbit tilt of about 3°**
 - Save this info for later!

Retrograde Motion

- Outer planets – location moves “backward” against the distance stars
- Occurs at times of Opposition
- Inner planets have “conjunctions” .. Could have transits!



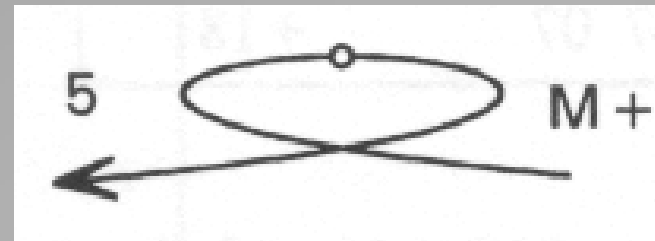
*Mars Retro
Example*

Shape of the retrograde loops?

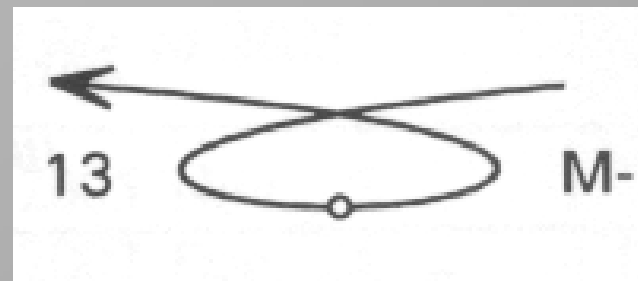
1. The outer planets have orbits tilted relative to the ecliptic.
2. Earth moves faster in orbit than outer planet.
3. As Earth moves past opposition point, angle between Earth and outer planet changes orientation in space .. points to different background stars!
4. During time of opposition, outer planet changes latitude above ecliptic.

High or Low above ecliptic

As outer planet moves toward highest point in it's motion, retrograde motion give "top loop" shape.



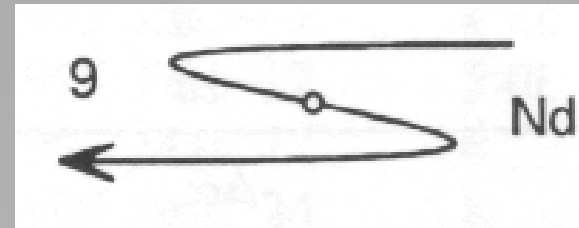
180 degrees away, as outer planet moves toward lowest point in it's motion, retrograde motion give "bottom loop" shape.



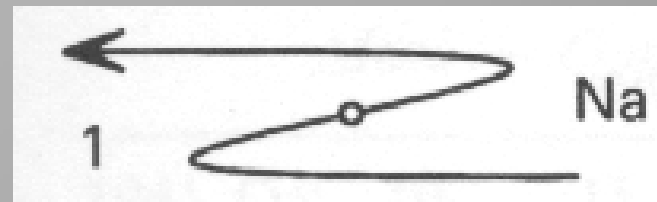
The "dots" are the moment of opposition.

Crossing above/below ecliptic

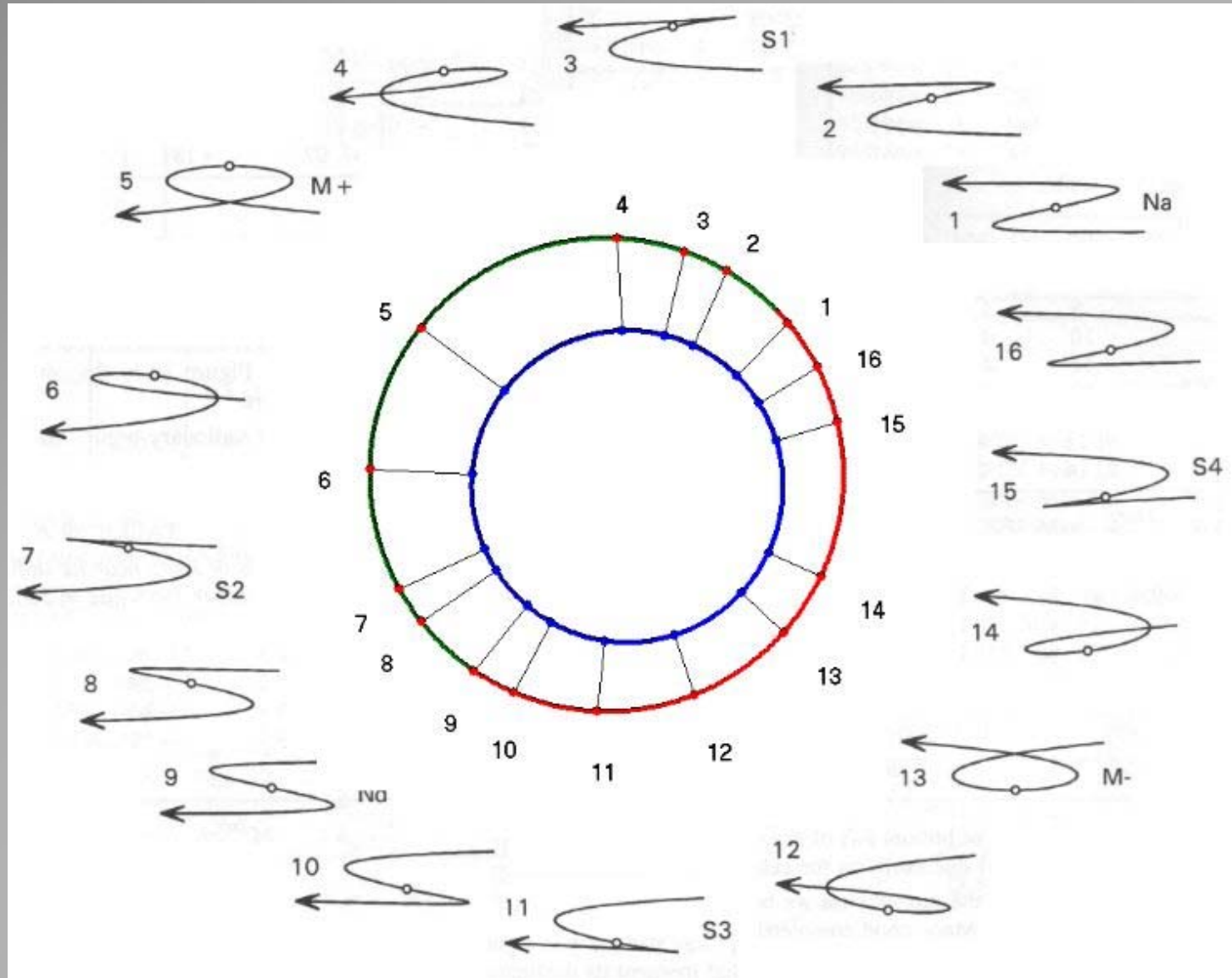
As outer planet through the descending node (high to low), retrograde motion gives a dropping “S” shape.



As outer planet moves through ascending node (low to high), retrograde motion gives a rising “S” shape.



16 basic shapes – depends on time of year!



References

Jean Meeus – TRANSITS – Willmann-Bell

Jean Meeus is an Astronomer from Belgium – does some absolutely amazing astronomical calculations.

Has three other excellent books :

Astronomical Algorithms

Astronomy Morsels

More Astronomy Morsels

What about Marvin?



What about Marvin?

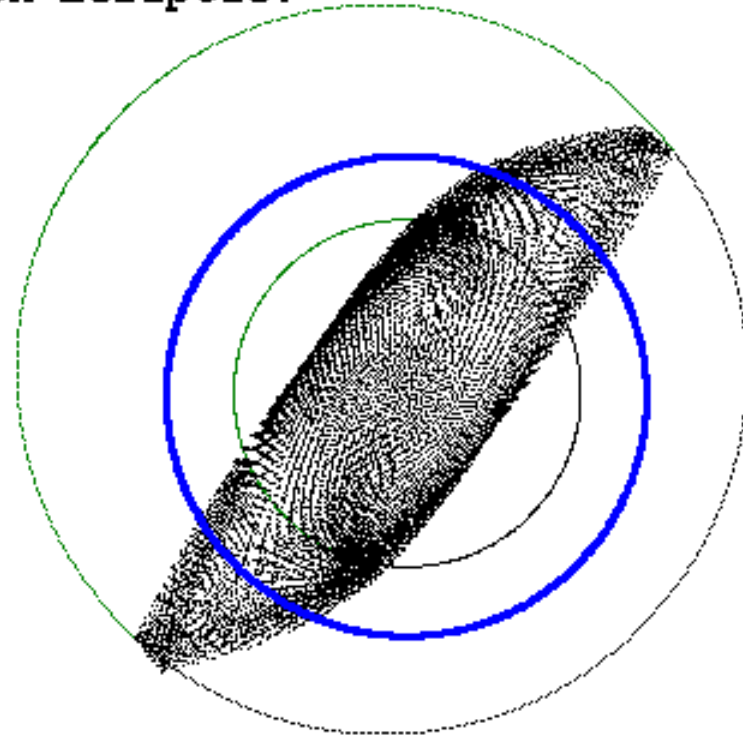


*Wanted to blow up the Earth because
it blocked his view of Venus!*

Conditions for blocking ..

- How often does Earth block Venus?
- Calculate the location where the Venus-Mars line crosses the ecliptic – if the Earth is there also – block!

Intersection of Mars-Venus line
with Ecliptic.



time = ~ 1000 yrs

After the computer pulled a
few all-nighters ...

From the year 1000 to 3000 ...

Only **one** time =

Nov 8th, 2746 ~ 7:45 pm

Conclusion ...



Marvin is just
a big foo-foo head!!

Last but not least ...

The Universe!

- **Logarithmic distance scale (y axis)**
 - Need strong kung-fu math to squash the distance scale of the Universe!
- **“Hour angle” (right ascension) (x axis)**
 - Measured from “Spring” event – (line in space)
 - 360 degrees = 24 hours
- **Much more info here :**
 - <http://www.astro.princeton.edu/~mjuric/universe/>