A Wandering Star: Observing Mars with the Unaided Eye

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Calendar in the Sky

November 22, 2013

Origins of Name "Mars"

- "planet" derived from Greek words for "wandering star"
- Greek name Ares
- Roman name Mars
- Antares = rival of Ares

Mars Statue in Rome's Musee Capitolini
(Image Credit: Jean-Pol Grandmont)

Mars: A Superior Planet

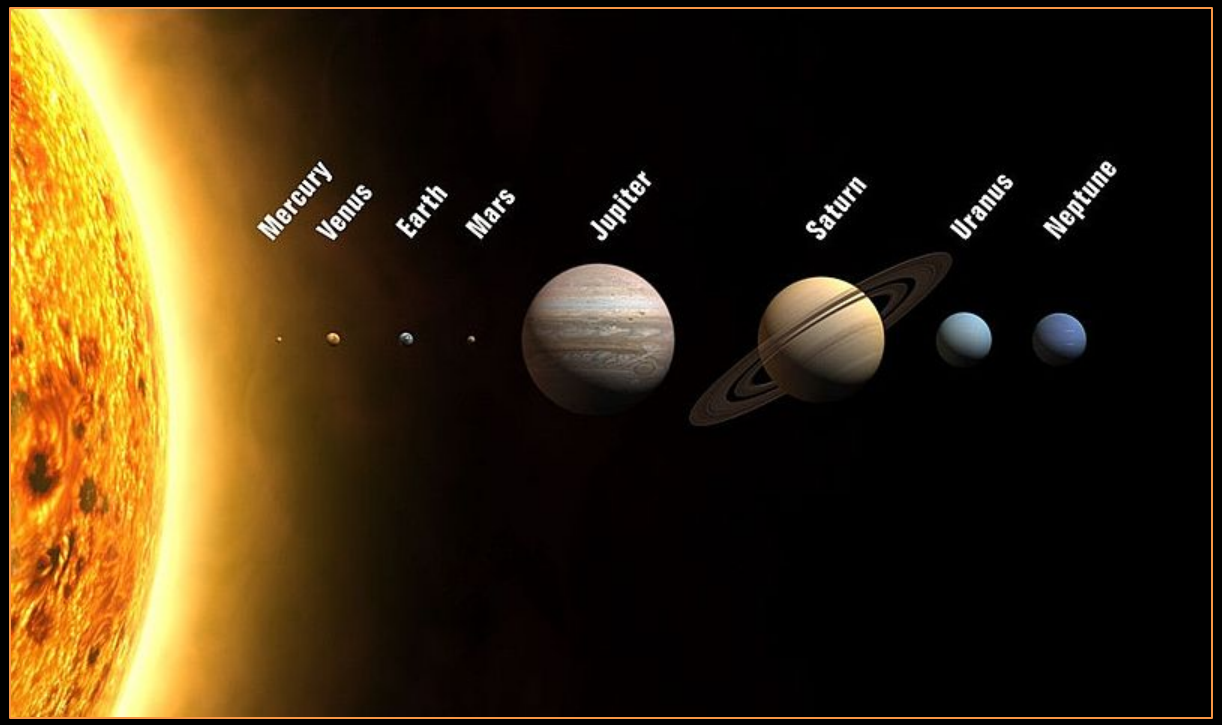


Image Source: Wikipedia

- Refers to a planet's orbit size relative to Earth's orbit size
- Different from "outer" planet, which refers to outside the asteroid belt
- Observing implications:
  - Appears to move along ecliptic seemingly independent of Sun (as opposed to inferior planets which appear to stick close to the Sun)
  - Can appear in the sky at any time (i.e. not just after sunset or before sunrise)

Mars Orbit

- Elliptical orbit
- Counter-clockwise when seen from “above” (i.e. looking down at Earth’s North Pole)
- Perihelion – 207 million km from Sun
- Aphelion – 249 million km from Sun
- 1 Martian year =

  687 Earth days

  1.88 Earth years

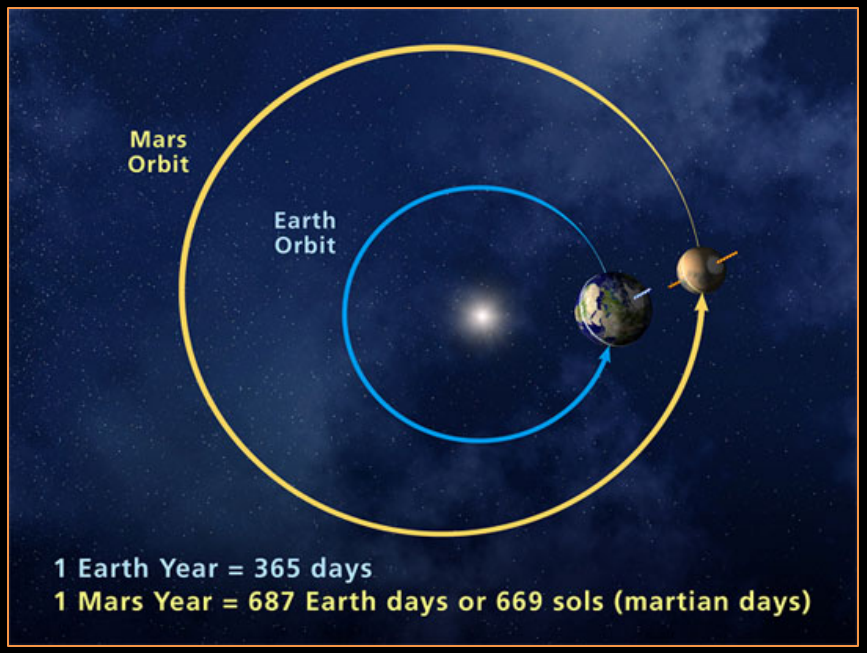


Image Credit: Universe Today

Mars Synodic Cycle

- Synodic = relative to the Sun
- It take ~780 days for Mars to return to the same position relative to the Sun as seen from Earth
  - 2.13 years

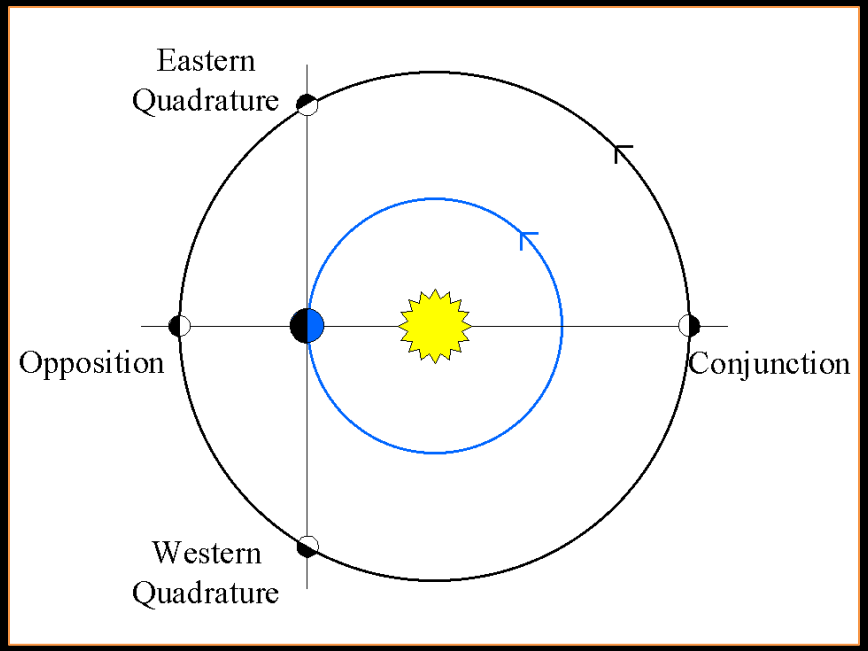
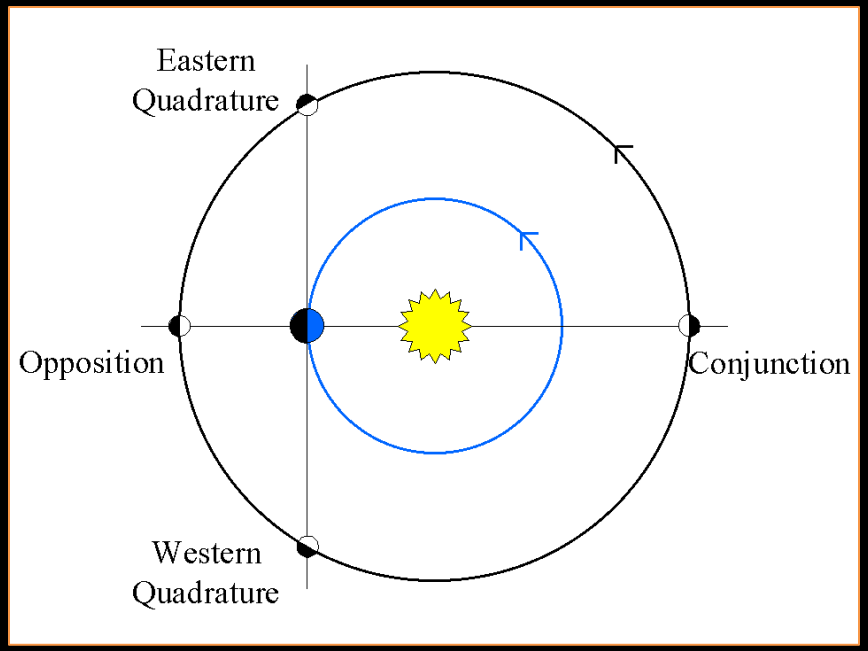


Image Source: Richard W. Pogge
http://www.astronomy.ohio-state.edu/~thompson/161/wanderers.html

NOTE: While this diagram represents the relative positions of Earth, Sun, Mars at particular points in their orbits, it does NOT represent the relative sequencing of these points in time.

Mars Synodic Cycle

- Conjunction – The Sun is between Earth and Mars
- Opposition – The Earth is between the Sun and Mars
- Quadrature – Mars is at a 90° angle relative to Earth and Sun



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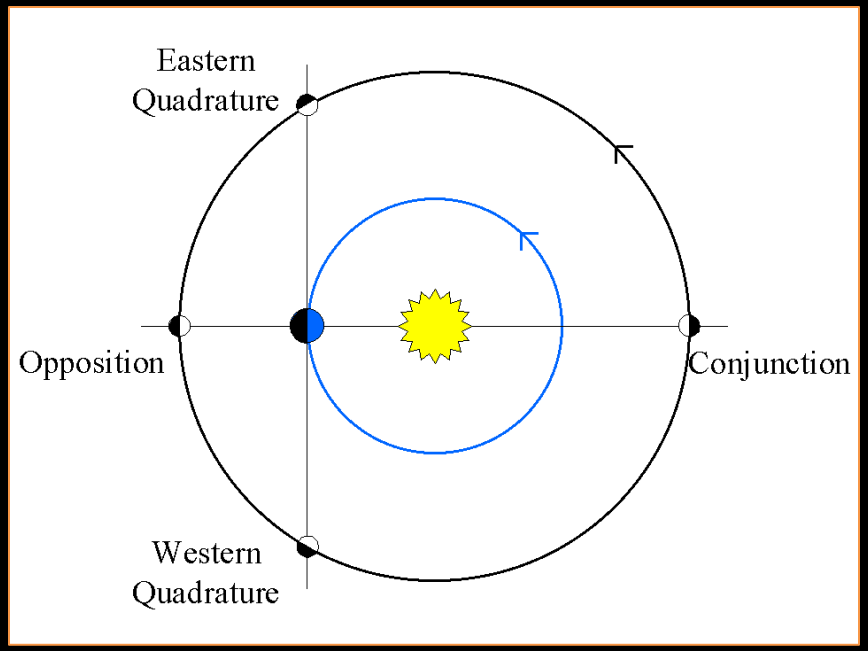
1. Conjunction (April 18, 2013)
2. Heliacal rising (mid-June, 2013)
3. Western quadrature (January 2, 2014)
4. Opposition (April 8, 2014)
5. Eastern quadrature (July 19, 2014)
6. Heliacal setting (mid-March 2015)
7. Conjunction (June 14, 2015)



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Conjunction – April 18, 2013

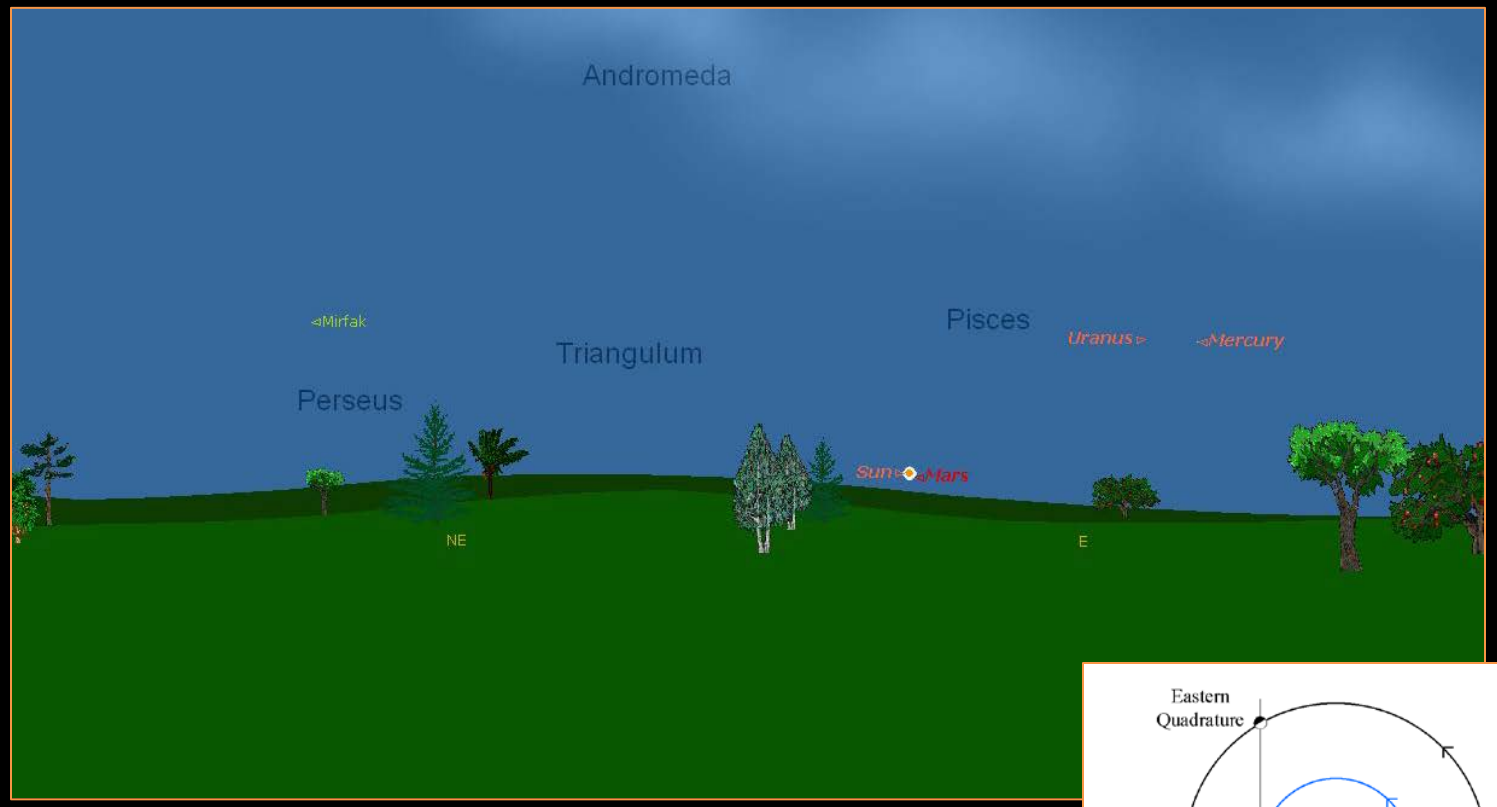
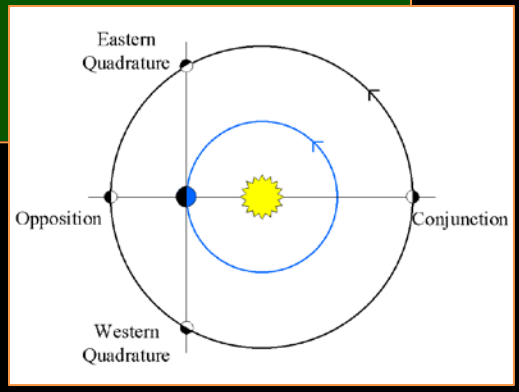


Image Credit: Starry Night Pro

Mars on same side of sky as the Sun (not visible)
Rises with the Sun
Does not appear in the night sky



Heliacal Rising ~ mid-June, 2013

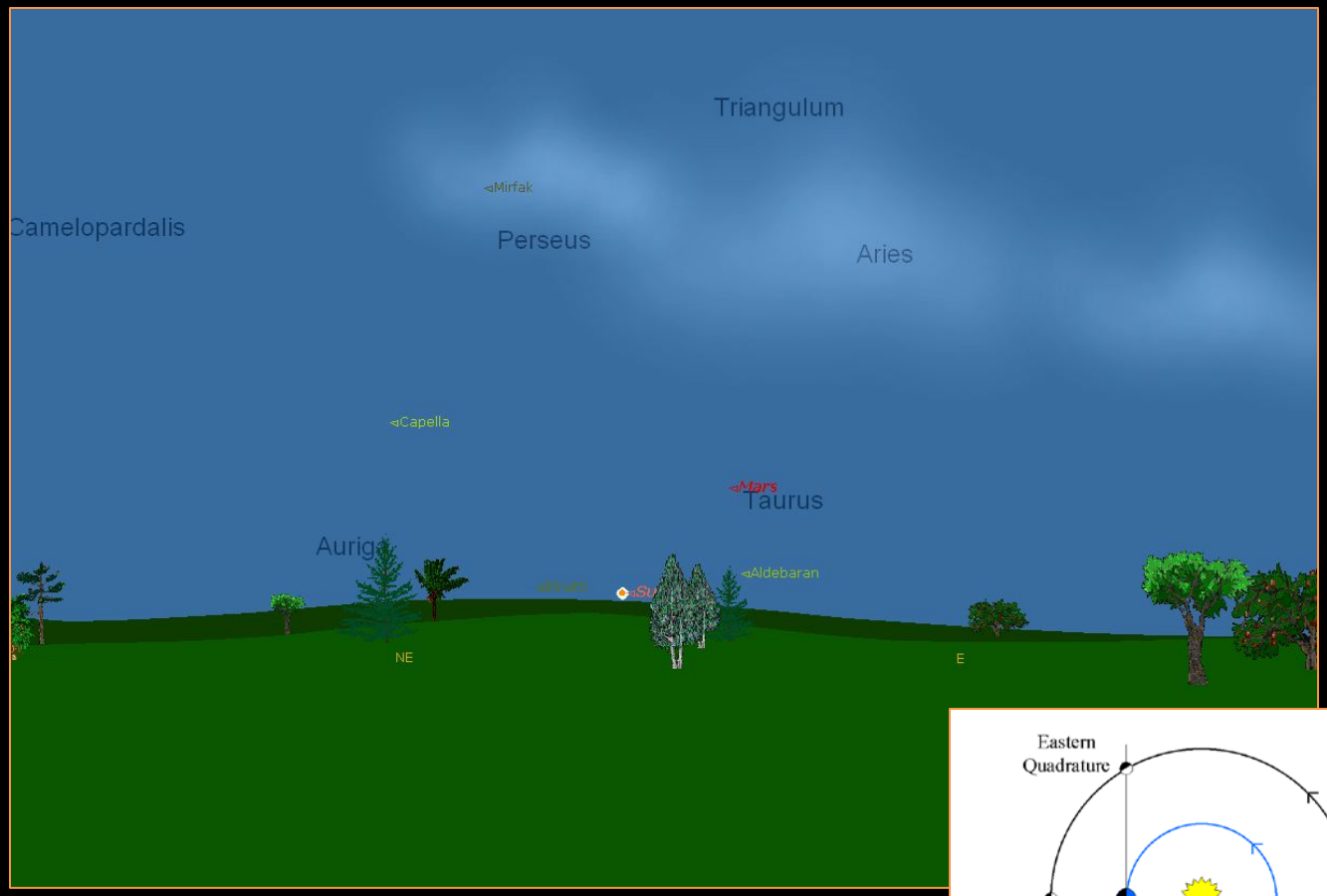
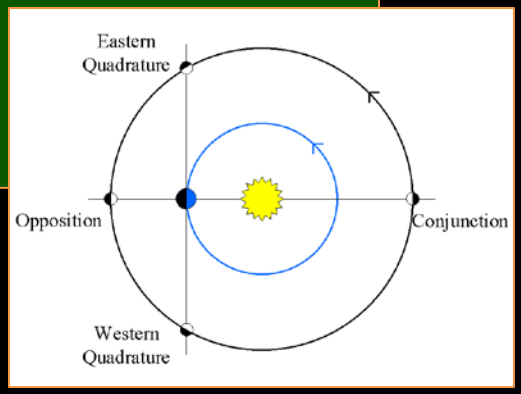


Image Credit: Starry Night Pro



First appearance rising in eastern sky at dawn
Morning star
Mars approximately 12° away from the Sun
Actual visibility date depends on many factors

Opposition – April 8, 2014

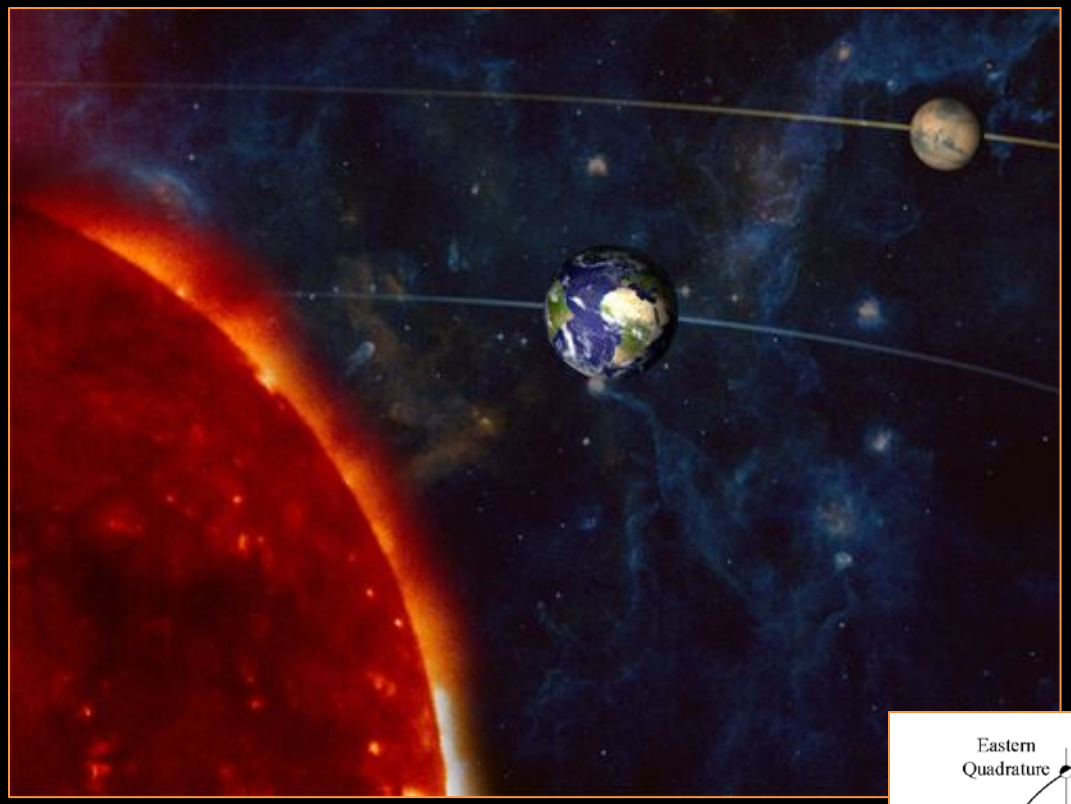
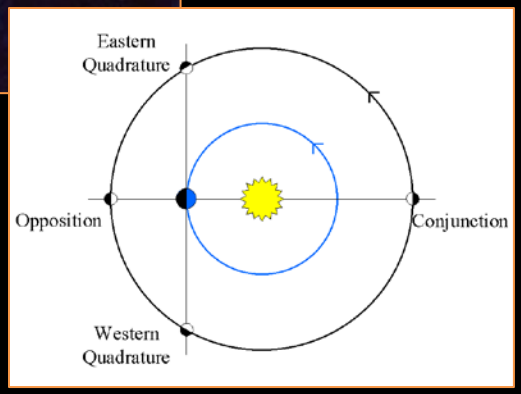


Image Credit: Mars Exploration Program

Mars on opposite side of sky as the Sun
Rises as the Sun sets (evening star)
Highest in the sky at midnight



Heliacal Setting ~ mid-April, 2015

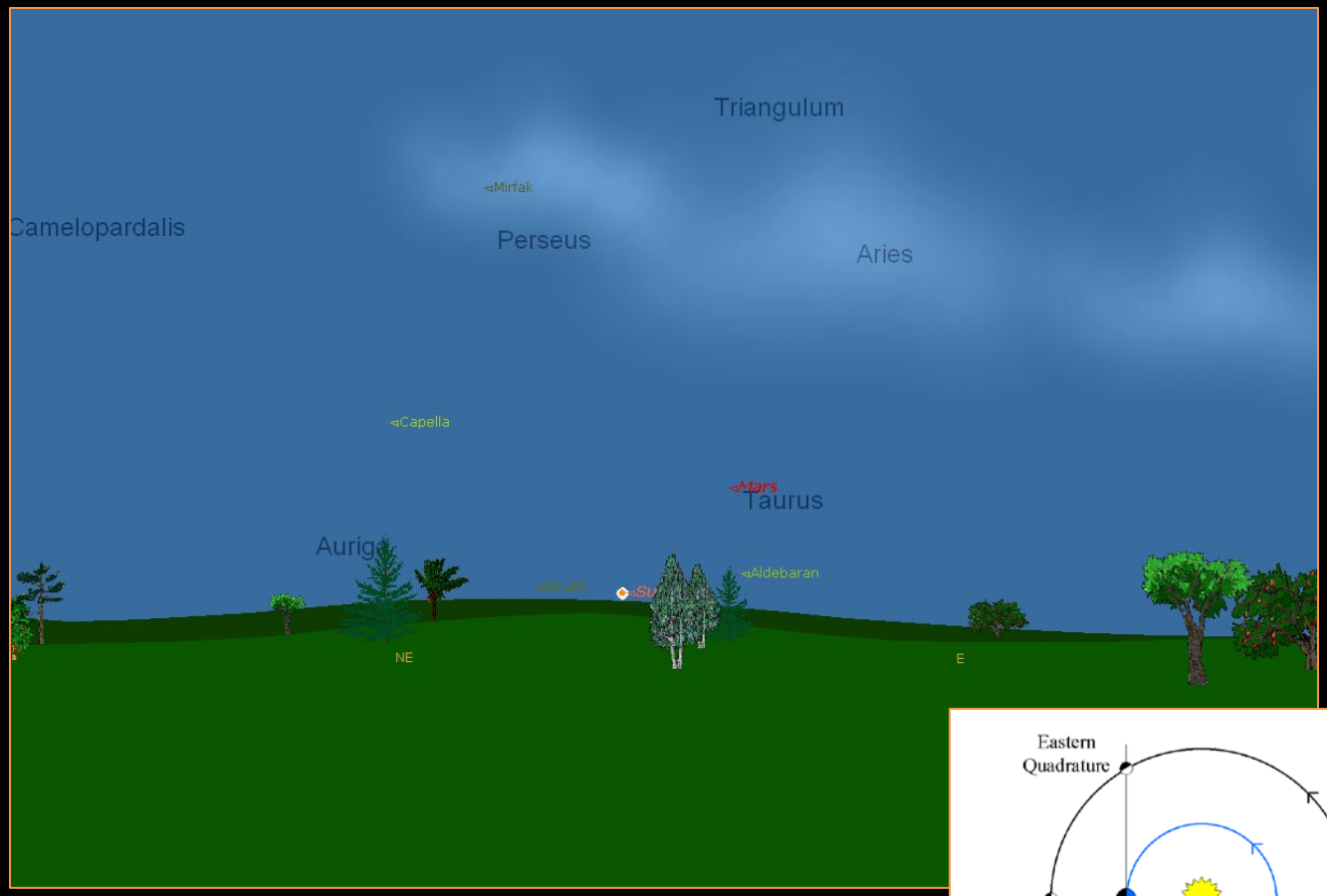
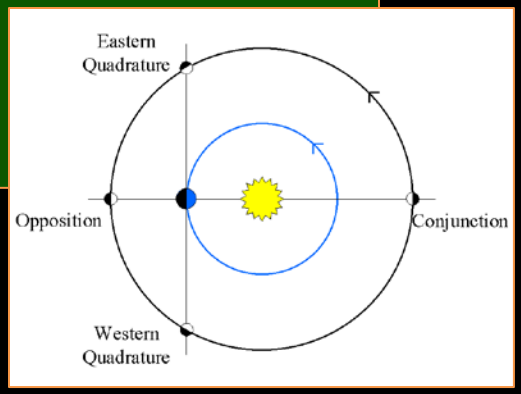


Image Credit: Starry Night Pro



Setting in west after sunset
Last visibility as evening star
Mars approximately 12° away from the Sun
Next conjunction: June 14, 2015

Apparent Movement: Diurnal

- Mars appears to move from east to west (westward) over the course of the night
- Due to the rotation of the Earth on its axis
- Position appears fixed against background of stars on any particular night

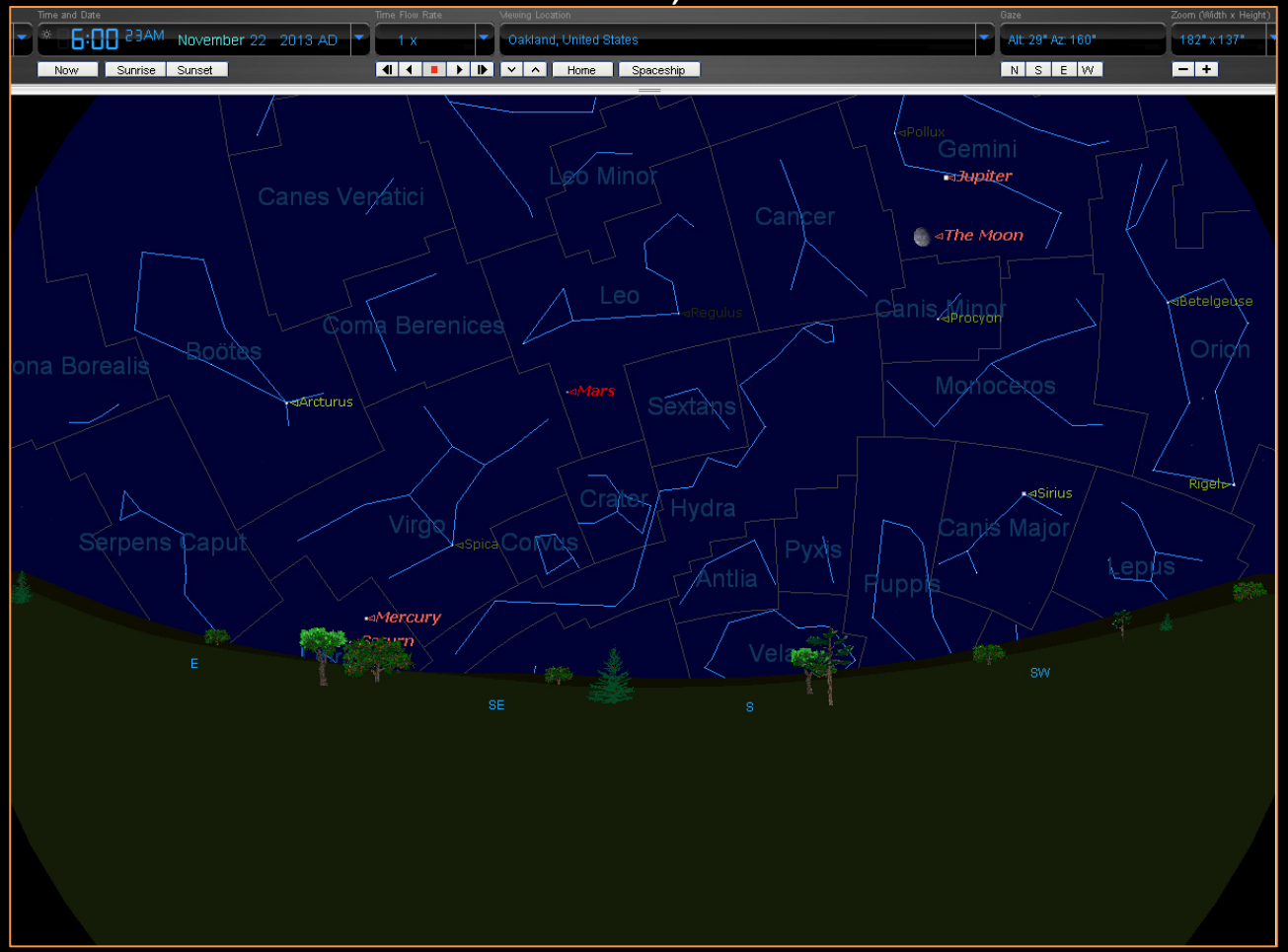
Video Credit: Animations for Physics and Astronomy, Penn State

Apparent Movement: Direct/Prograde

- Mars appears to move from west to east (eastward) from night to night, week to week, month to month
- Relative to the background of stars
  - Mars appears to moves through the zodiac constellations
  - Taurus – June/July 2013
  - Cancer – August 24, 2013
  - Leo – September 25, 2013
  - Virgo – November 25, 2013

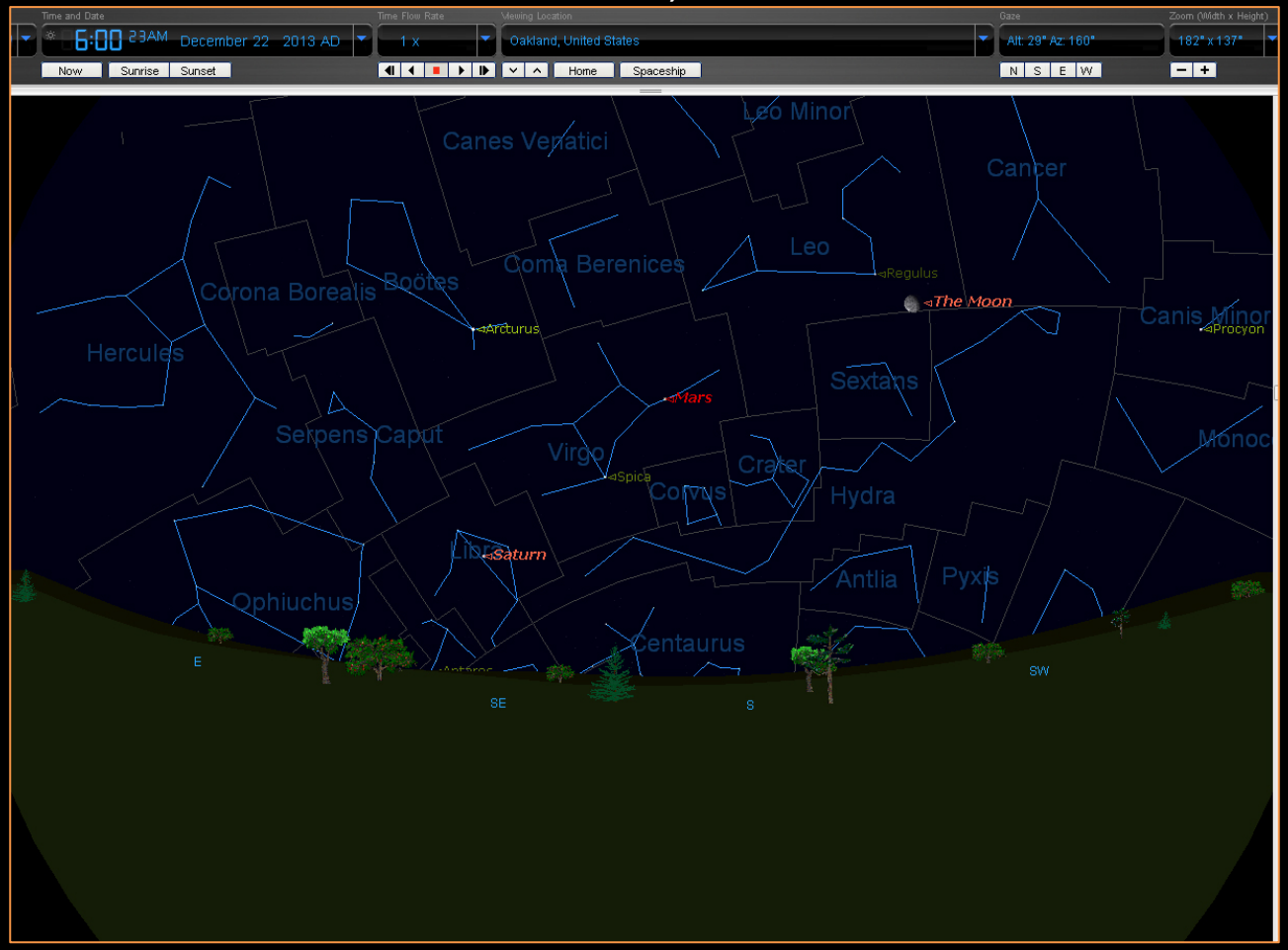
Apparent Movement: Direct/Prograde

November 22, 2013



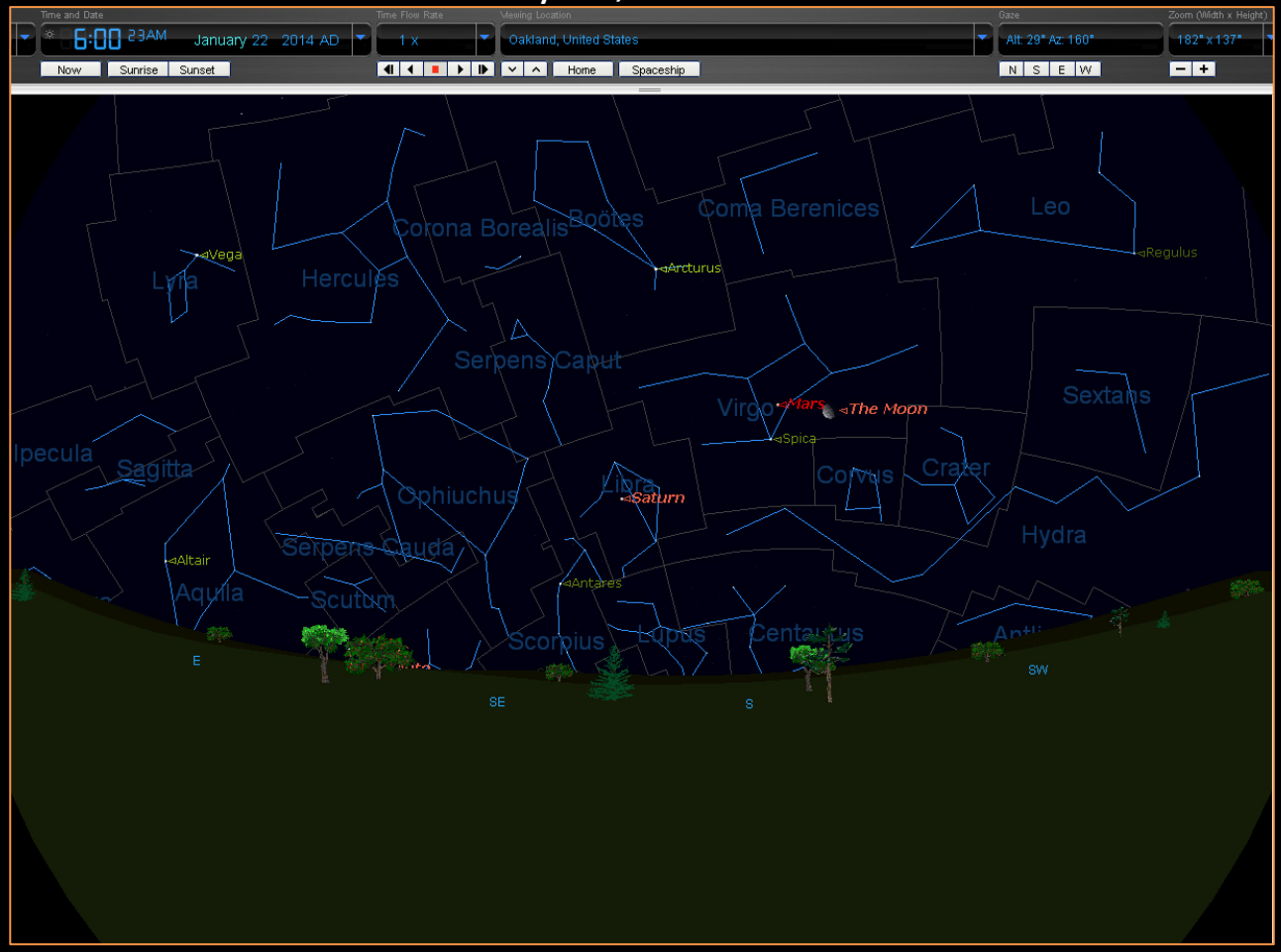
Apparent Movement: Direct/Prograde

December 22, 2013



Apparent Movement: Direct/Prograde

January 22, 2014

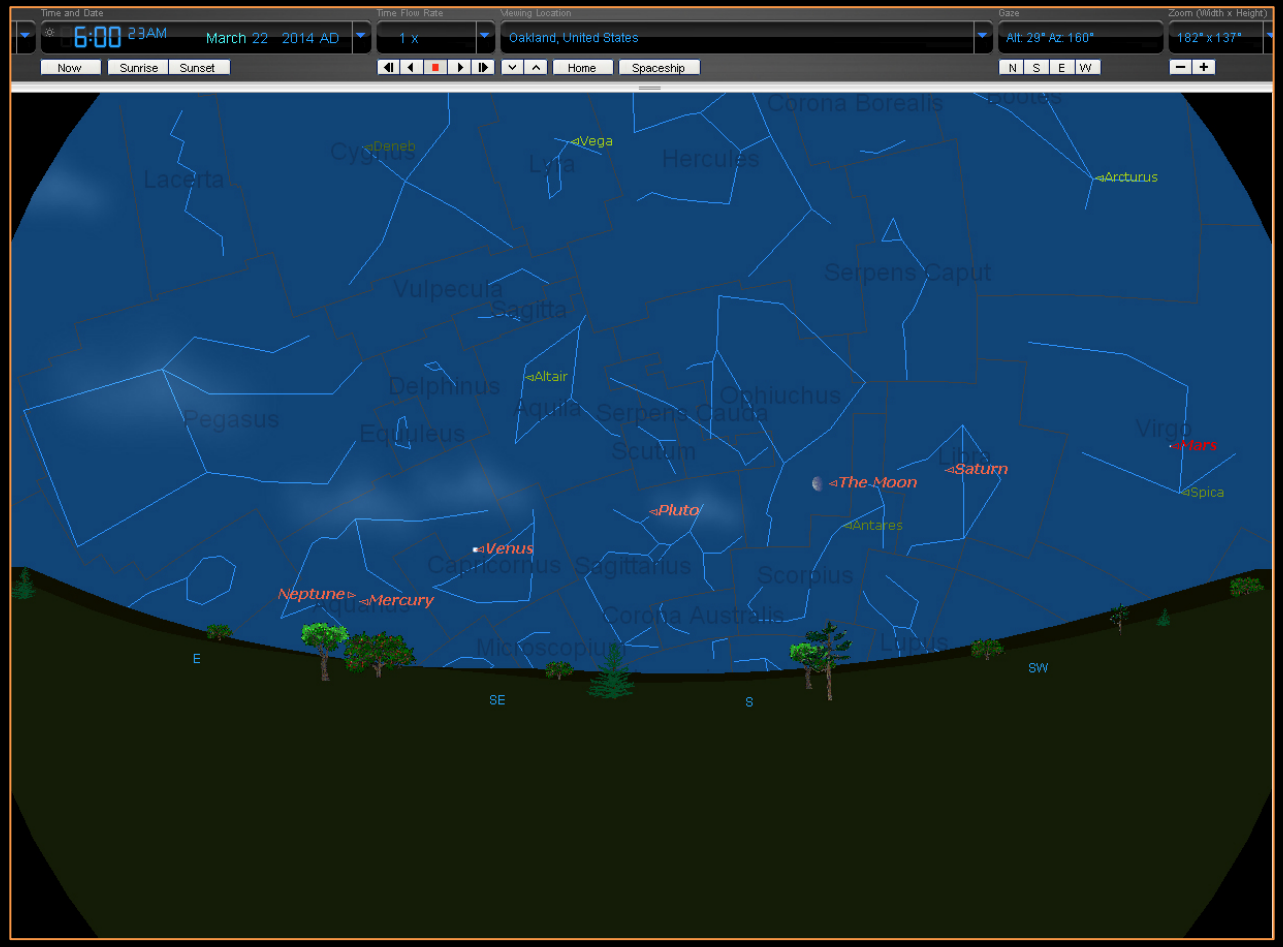


Apparent Movement: Direct/Prograde

February 22, 2014

Apparent Movement: Direct/Prograde

March 22, 2014



Apparent Movement: Retrograde

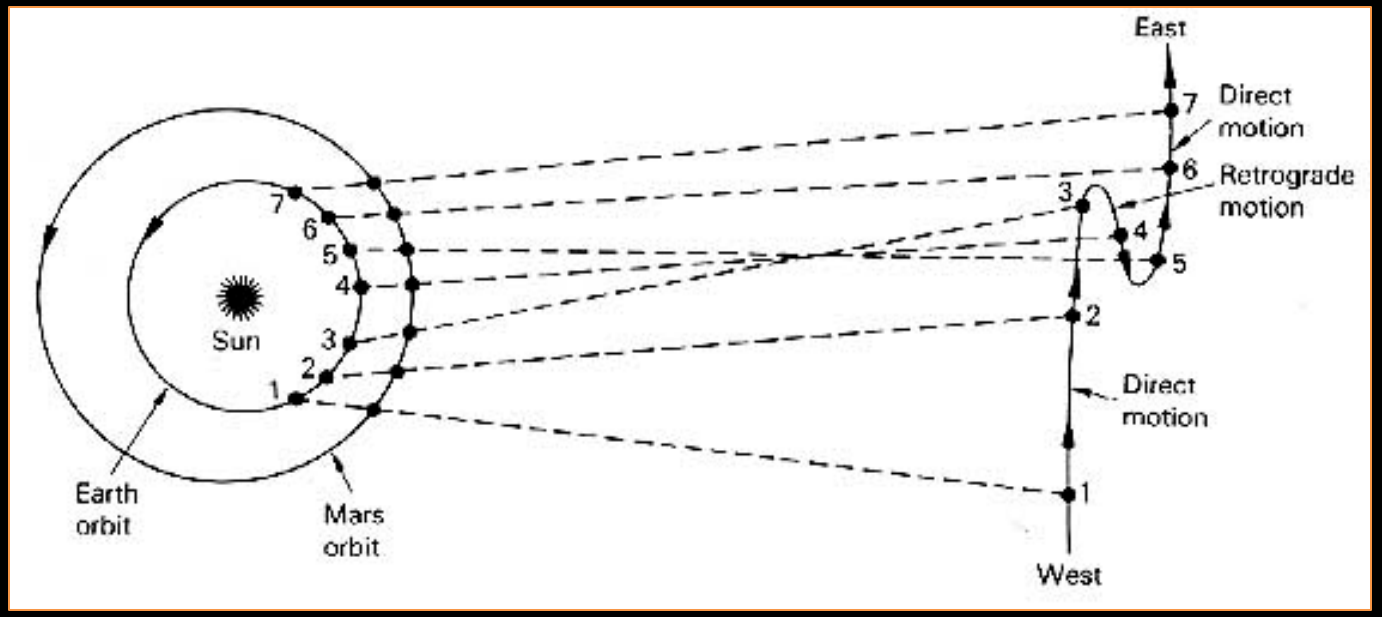


Image Credit: history.nasa.gov

- Occasional westward motion relative to the background stars
- Only occurs around opposition
- March 1 – May 12, 2014: retrograde motion
- Retrograde animation at http://mars.nasa.gov/allaboutmars/nightsky/nightsky04/

Apparent Movement: Retrograde

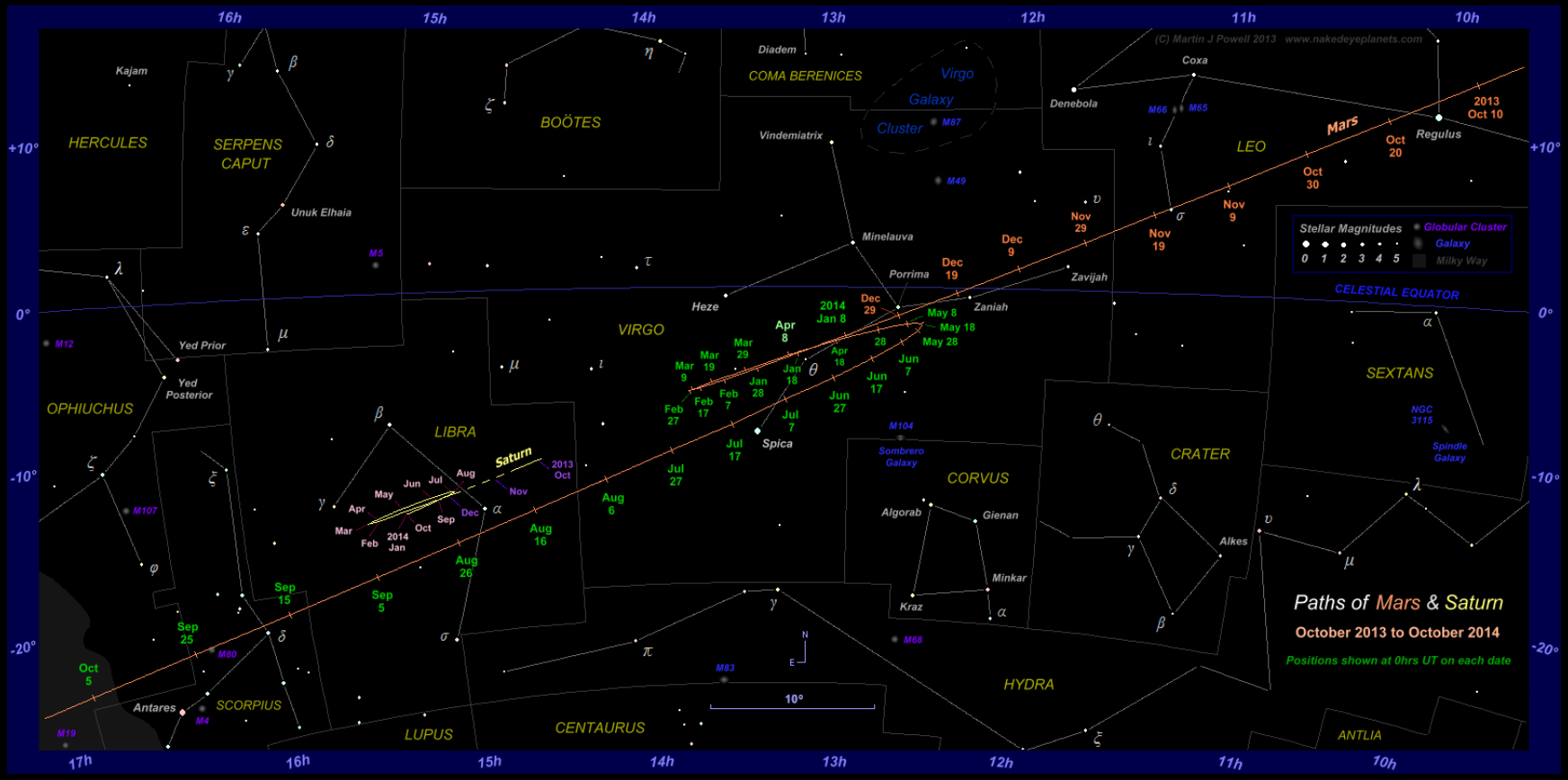


Image Credit: www.nakedeyeplanets.com

MAVEN Launch & Earth-Mars Orbits

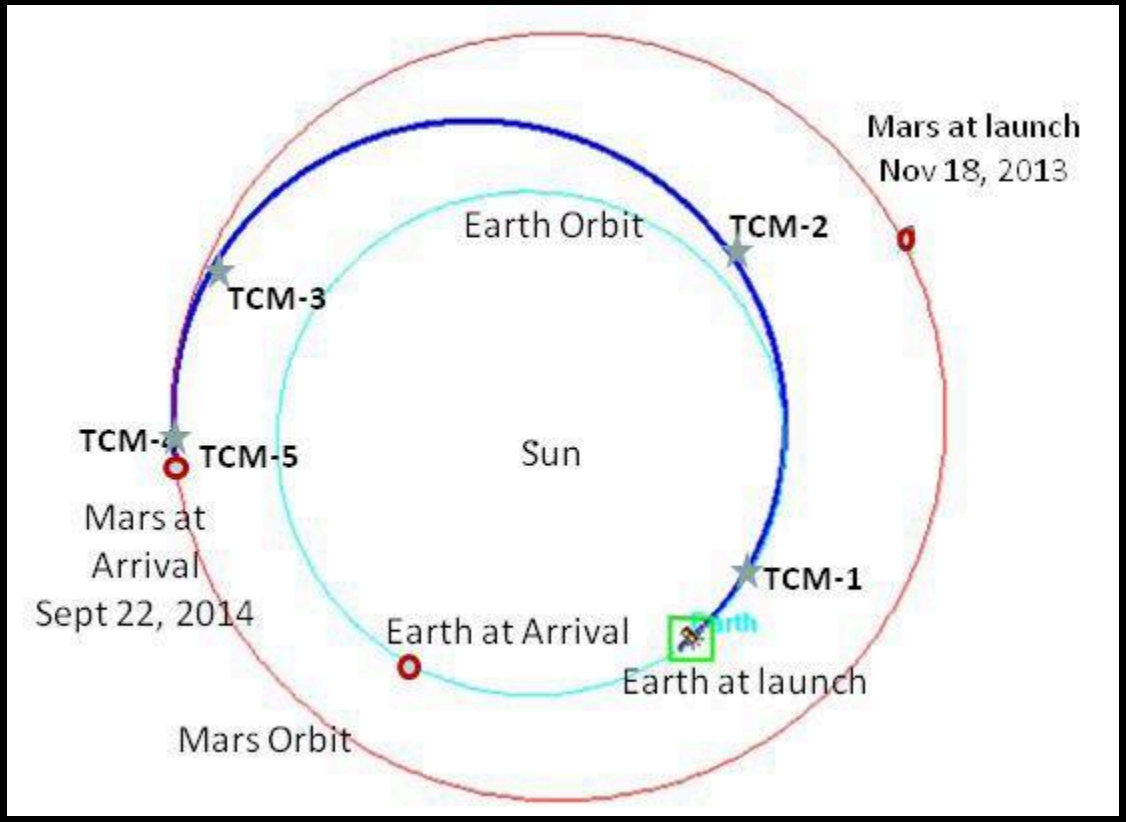


Image Credit: NASA MAVEN Mission