Aspects of the Moon

Motions of The Moon on the Celestial Sphere

- The Moon moves slowly Eastward among the fixed stars of the Celestial Sphere
  - A circuit of the Celestial Sphere take a Sidereal Month of 27.3 days.

  - The *average* time from moonrise to moonrise is $24^h\ 50^m\ 29^s$
    (*i.e.*, the Moon rises - and sets - about 50 minutes later each night.)

- The Path of the Moon is inclined 5.15° with respect to the Ecliptic.

  - The Moon does not return to exactly the same point after each month.
    The *nodical month* is 27.2 days
    But the overall pattern of motion repeats every 18.6 years.)

  - The two points where the Moon's Path crosses the ecliptic are called the nodes.
    (Lunar and Solar eclipses can only occur if the Moon is at one of these nodes.)

The Appearance of the Moon

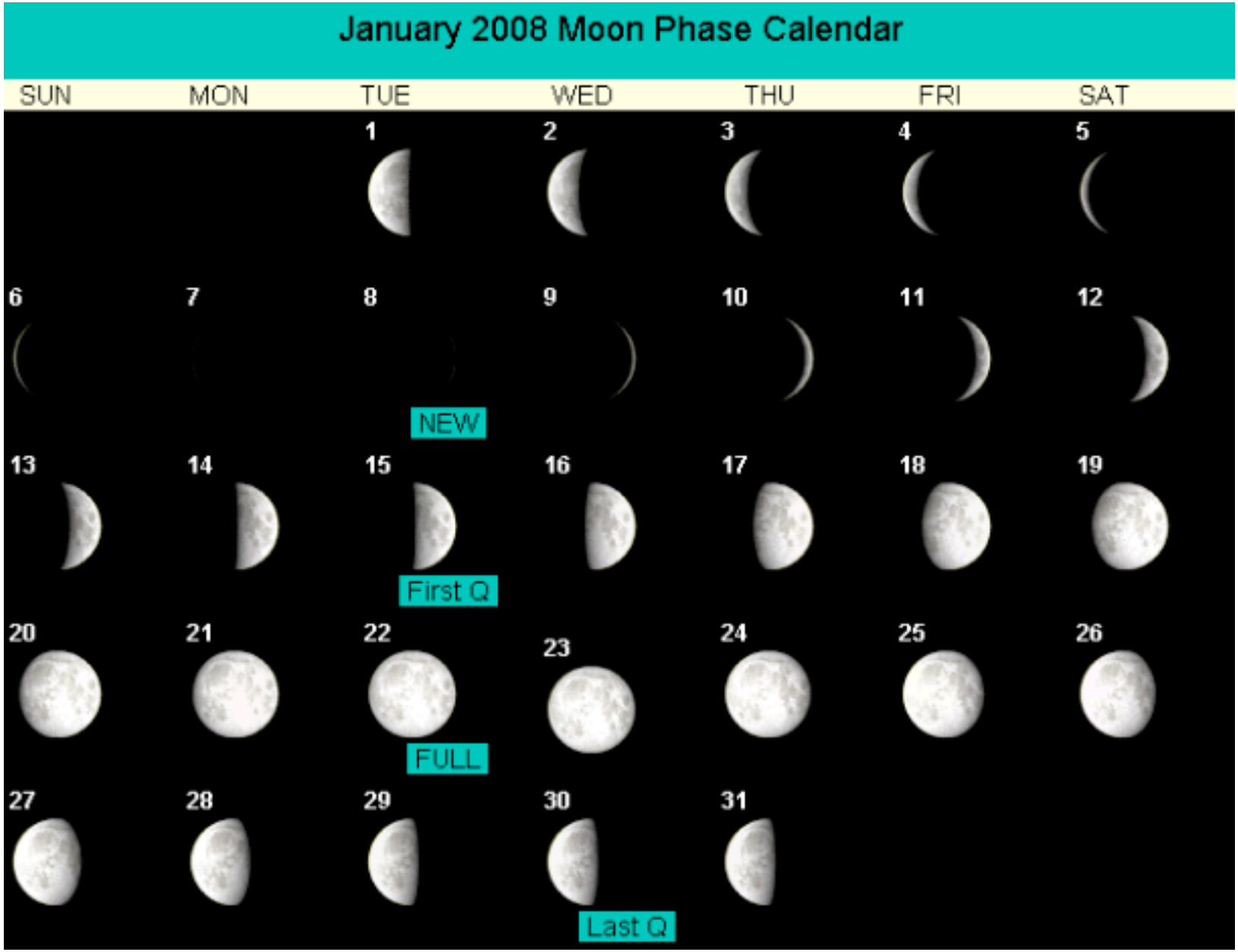
- The Moon appears as a partially illuminated mottled disk.
  - The pattern is variously called “The Man in the Moon”, “The Rabbit”....
  - The angular diameter of the Moon appears fixed at about 1/2 degree.
- The Moon goes through a repeated sequence of Phases.
  - The sequence of phases occupies one Synodical Month of 29.5 days.
    (... different from the Sidereal Month of 27.3 days)
- The Moon’s phase is determined by where it is on the sky with respect to the Sun.
  (full Moon when opposite the Sun, for instance)
  - The Sequence of Lunar Phases is:

New - Waxing Crescent - First Quarter - Waxing Gibbous - Full
followed by:
Full - Waning Gibbous - Third Quarter - Waning Crescent - New

whereupon the sequence of phases repeats.

The Man in the Moon?

January 2008 Moon Phase Calendar



Lunar-Solar Phenomena

- Lunar Phase is determined by the relative locations or directions of the Sun and Moon upon the sky.

- Lunar Eclipses occur when the Moon is both Full and at a Node. (i.e., when the Moon is both Full and on the ecliptic.)

The Earth's shadow is falling onto part of the Moon.

- Solar Eclipses occur when the Moon is both New and at a Node. (i.e., when the Moon is both New and on the ecliptic.)

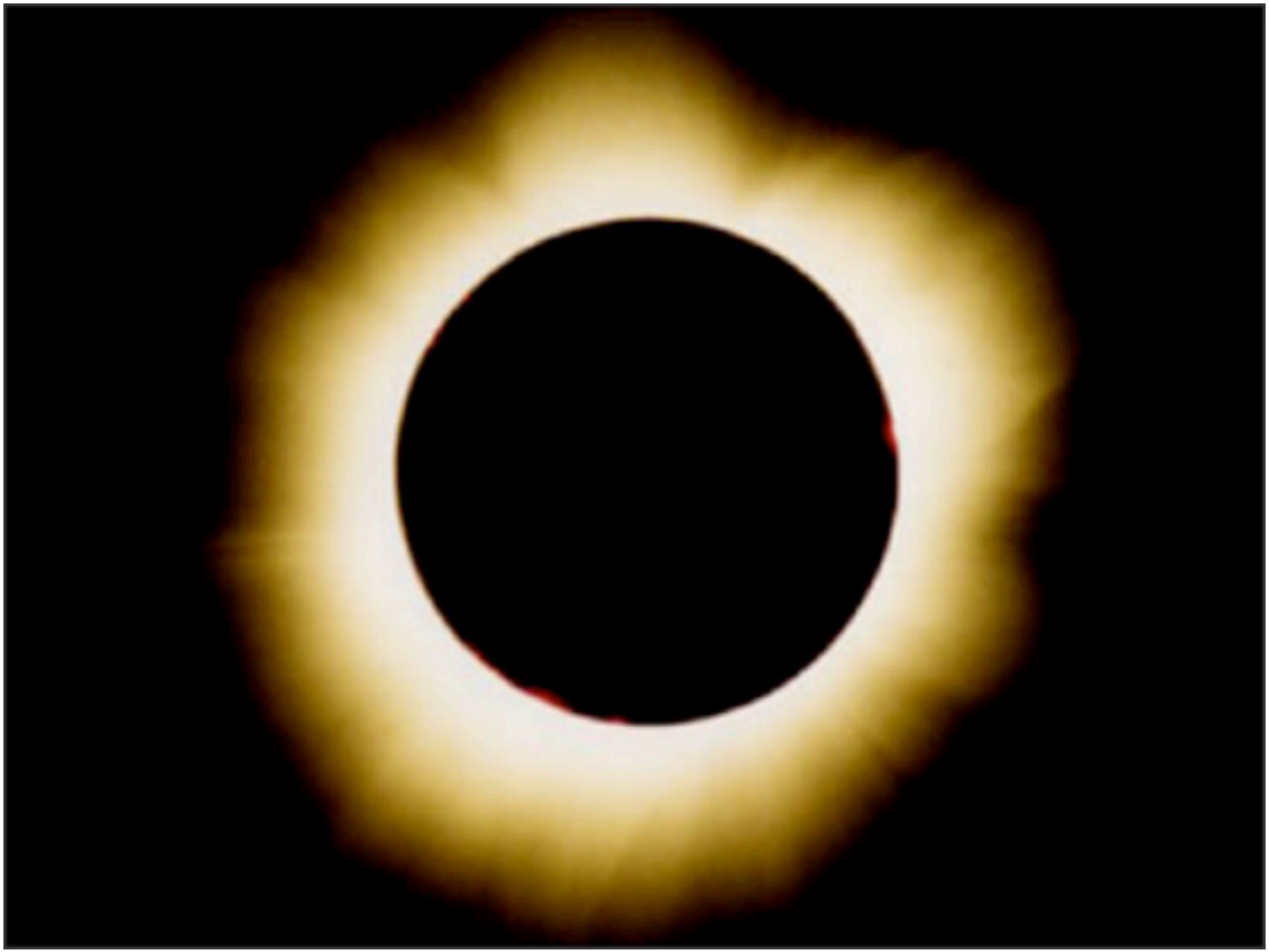
The Moon's shadow is falling onto part of the Earth.

- Eclipses can be partial or total. Solar eclipses can be annular.

- Eclipses tend to occur in pairs, with a pair about every half year.

A Lunar Eclipse (New Mexico, 27 October 2004)

A Total Solar Eclipse (Zambia, 21 June 2001)



A Total Solar Eclipse (Altai Mountains, Mongolia, 1 August 2008)

Lunar-Solar Phenomena: The Tides

- Coastal Regions see two high tides and two low tides per day.
....and about 50 minutes later each day.

- Low tides occur near the times of Moonrise and Moonset
and High Tides occur about midway between these times.

- The amplitude of the tides depends upon the Phase of the Moon
(or, equivalently, where the Sun is on the sky.)
....and upon local topography.

- The greatest tidal amplitudes occur at Full and New Moon.
"Spring Tides"

- The least tidal amplitudes occur at First and Third Quarter Moon.
"Neap Tides"

- There are also Earth Tides with amplitudes of 30 cm or less.

Low Tide

High Tide

Hopewell Rocks, The Bay of Fundy
New Brunswick & Nova Scotia
Canada

(The highest tidal amplitudes have been recorded here: 17 meters or about 56 feet.)

The Planets

• The five "Classical Planets" are those visible to the unaided eye.
Mercury, Venus, Mars, Jupiter, Saturn

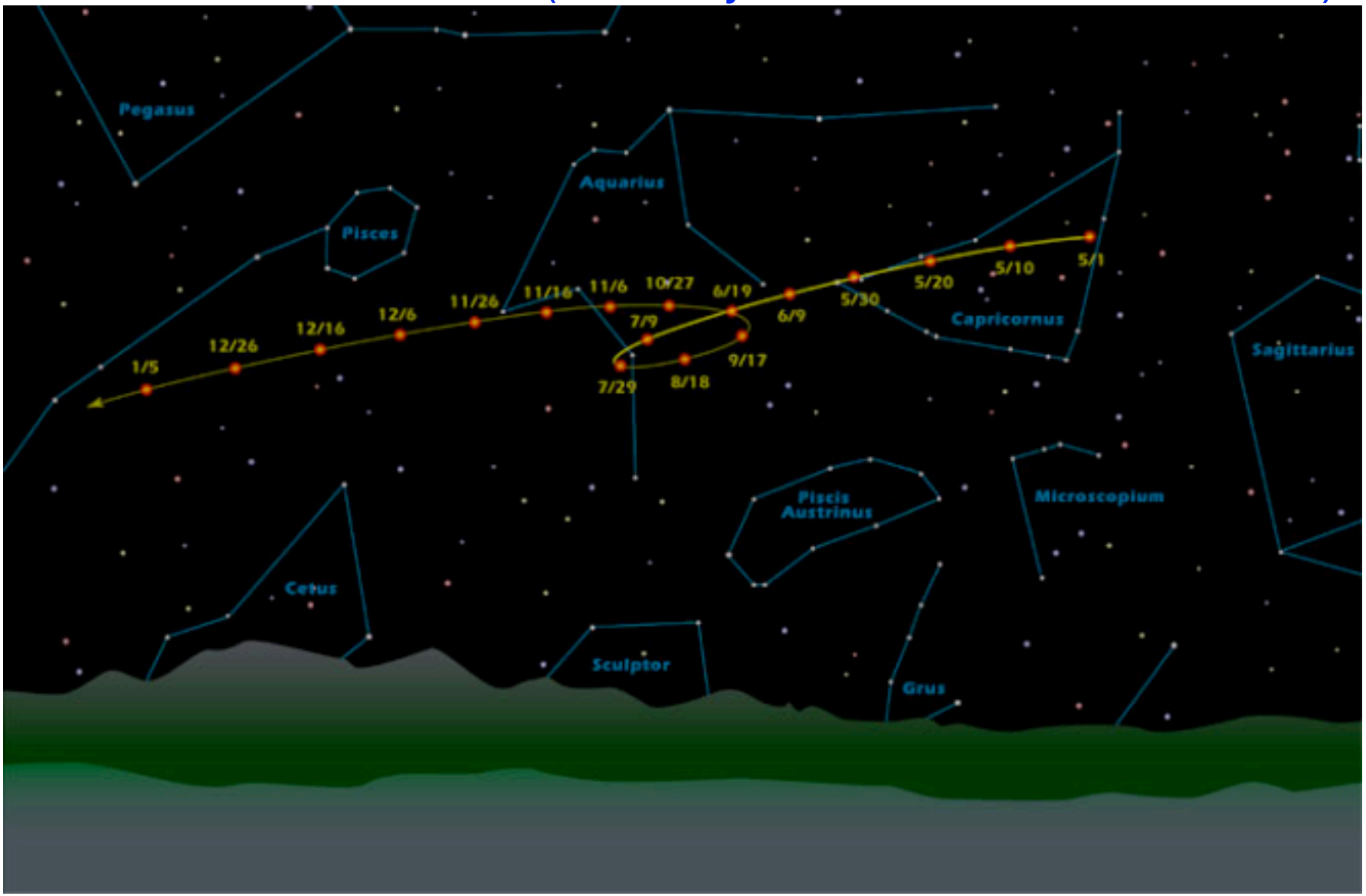
• They look like stars - but are distinguished their motions.
Planetes = "Wanderers"

• When visible they are generally brighter than almost all stars
...and tend not to "twinkle" as do the stars
... and vary periodically in apparent brightness

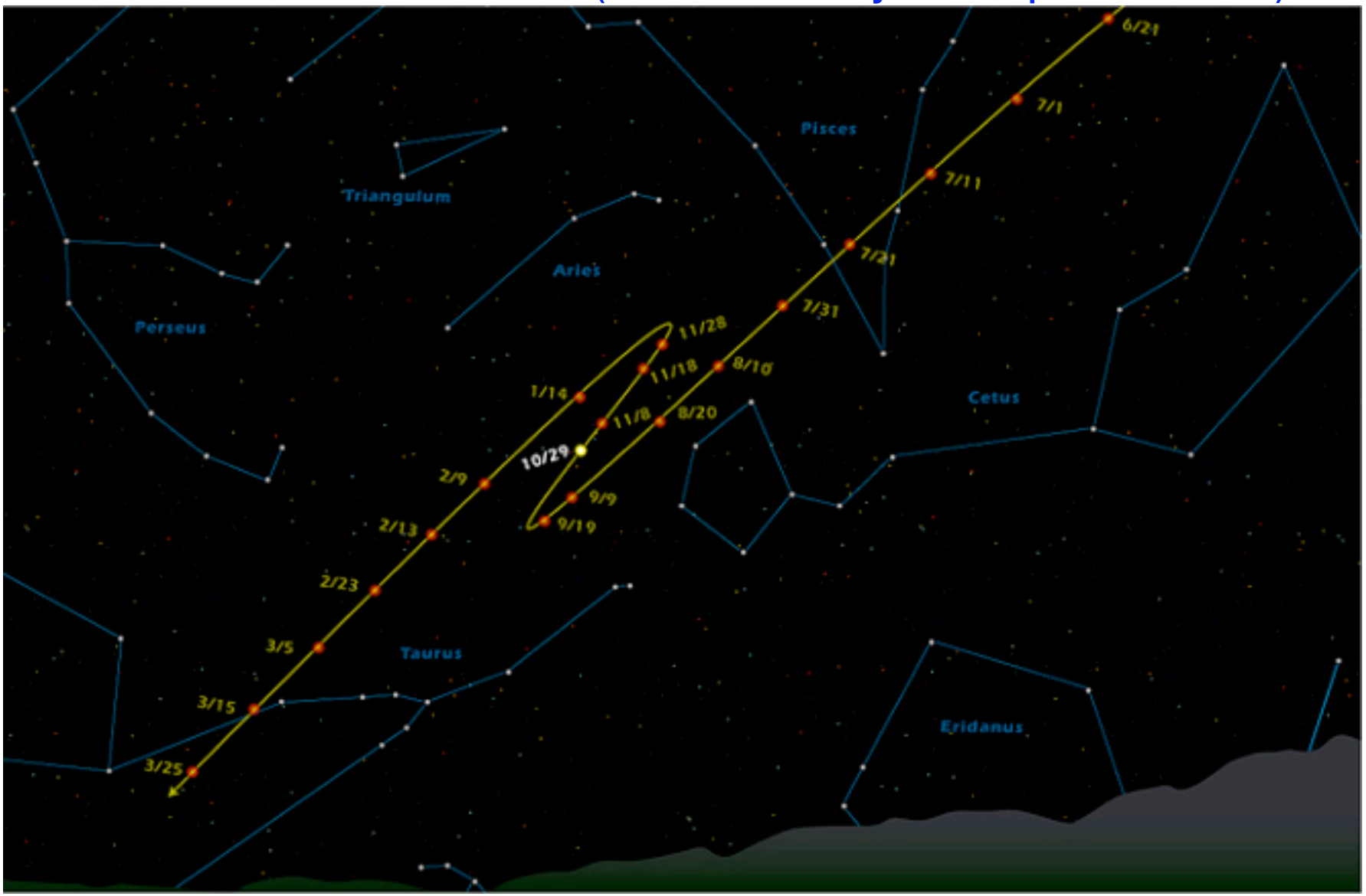
• Planets exhibit cycles of Direct and Retrograde motions.
Direct = Motion Eastward among the fixed stars.
Retrograde = Motion westward among the fixed stars.

• Each planet's motion cycle is characterized by a Synodic Period
... which is the same as the period of its brightness variations
... and is related to its location (in the Zodiac) relative to the Sun.

Mars in 2003 (Mars' Synodic Period is 2.14 Years)



Mars in 2005 (About one synodic period later)



Synodic Periods →

Mercury	0.317	years	(Hermes,Tiw*)
Venus	1.599	"	(Aphrodite, Frigg*)
Mars	2.135	"	(Ares, Woden*)
Jupiter	1.092	"	(Zeus, Thor*)
Saturn	1.035	"	(Cronus)
Uranus	1.012	"	
Neptune	1.006	"	(Poseidon)
Pluto	1.004	"	(Dis)
Eris (!)	1.002	"	

Note: All objects in orbit about the Sun have a Synodic Period.
(Asteroids, Comets, TNOs & KBOs, Spacecraft,...)

*Norse: Tiw→Tuesday, Woden→Wednesday, Thor→Thursday, Frigg→Friday

Resumé

The Moon

- Motions of the Moon: The Sidereal Month
- Phases of the Moon: The Synodical Month

Lunar-Solar Phenomena

- Phases of the Moon
- Lunar & Solar Eclipses
- Tides

The Classical Planets

- Found Near the Ecliptic (in the Zodiac)
- Direct and Retrograde Motions: Synodic Periods
- Brightness Variations: Synodic Periods
- Locations relative to the Sun: Synodic Periods

(see Planetary Configurations)

Next: Mediterranean Astronomy in the Classical Era