The Wanderers!

Cosmological Models

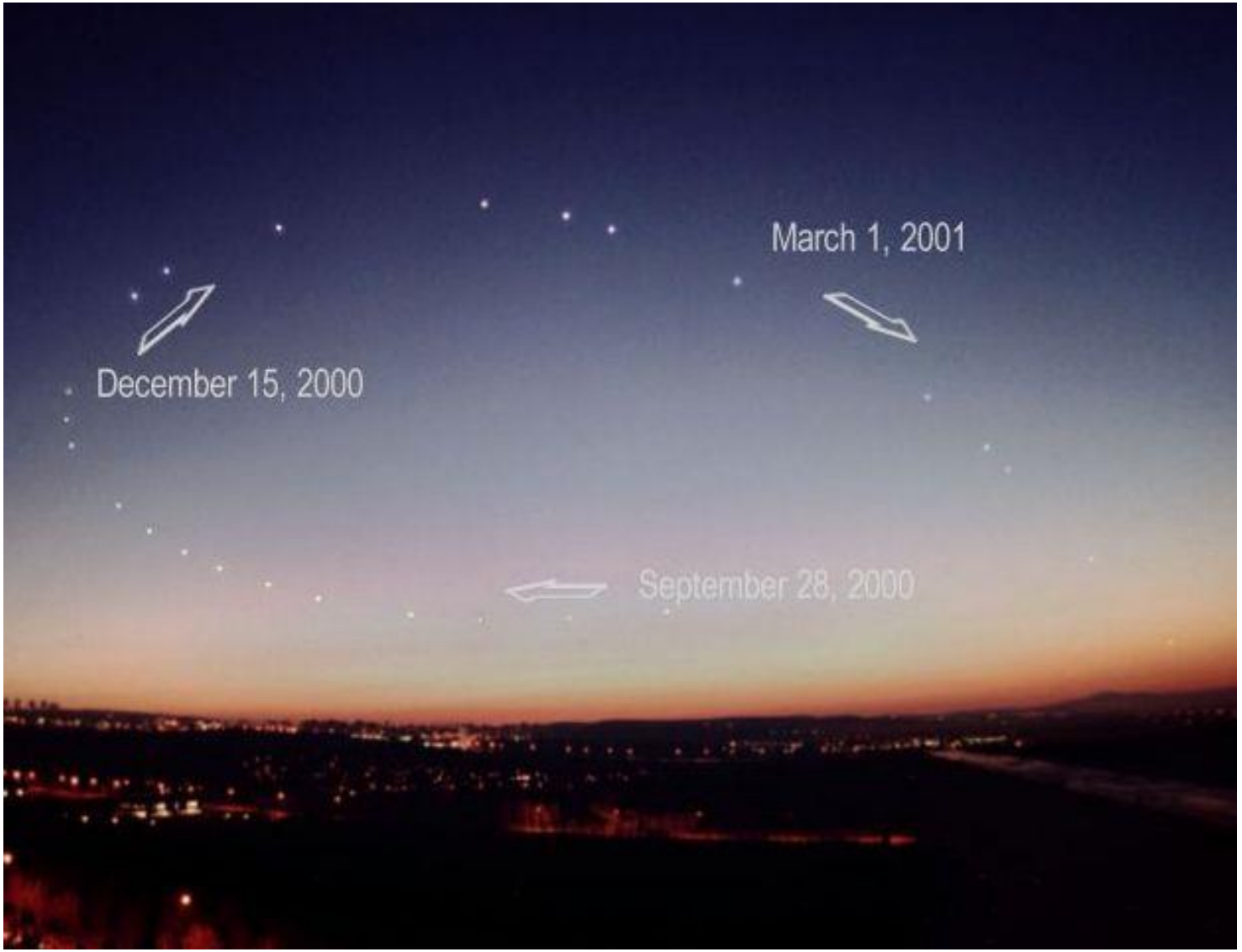
I. Planetary Motion
II. Aristotle and Ptolemy
III. Copernicus
IV. Galileo
V. Kepler's Laws
VI. Newton's Laws
VII. Einstein

The student will be able to:		HW:
1	Describe and illustrate the apparent motion of each of the eight planets as seen from Earth bringing special attention to the similarities and differences.	1 – 5
2	Define, illustrate, and apply the following concepts: direct or prograde motion, retrograde motion, conjunction, opposition, and elongation.	
3	Explain and illustrate aspects of ancient geocentric models of the universe including the concepts of deferents, epicycles, and the works of Ptolemy.	6 – 8
4	Explain and illustrate the heliocentric model of the universe proposed by Copernicus including its seven main points and its own inconsistencies.	9 – 11
5	Explain and illustrate how Galileo was able to provide evidence for the validity of the heliocentric model.	12
6	Desribe Tycho Brahe's contribution to the formation of Kepler's Laws.	13 – 14
7	Define and apply the characteristics of ellipses: focus, semi-major axis, semi-minor axis, and eccentricity.	15 – 16
8	Define, illustrate, and apply the concepts of aphelion and perihelion.	
9	Explain, illustrate, and apply Kepler's three laws of planetary motion and properties of ellipses to solve problems involving orbits.	17 – 21
10	Explain, illustrate, and apply methods for determining the absolute and relative scale of the solar system.	22 – 25
11	Explain, illustrate, and apply Newton's Laws of Motion and Universal Gravitation.	26 – 29
12	Compare and contrast Newton's Laws with Kepler's Laws.	30 – 32

Appearances of the Planets

1. The planets are always located near the ecliptic.
2. Most of the time planets move west to east, which is called direct (or prograde).
3. Occasionally, planets move east to west, which is called retrograde.
4. Retrograde paths look like loops or zigzags.
5. The rate at which a planet moves decreases during a reversal in direction.

fast to slow:	Conj. occurs	Opp. occurs	Max. Elong.	Retrograde occurs during	Synodic Period (days)	Elong. @ max Brightness
Mercury	Y	N	28º	conjunction	116	
Venus	Y	N	47º	conjunction	584	
Mars	Y	Y	180º	opposition	780	
Jupiter	Y	Y	180º	opposition	399	
Saturn	Y	Y	180º	opposition	378	
Uranus	Y	Y	180º	opposition	370	
Neptune	Y	Y	180º	opposition	367	
Pluto	Y	Y	180º	opposition	366	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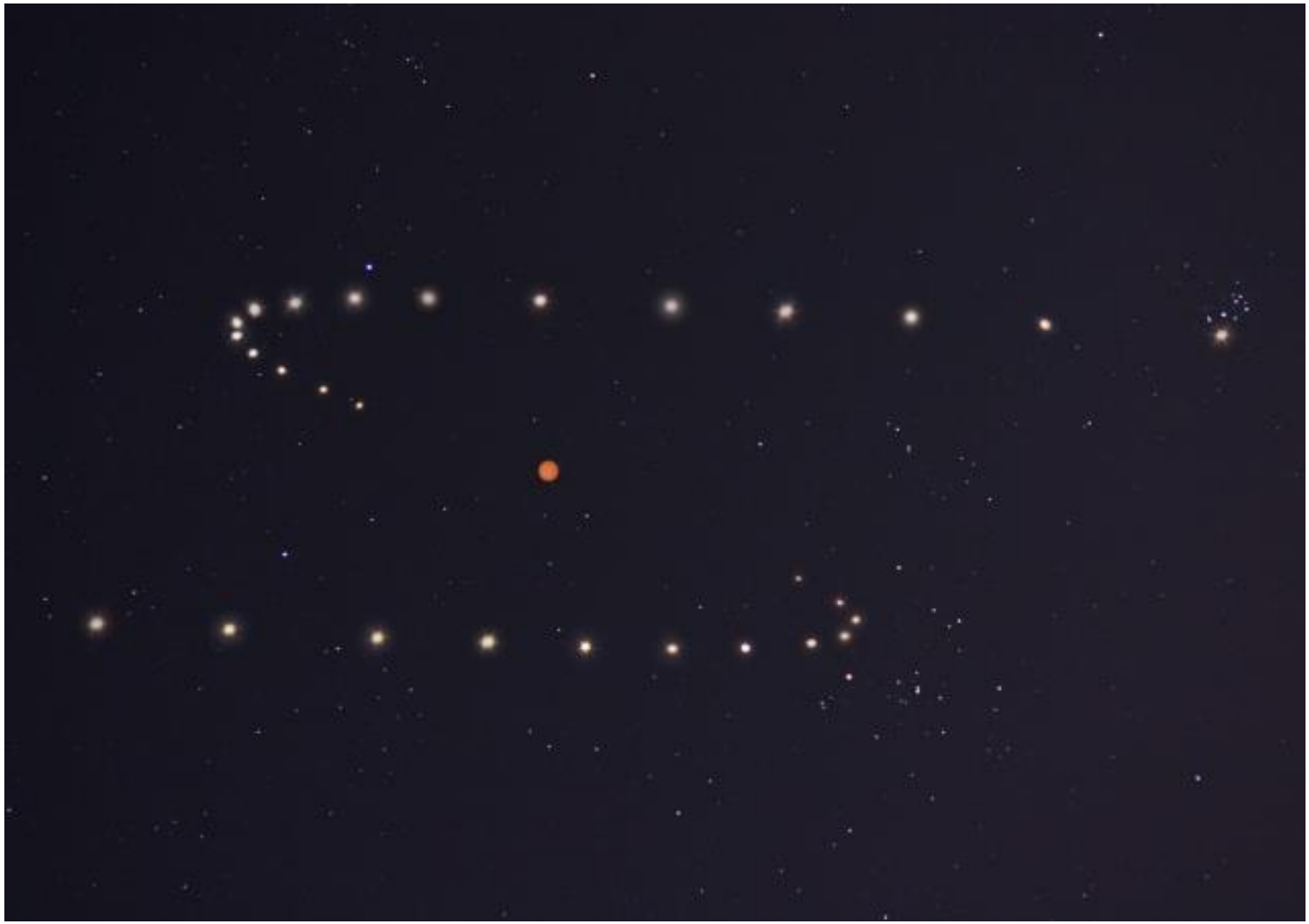

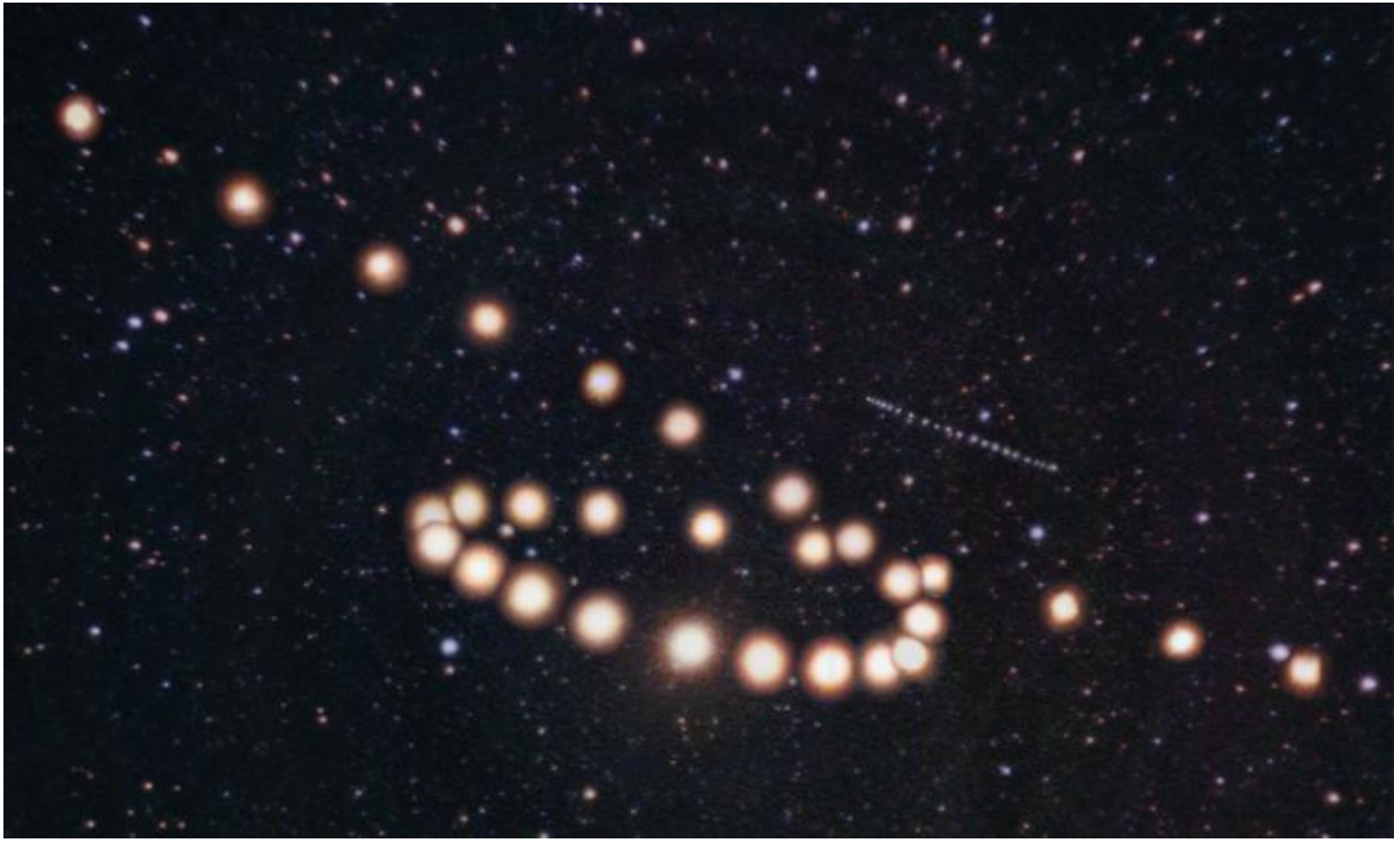

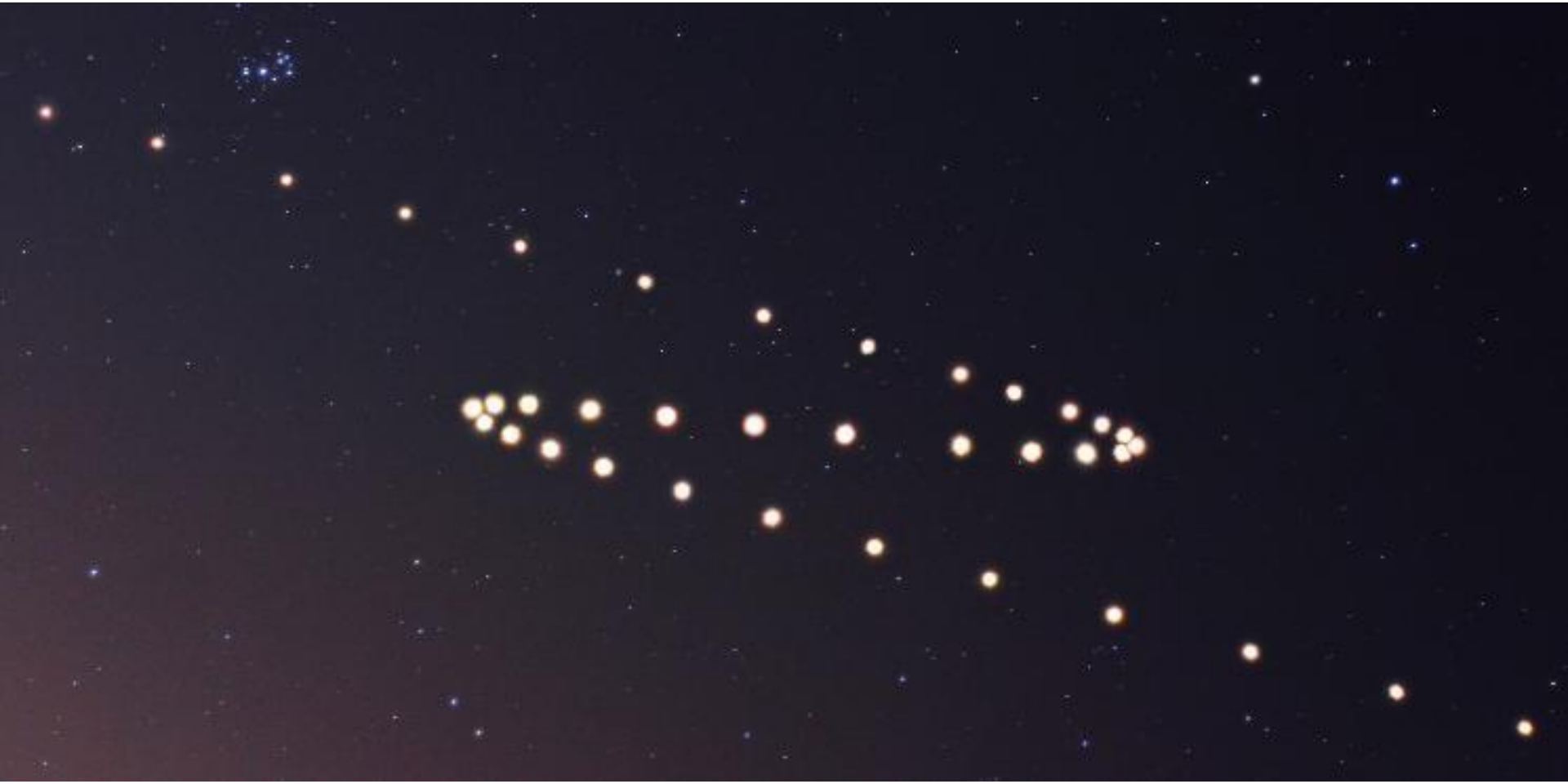

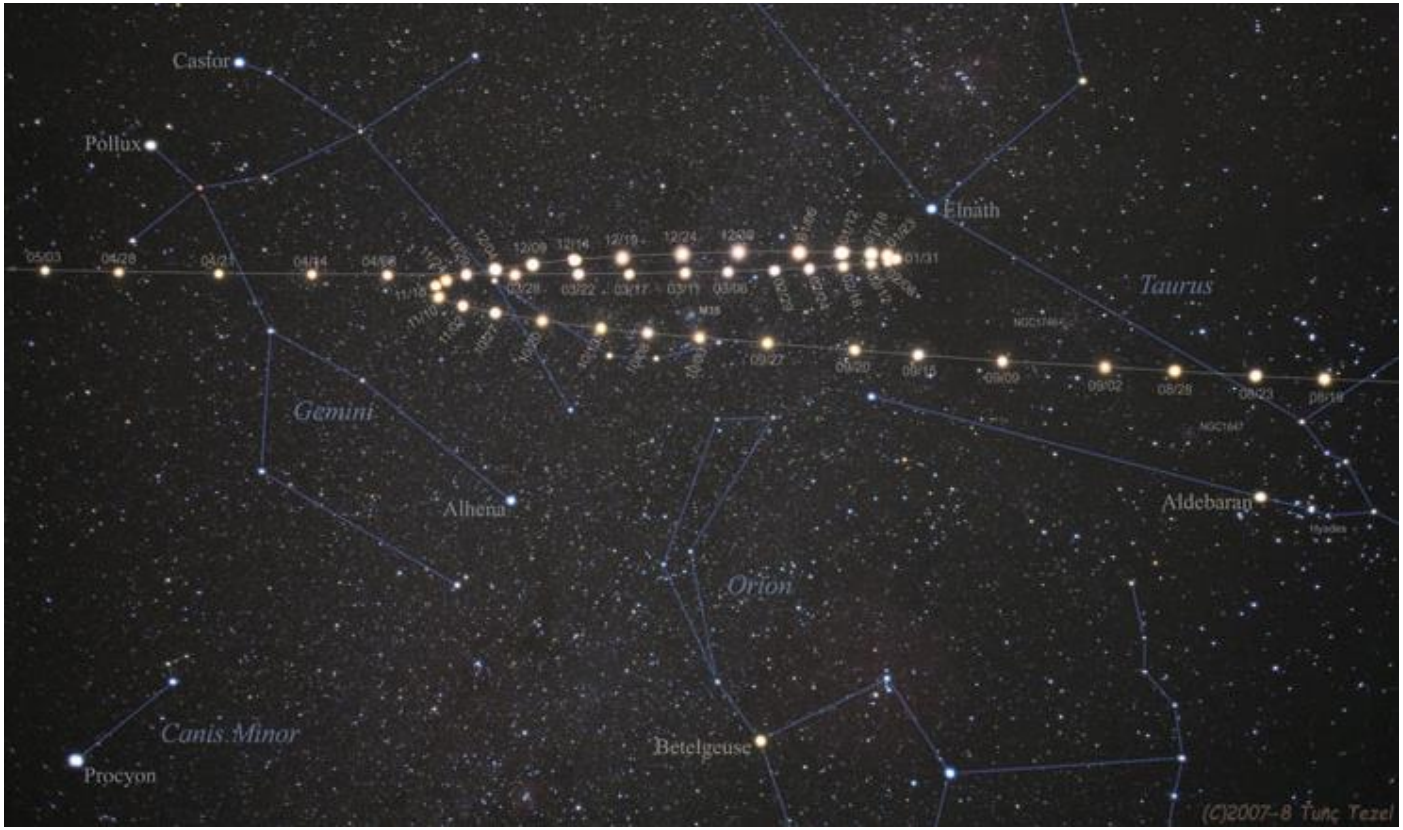
Castor
Pollux
Elnath
Taurus
Gemini
Alhena
Aldebaran
Orion
Canis Minor
Procyon
Betelgeuse
(C)2007-8 Tunc Tezel

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Venus	Y	N	47º	conjunction	584	40º
Mars	Y	Y	180º	opposition	780	180º
Jupiter	Y	Y	180º	opposition	399	180º
Saturn	Y	Y	180º	opposition	378	180º
Uranus	Y	Y	180º	opposition	370	180º
Neptune	Y	Y	180º	opposition	367	180º
Pluto	Y	Y	180º	opposition	366	180º

Key Ideas

- Planets exhibit very particular behaviors.
- Based on years of observations, the planets' behaviors were known to ancient societies.
- It was desired to understand these patterns of behavior. Many different people made contributions to our ultimate understanding of what we observe.
- A successful "cosmological model" can explain all of the apparent behaviors of the planets.