

2012

(NOT) THE END:

Gregorian: 11:11:37 (UTC) 21 December

Long Count: 13.0.0.0.0 (B'ak'tun 13)

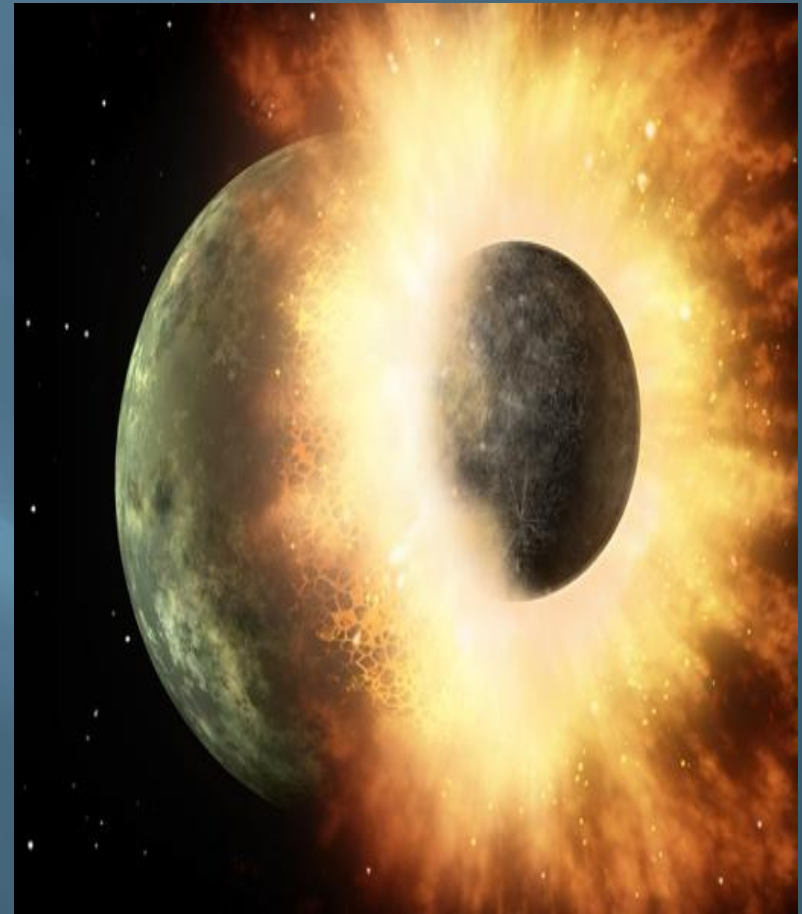
Calendar Round: 4 Ajaw 3 K'ank'in



Movie poster for "2012", released in November 2009. The movie features worldwide tectonic activity and natural disasters, triggered by neutrinos emitted by the Sun during a massive solar flare.

Did the World End in 2012?

- ❑ Doomsday rumors abounded: books, TV, movies, Internet
- ❑ Most rumors cited the “end” of the Maya Long Count calendar on the Winter Solstice that occurred on 21 December, 2012
- ❑ Doomsday scenarios included:
 - Collision of a rogue planet with Earth (Nibiru/Planet X)
 - Planetary alignment
 - Galactic alignment
 - Violent solar storms
 - Sudden geomagnetic reversal
 - “Earth crust displacement”
 - Earthquakes, tsunamis, supervolcanoes
- ❑ New Age interpretation: “cosmic shifting” (spiritual transformation of human consciousness)



Artist rendition of two planets undergoing a catastrophic collision. Such collisions do happen in planetary systems, but are highly unlikely after the system has formed.

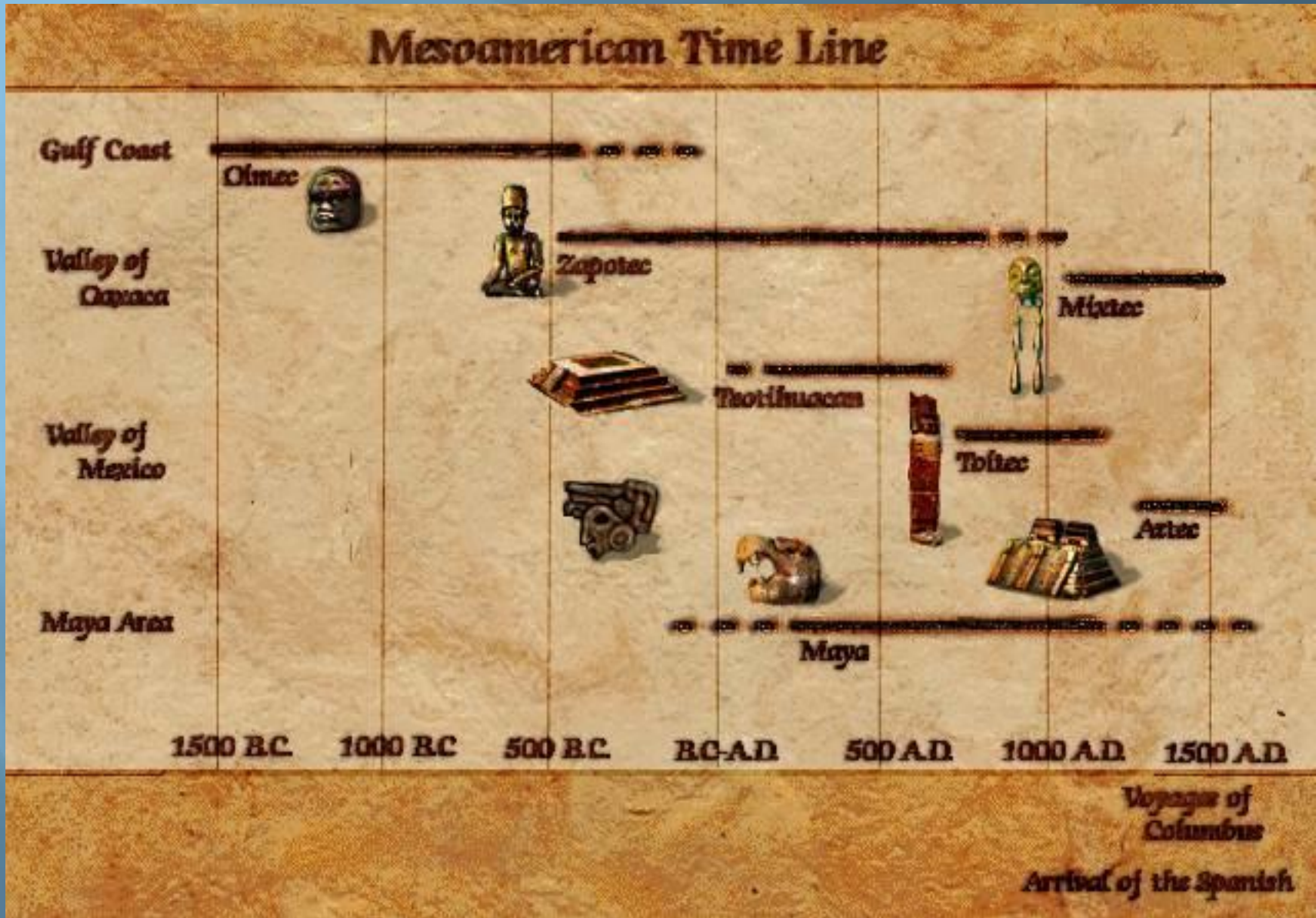
NO!!!

Mesoamerica





Mesoamerica: Chronology



Maya Civilization

Preclassic (c. 2600 BC – 250 AD):

- Mythical creation date: 11 August, 3114 BC
- Earliest occupation, c. 2600 BC
- 1st clearly Maya settlements, c. 1800 BC
- Development of mid-size communities
- 1st written hieroglyphics (c. 250 BC)
- Overlap with other Mesoamerican civilizations

Classic (c. 250 AD – 950 AD; Bak'tun 8-10):

- Large-scale architectural construction & urbanism, intellectual & artistic development, religion, intensive agriculture
- Independent city-states, rather than centrally administered empire (Aztec, Inca)
- Notable temples & monuments include stepped pyramids – religious centers, palaces of rulers
- Astronomy: numerous calendars used including “Long Count”
- Dresden Codex: contains highly accurate astronomical tables
- Long-distance trade with other Mesoamerican cultures (Teotihuacán, Zapotec) & non-Mesoamerican groups (Tainos in Caribbean)
- Traded goods: cacao, salt, sea shells, jade, obsidian



Maya Civilization

Collapse (southern lowlands, c. 900 AD):

- ❑ Overpopulation
- ❑ Carrying capacity exceeded: population growth outstripped available resources
- ❑ Deforestation
- ❑ Soil erosion & depletion
- ❑ Chronic warfare among kingdoms
- ❑ Civil war within kingdoms
- ❑ Peasant revolt
- ❑ Climate change: 200 year period with multiple episodes of severe droughts
- ❑ Malnutrition, starvation, disease

Postclassical (c. 900 AD – early 16th century AD):

- ❑ Development in northern centers persisted
- ❑ Maya cities of northern lowlands flourished
- ❑ Increasing diversity of external influences
- ❑ Spanish conquest: 16th – 17th centuries



Temple in Tikal



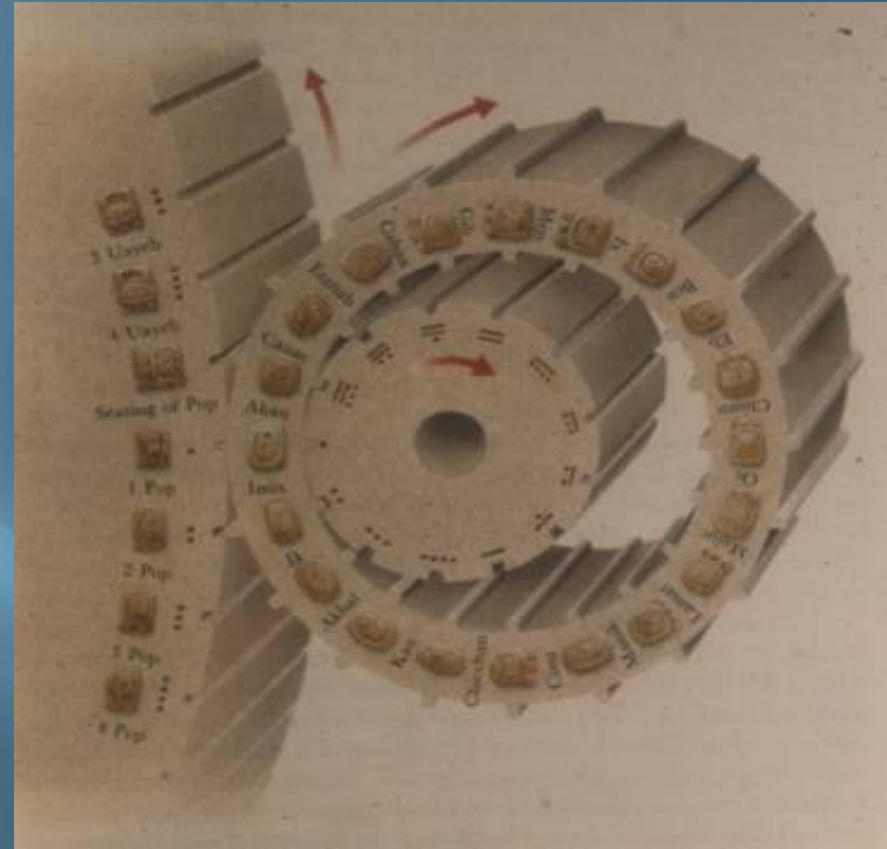
Maya Calendars

- Maya concepts of time
 - Cyclical nature
 - Rituals & ceremonies closely associated with terrestrial & celestial cycles which Maya observed & inscribed as separate calendars

- Tzolk'in ("Sacred Round")
 - 260 days: 13 months, 20 days/month
 - Interlocking 13 & 20 day cycles produce 260 day sacred year
 - Used to determine time of religious & ceremonial events, also for divination

- Haab' ("vague year")
 - Civil year
 - 365 days, "vague": does not include a leap year
 - 18 months, 20 days/month + 5 nameless days at end of year "Wayeb" ("dangerous time")
 - Ignored approximate extra quarter day/year, seasons wandered with respect to calendar year
 - Equivalent to Egyptian wandering 365 day year
 - Julian/Gregorian calendars more accurate

- Other calendars
 - Short count
 - 819 day
 - Moon, Mercury, Venus


















The Calendar Round

- Combination of a Tzolk'in date & Haab' date
- 52 Haab' or solar year cycle (18,980 days)
- End of calendar round: period of unrest & bad luck; Maya waited to see if gods would grant another 52 year cycle
- "Long Count" calendar devised to measure dates longer than 52 years

Long Count Calendar

- Used by Maya during classic period; likely invented by Olmec or Zapotec
 - Linear through Maya history
 - Greater cycle: “The Great Circle”
 - Base 20 (vigesimal): Based on human anatomy (10 fingers + 10 toes)
- Zero or Creation Date: 11 August, 3114 BC
Long Count date: 13.0.0.0.0
- 21 December, 2012:13.0.0.0.0
 - Completion of B’ak’tun 13 (*Pik*)
 - Calendar “resets”
 - 1,872,000 days = 5,126 years
 - Like New Year’s when both day & month reset
 - 13 (of at least 20) Maya time increments reset
 - Just another day – life goes on...
- [*Maya Calendar: NY Times App*](#)

	Symbolic Variant	Head Variant	Head Variant	
B’aktun				144,000 days (20 K’atuns)
K’atun				7200 days (20 Tuns)
Tun				360 days (18 Winals)
Winal				20 days (20 kins)
K’in				1 Day

Why was December 21, 2012 Important?

August 11, 3114 BC

13.0.0.0.0 4 Ahaw 8 Cumku

Baktuns

Katuns

Tuns

Uinals

Kins

Tzolkin

Haab

Why was December 21, 2012 Important?

December 21, 2012

13.0.0.0.0 4 Ahaw 3 K'ank'in

Baktuns

Katuns

Tuns

Uinals

Kins

Tzolkin

Haab

Long Count Calendar

- Maya recorded recurring astronomical events relating to the Sun, Moon, & five visible planets
 - Did not predict natural disasters or undiscovered astronomical objects
 - Did not predict the collapse of their own civilization, or rise of later empires, or subsequent Spanish conquest
- Significance of B'ak'tun13 to classic Maya uncertain
 - Tortuguero Monument 6:
 - Reference to patron deity of “period endings” who descends to oversee ceremonies on that day
 - PARTY!!!
 - La Corona Hieroglyphs Stairway 2, Block V:
 - Political history of a Mayan king named Jaguar Paw
 - Linked his reign to B'ak'tun 13 to promote continuity & stability
 - Not a prophetic declaration
 - Priest timekeepers at Palenque believed cycle would end after 20 B'ak'tun, not 13; temple inscription refers to a date in 4772 AD
 - Present day Maya attach no significance to this date; they have practical concerns like crops, rain
- Other Long Count cycles: Piktun, Kalabtun, K'inchiltun, Alautun
 - Allows dates trillions of years into past or future
 - Maya not concerned about a specific end date



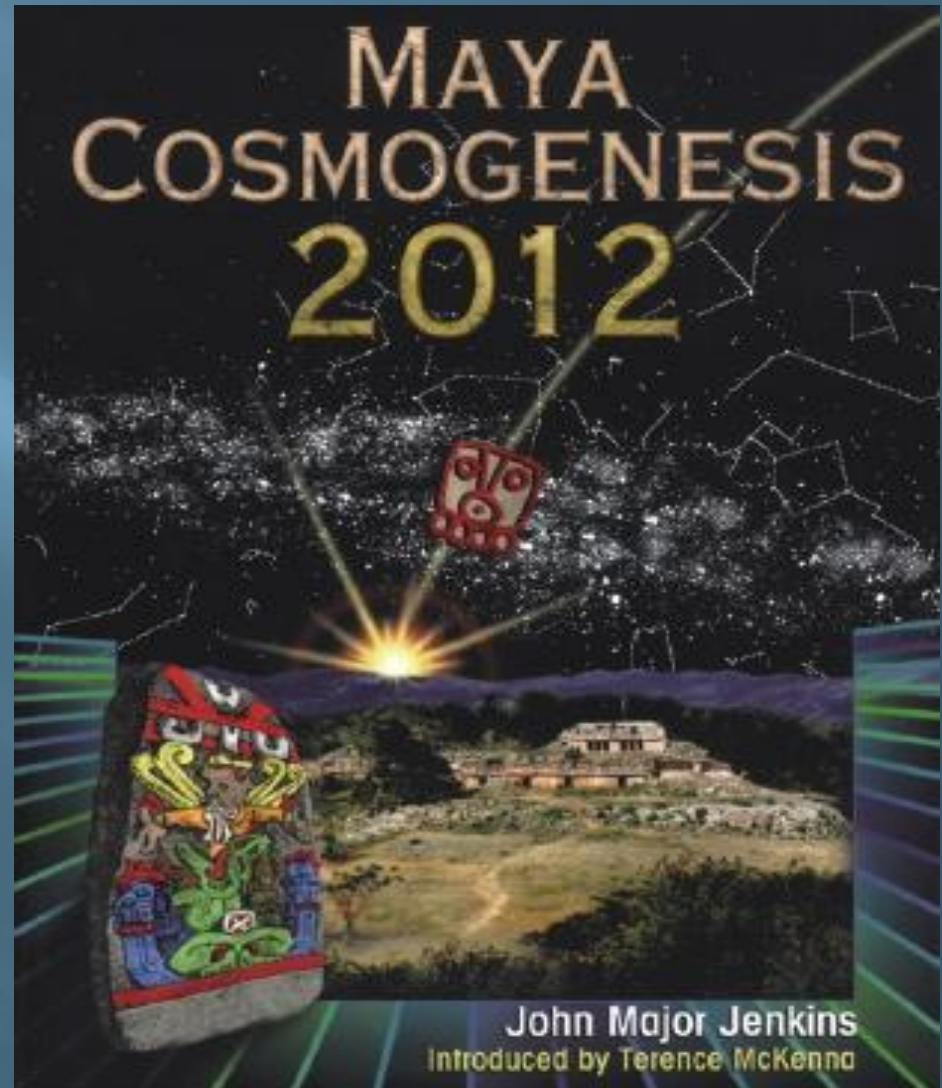
A date inscription for the Long Count



Galactic Alignment and Transcendence



John Major Jenkins



Galactic Alignment

“Black Road”: J.M. Jenkins (1990s):

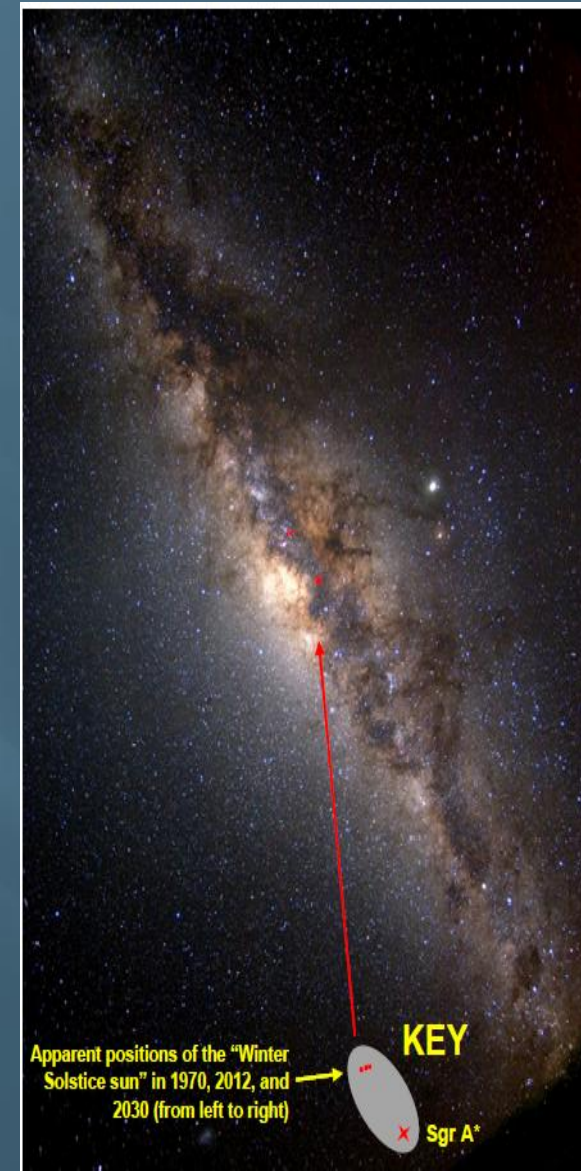
- Claim: Sun precisely aligns with intersection point of ecliptic plane & “Black Road” on 21 December, 2012
- Jenkins claimed classical Maya anticipated this conjunction & celebrated it as the harbinger of a profound spiritual transition for mankind

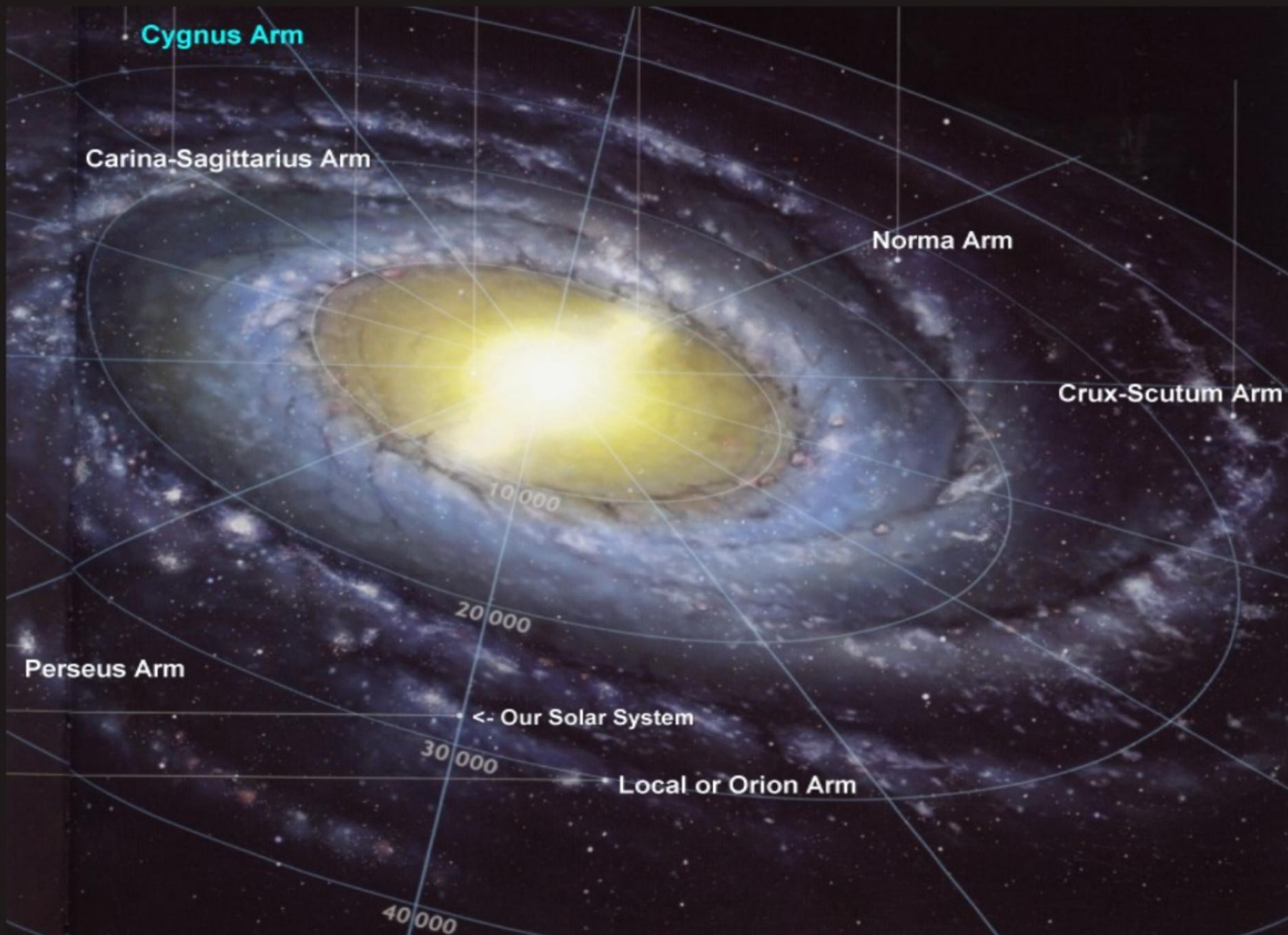
Nothing special about so-called alignment:

- Earth-Sun aligns (approximately) with galactic center every winter solstice for past 1,000 years
- Ecliptic: Apparent path of Sun & planets across the sky during a year
- Zodiac: 12 constellations (13 really) along ecliptic through which Sun appears to pass each year
- Spring Equinox: Pisces
- Winter Solstice: Sagittarius (direction of galactic center)
- Sagittarius A*: Supermassive black hole (4×10^6 solar mass) 26,000 ly from Earth (much too far away to have any possible effect)



The Milky Way near Cygnus showing the lane of the Dark Rift, which the Maya called the Xibalba be or “Back Road”





Cygnus Arm

Carina-Sagittarius Arm

Norma Arm

Crux-Scutum Arm

Perseus Arm

10 000

20 000

<- Our Solar System

30 000

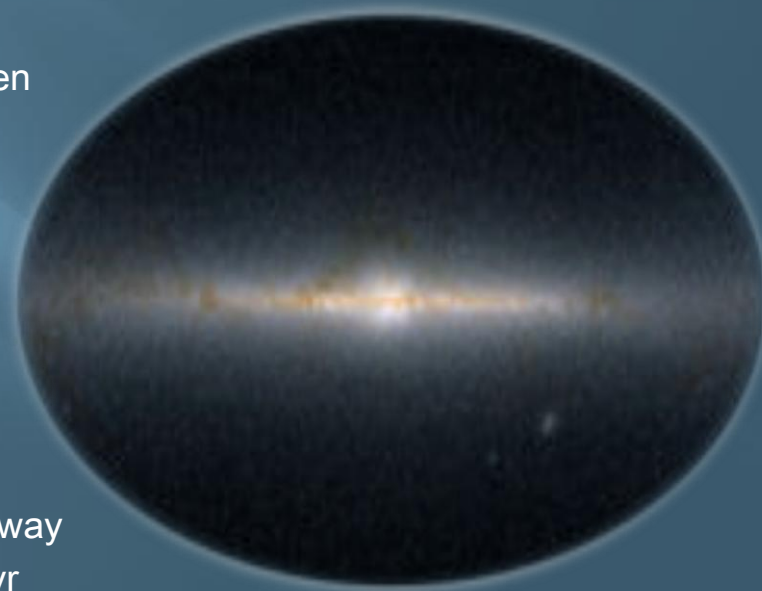
Local or Orion Arm

40 000

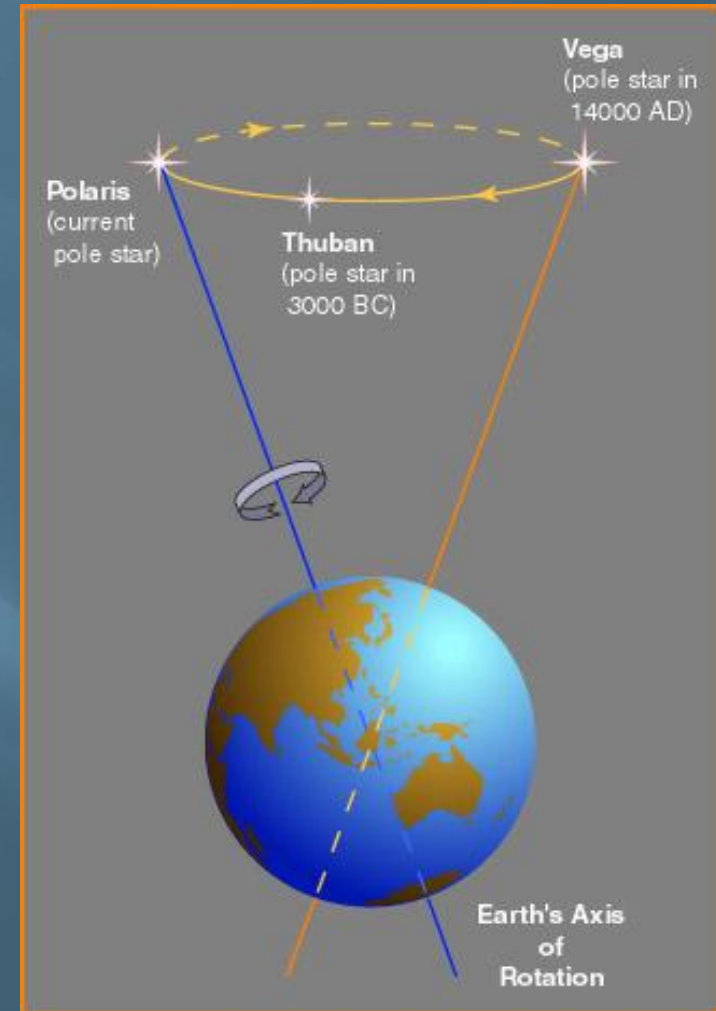
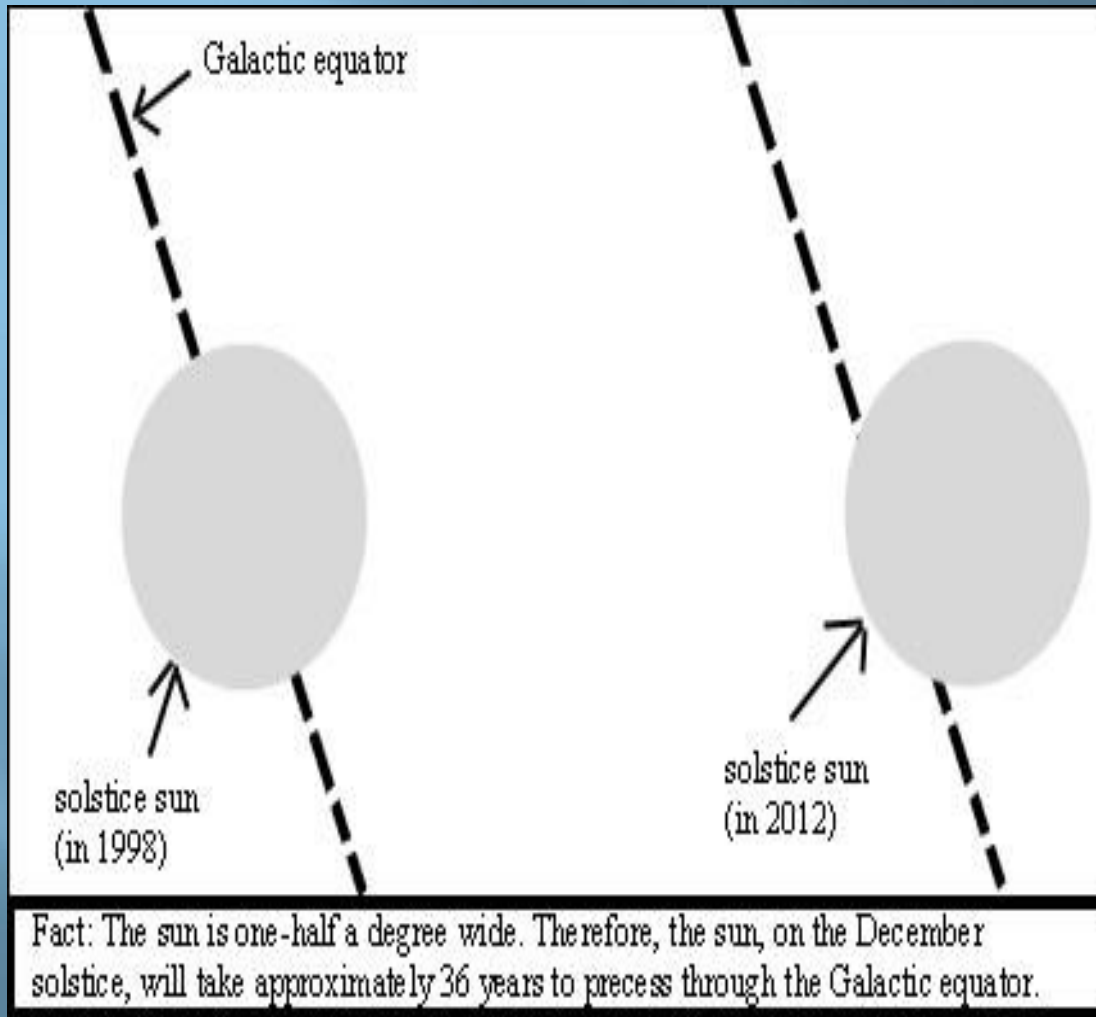
Galactic Alignment



- Galactic Equator: Sun-centered, mathematically convenient reference frame based on H1 plane
- Sun never crosses galactic equator; Sun by definition (IAU) is on the galactic equator
- Galactic Alignment: Solstice occurring closest to the time when the Sun is aligned with the intersection of the ecliptic & the galactic equator (from Earth frame)
- Actually, it is Earth that is getting in line
- 1998: Date of the solstice point crossing the galactic equator
- No significance in the direction in which the axis or line of solstices happens to be pointing
- Galactic plane: a plane of symmetry of the whole Galaxy's distribution of mass
 - Sun is ≈ 100 ly “above” galactic plane & moving farther away
 - Sun last passed through galactic disk ≈ 3 Myr ago; 30 Myr until Sun again passes through galactic disk
- *“Clearing Up the Sky of 2012”*, James Smith



Galactic Alignment



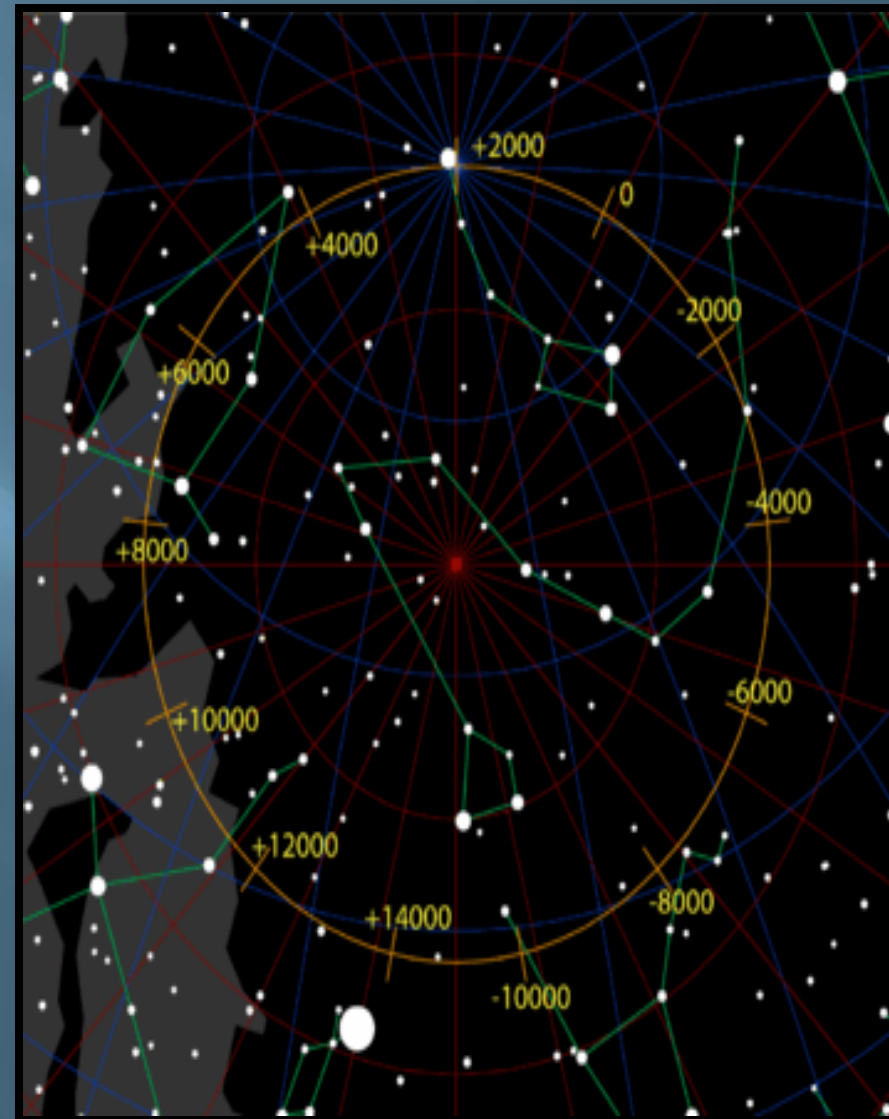
Precession: 25,800 years

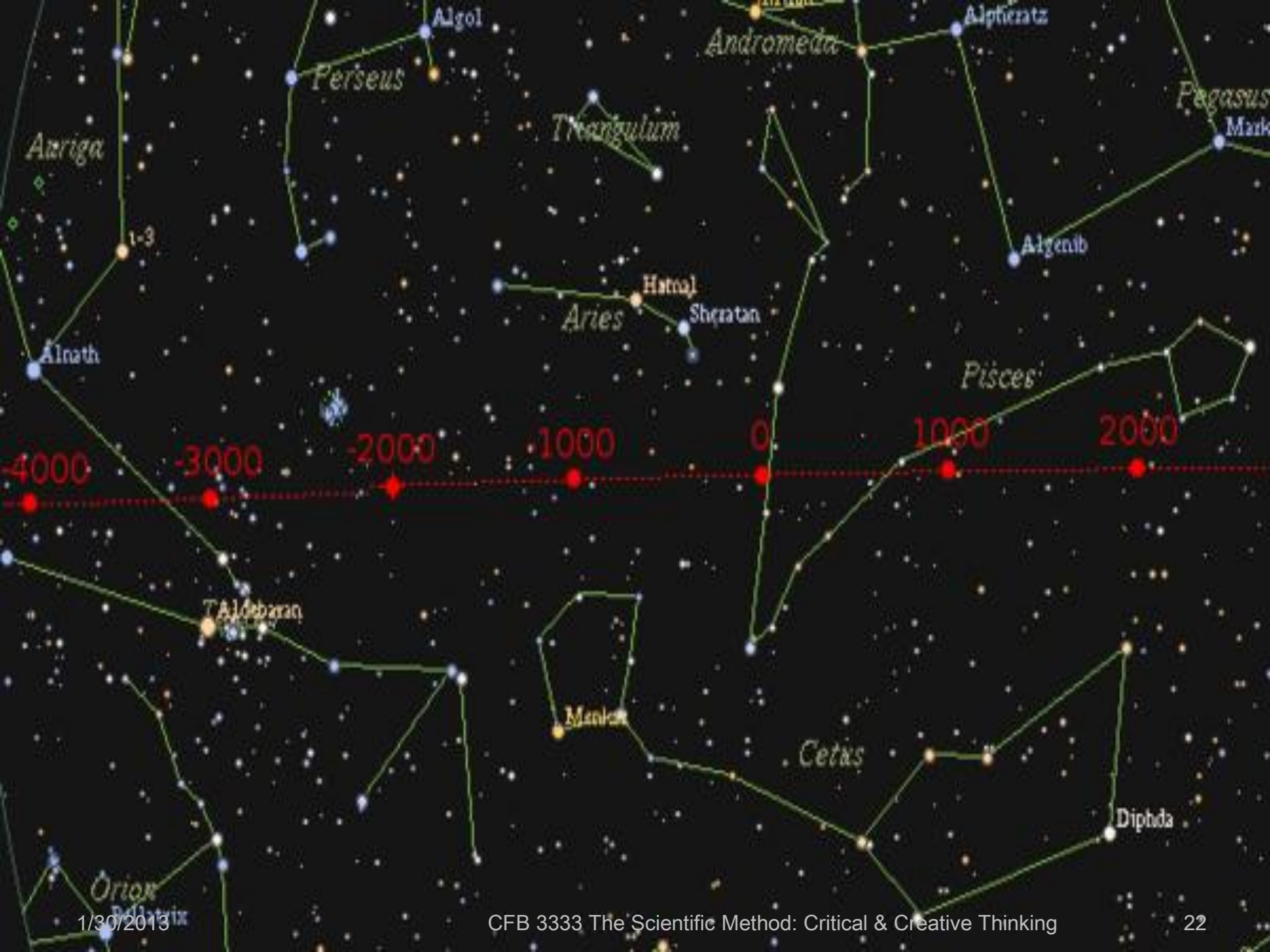
Precession of the Equinoxes

- Slight wobble in Earth's spin axis
 - Earth not quite spherical (oblate spheroid)
 - Gravitational pull of Sun & Moon tugs on Earth's equatorial bulge causing the wobble

- Sun's annual passage recedes CCW about 1° every 72 years (from POV of Earth frame)
 - Sun appears to drift westward against background of fixed stars
 - About 2,160 years for Sun to pass through each zodiac constellation
 - Astrological age: "Age of Aquarius" follows "Age of Pisces"

- About 26,000 years for precession cycle : Sun to complete one trip around ecliptic
 - Claim: Maya aware of precession cycle from observations of Pleiades
 - 5 Long Counts \approx 25,800 years
 - Scholarly opinion mostly dismisses such claims
 - Maya seldom chose a solstice or equinox to commemorate an important event so unlikely to set an "end date" at a solstice





Problems with Galactic Alignment Hypothesis

- Happened already
- Jenkins now says “The era of 2012”
- Uncertain if Maya knew about precession
- Solstices and equinoxes not so important to Maya

Nibiru/Planet X

Claim: Nibiru/Planet X/brown dwarf impacted Earth in 2012; conspiracy withheld information

- Zecharia Sitchin, “The 12th Planet” (1976):
 - Interprets Babylonian texts to claim that Nibiru passes by Earth every 3,600 years
 - Sentient inhabitants (Anunnaki of Sumerian myth) interact with humanity as Nibiru passes
 - Sitchin’s scientifically illiterate work is filled with poor scholarship, poor translations, & poor science
- Nancy Lieder (1996):
 - Claim: Brain implants allow her to communicate telepathically with gray aliens from Zeta Reticuli (binary star system, no confirmed planets yet)
 - Conflated Nibiru with Planet X
 - Claimed Nibiru is 4X size of Earth; others claimed Nibiru is a brown dwarf
 - Catastrophic collision with Earth originally forecast for May 2003
 - When nothing happened, doomsday date was advanced to 2012 winter solstice & “end” of Maya calendar (merging of 2 fables)
 - Sitchin disavowed any association with Lieder; claimed Nibiru would not return until 2900 AD



V838 Monocerotis: variable star in constellation Monoceros 20,000 ly from Sun. Some Nibiru believers claimed that this was Nibiru & that NASA, other agencies, & world governments engaged in a vast conspiracy to hide the truth.

[NASA Crushes 2012 Mayan Apocalypse Claims](#)

Nibiru/Planet X

- A planet that had headed toward Earth would have been easily visible:
 - Table assumes an Earth-sized object
 - For object 4X Earth diameter, subtract 3.0 from magnitude
 - For Jupiter-sized brown dwarf, subtract 5.0 from magnitude
 - Claim: Nibiru was “invisible”, or hidden behind Sun, or only visible from Antarctica -- seriously? (fallacy of special pleading)
- No such planet exists:
 - A few Pluto-like dwarf planets have been discovered in our outer solar system recently (Eris, Sedna)
 - None have orbits that bring them inside ~ 35 AU
 - Nibiru’s orbit would be impossibly elliptic & highly unstable
- Conspiracies in astronomy?
 - Can 10,000 professional astronomers & 100,000 highly skilled amateurs who regularly pioneer new discoveries keep a secret?
 - Impossible to conceal existence of such a planet if it actually existed

Date	Distance from Sun (AU)	Magnitude
1/1/2012	4.72	3.1
4/1/2012	3.78	2.2
7/1/2012	2.76	0.2
10/1/2012	1.65	-3.8
12/1/2012	0.98	-17.9



Artist's conception of dwarf planet Eris. From NASA / ESA / A. Schaller

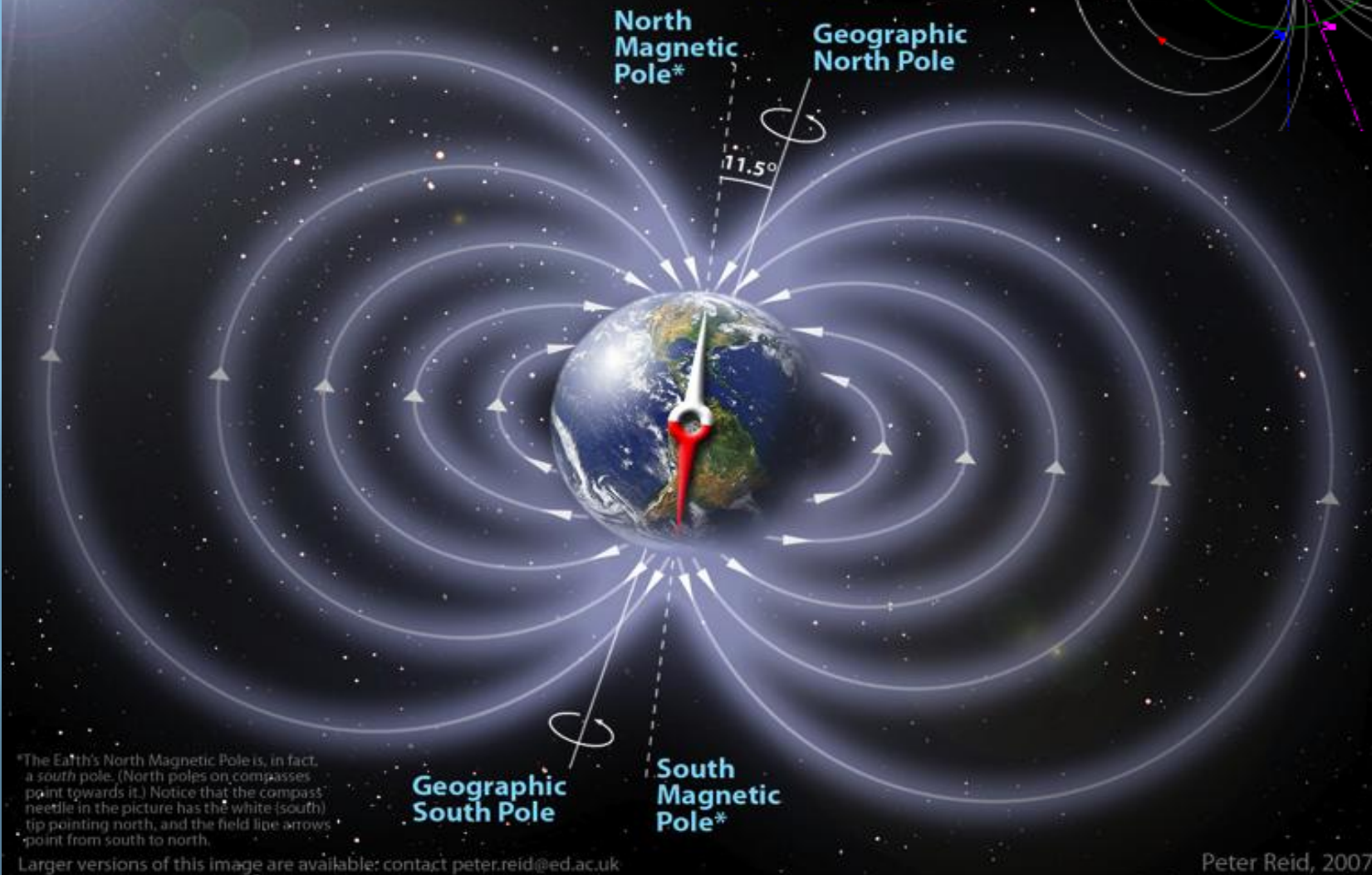
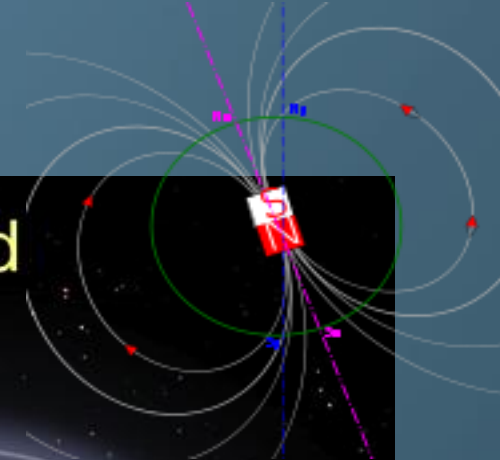
[Doomsday 2012, the Planet Nibiru, and Cosmophobia](#)





Pole Shift

The Earth's Magnetic Field



*The Earth's North Magnetic Pole is, in fact, a south pole. (North poles on compasses point towards it.) Notice that the compass needle in the picture has the white (south) tip pointing north, and the field line arrows point from south to north.

Larger versions of this image are available: contact peter.reid@ed.ac.uk

Peter Reid, 2007

Earthquakes, Tsunamis, Super volcanoes, oh my!

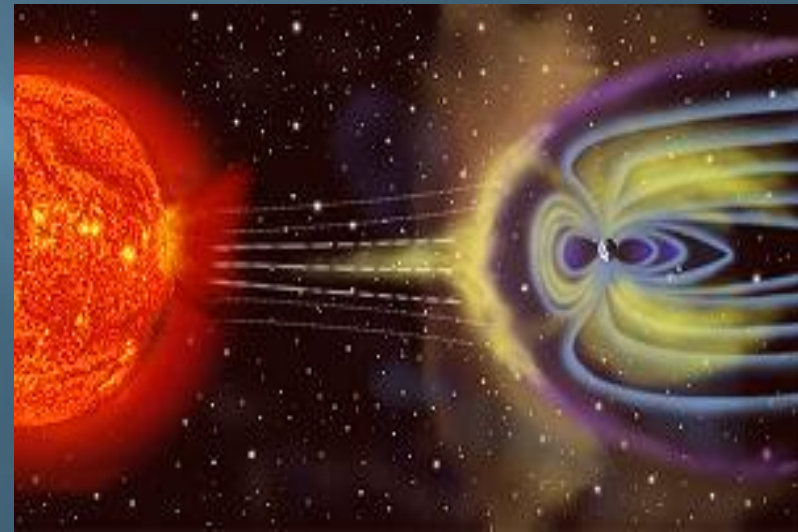
Geomagnetic reversal:

- ❑ Claim: Earth's magnetic field weakening; massive solar flare during next solar maximum will cause sudden reversal of magnetic north & south poles
- ❑ Reversals do occur: 400,000 years on average, last one occurred about 780,000 years ago
- ❑ Possibly overdue for reversal; reversals take up to 5,000 years & do not start on any particular date
- ❑ Cycle 24 Solar Maximum: 2013 (cycle fairly weak with below average # of sunspots so far)
- ❑ So what? No evidence for biological extinctions; human ancestors survived numerous previous reversals



Earth crust displacement (“pole shift hypothesis”):

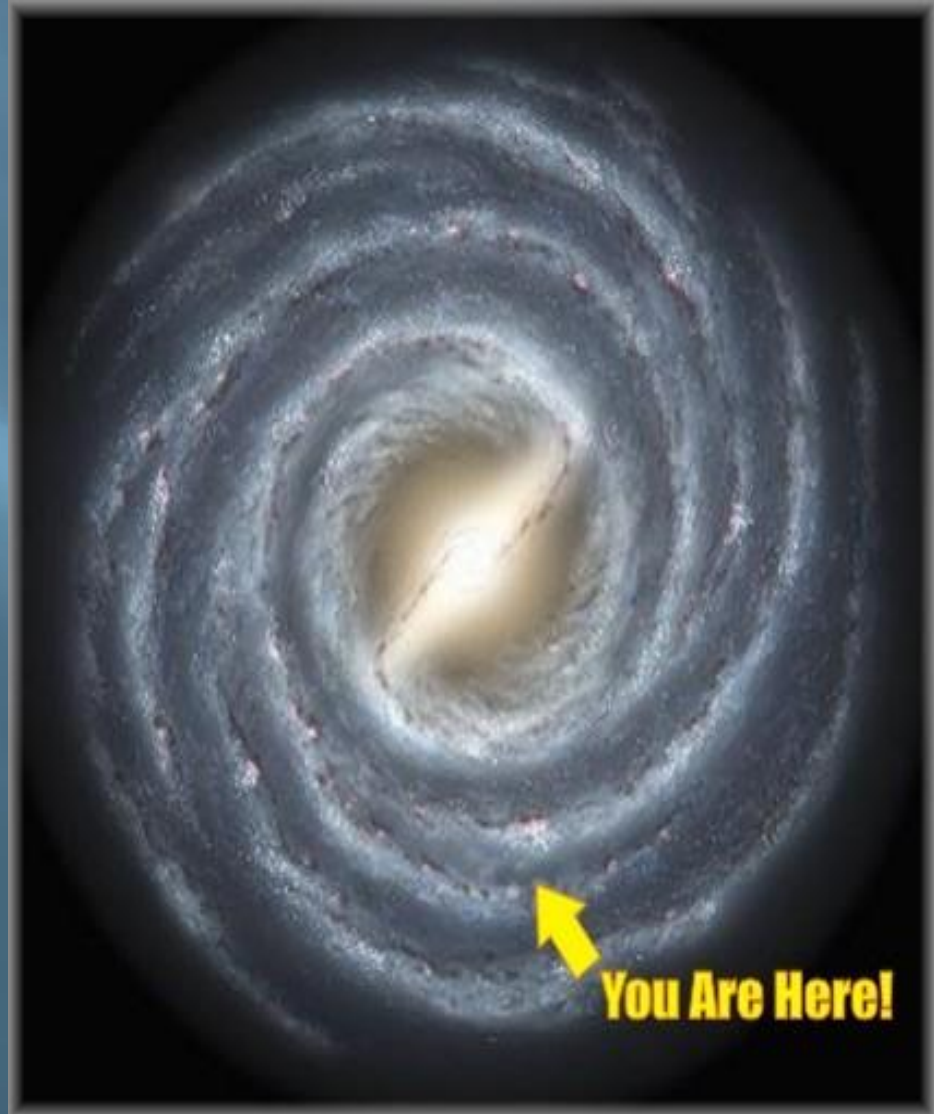
- ❑ Charles Hapgood: *The Earth's Shifting Crust* (1958)
- ❑ Speculated that ice mass at one or both poles over-accumulates and destabilizes the Earth's rotational balance: sudden violent shifting of continents and poles
- ❑ Causes slippage of all or much of Earth's outer crust around the Earth's core (retains axial orientation)
- ❑ Shift took about 5,000 years, then 20,000-30,000 year period of no polar movements
- ❑ Foreword by Albert Einstein (1953): Written before theory of plate tectonics was widely accepted; pointed out that weight of polar ice insufficient to cause shift
- ❑ Fallacy of appeal to authority
- ❑ True polar wander: 1° per million years or less



The magnetosphere shields the surface of the Earth from the charged particles of the solar wind and is generated by electric currents located in many different parts of the Earth. It is compressed on the day (Sun) side due to the force of the arriving particles, and extended on the night side. (Image not to scale.)

The Big Picture

- Many of these doomsday scenarios are not new but have been recycled for many years
 - Nostradamus, Millerites, Jupiter Effect, Heaven's Gate, Y2K, Harold Camping...
- 2012 doomsday hoax promotes “cosmophobia”: Fear of the cosmos – unfortunate & sad to cause people to be fearful of astronomy and of the cosmos
- Ancient (and modern) astronomers could not predict the future beyond *repeated* events (e.g. lunar cycles, eclipses, planetary positions) based on *observations*
- One advantage of studying science at any level is that one learns how to think critically about any topic such as the 2012 hoax
- Taking this course empowers you to distinguish science from pseudoscience, hoaxes, and all other sorts of nonsense



References

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- The Long Count: <http://www.nytimes.com/interactive/2009/11/16/science/20091116-maya.html>
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