Persistence of Myths into Modern Astrophysics
From Myth via Science back to “Natural Philosophy”?

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What preceded the Big Bang?
Ekpyrotic Universe and Cyclic Theory from superstring models:
No experimental verification, should we call it natural philosophy or even mythology?

Einstein and Hubble at Mt. Wilson

Constellation TAURUS at LASCAUX?

Stone Age ORION?
Schwäbische Alb
Introductory remark

I suppose that Karl-Ludwig had the beginning of his lecture “Introduction to Astrophysics” in mind, when he asked me to give you a lecture on myths. After some time dedicated to collecting ideas, I got the horrible impression that one of the main themes of this workshop, the synthesis of the chemical elements, had hardly any overlap with ancient creation myths. And neither has the energy production in stars.
But there are evidently relations of the creation myths with modern cosmology. And unfortunately, the ancient myths and legends are exploited by “strange people”, to be polite. During the research via Internet for portraits, illustrations and facts, I nearly inevitably found much more “strange” web-pages than scientific ones. In the next 45 minutes, I will try to avoid to present too many maverick ideas (you can find some in the extended version to be placed on the web), some historic ideas of “heroes of science” are already difficult enough to understand.

But there is an additional problem. Reading at least short versions of many creation myths, it seems to me that many of them take some sort of matter as “eternally” existent. Let’s take a text most of you ought to be familiar with:

1:1 In the beginning God created the heaven and the earth.
1:2 And the earth was without form, and void; and darkness was upon the face of the deep.
And the Spirit of God moved upon the face of the waters.

It seems to me that there existed an “earth without form” and the Spirit of God could move “upon the waters”. For many ancient people, there exists a sort of “primæval matter” in an unordered, chaotic state. The act(s) of creation consist in “bringing order into chaos”, often in introducing time [the Greek expression χρόνος refers to the titan Chronos (Saturn)]. And gods and humans have both to participate with their own hands, often (as in Meso-America) perpetually.

So there is no mythology of the creation of the chemical elements! At least I did not find it.

"What, then, is time? I know well enough what it is, provided that nobody asks me; but if I am asked what it is and try to explain, I am baffled.“

[Saint Agustine, AD 354-430, Confessions 11.14]
Humans, even already hominids, try to find recurring patterns underlying Nature, facilitating survival in a hostile environment.

And since time immemorial, people were observing the course of celestial bodies, Sun, Moon and stars. And they found regular patterns on a variety of time scales: days, months, seasons, …… And they found seven celestial objects that behaved quite irregular, the “wanderers”, the “classical” planets: Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn

The task of early “science” was to find hidden regularities underlying the “chaotic” movements of these objects, as the retrograde motion.

Humans were so awestruck by the overwhelming natural forces acting on them “chaotically” that they deified them, fearing their wrath and worshipping them simultaneously.

But humans want to gain control over their destiny!
The best strategy is not to react only on unpredictable events, but to try to predict natural forces in advance!

One way was to relate events on Earth with celestial events: Astrology was borne!

Priests were observing the heavens and events on Earth, collecting such “coincidences” in huge libraries and using them for predicting future events, as the several thousand clay tablets “Enamu Anu Enlil” found in Niniveh or the ten thousands of oracle bones of the Shang Dynasty.

A special case were eclipses of the Sun and the Moon. In Mesopotamy, rulers tried to divert the wrath of the Gods on “Substitute Kings”. Some scholars believe that the priests started mathematical astronomy in order to predict eclipses, giving them the time to prepare the rituals to chase the dragons swallowing Sun or Moon.

The famous drunken Chinese court astrologers were not decapitated for not having predicted an eclipse, but for not having performed the rituals to end the threat to the country.
In the month Sivan, on the twenty-fifth day, Ninsianna [Venus] disappeared in the east; she remained absent from the sky for two months six days; in the month Ulul, on the twenty-fourth day, Ninsianna appeared in the west - the heart of the land is happy. In the month Nisan, on the twenty-seventh day, Ninsianna disappeared in the west; she remained absent from the sky for seven days; in the month Ayar, on the third day, Ninsianna appeared in the east –

hostilities occur in the land, the harvest of the land is successful.

Famous are the tablets of the omen collection “Enuma Anu Enlil” of the palace library of Assurbanipal (669-627 BC) in Niniveh.

The different versions contain a lot of copying errors. Scholars had derived chronologies based on these errors, as evidenced by V.G. Gurzadyan, who applied the statistical filters for the COBE data on the tablets: Astronomy and the Fall of Babylon, S&T 100, 40 (2000).
“Star wars” in the late/post classical Maya periods

The Maya priest-astrologers observed the heavens meticulously and assembled long-term registrations, enabling them to develop complicated calendars more precise than the Gregorian. All documents on perishable material were burnt by the conquistadores, with the exception of 3(4) codices. Most of the cities of the classical period were already abandoned and the jungle preserved at least inscriptions on stone.

The preserved codices deal only with astronomical and related ritual matters. As the Chaldean omen tablets, they deal with divination based on astronomical observations. They all contain observations of the planet Venus, showing its importance. The planet Venus was the war god of the Mayas. The priest-astrologers had to determine favorable dates for the beginning of wars. The first appearance of Venus at the night sky was such a date. This happened regularly (every 584 days), and the late periods were characterized by permanent wars between the city states.

By the way, if one displays consecutive apparitions and disappearances of Venus in the two aspects of morning and evening star in the zodiac, one ends up with the pentagram. The Latin name for the morning star is Lucifer, which might explain the use of the Pentagram in magic.
Divination in Ancient China
Oracle bones of the Shang Dynasty

In the region of Anyang, Henan Province, there have been found more than 100,000 inscribed turtoise shells and bones. They date back to the Shang Dynasty (c. 1700 – 1050 BCE) and are the oldest examples of Chinese scripture.

Diviners heated the bones and then tried to read the future from the fissures and then wrote the result of their imagination (divine inspiration, I wanted to say) on the bones.

Fortunately for historians, they were long forgotten when Qin Chi Huangdi, the “First Emperor” of Qin Dynasty (221 – 206 B) ordered the destruction of all historical documents.

Historians of astronomy could find some observations of eclipses:

*Diviner Ko:*

... day yi-mao [cyclic day 52] to [next] dawn, fog.
*Three flames ate the sun. Big stars [seen].*

This can be dated to May 6, 1302 BCE. From this observation can be deduced that the day was 47 ms shorter than now.

The successors of this diviners were the influential court astrologers. Their astronomical observations were meticulously recorded in the official annals of later rulers comprising an inestimable source on ancient eclipses, comets, (super)novas and palaeo-climate data.
Empress of Kao-tzu, 7th year, first month, day chich'ou, the last day of the month. The sun was eclipsed; it was total; it was 9° in [the lunar lodge] Ying-shih, which represents the interior of the Palace chambers. At that time the [DOWAGER] Empress of Kao-[tzu] was upset by it and said, “This is on my account.” The next year it was fulfilled.

Han shu (Annals of the Han-Dynasty)

These observations for astrology are now used to determine the slowing down of Earth’s rotation!
The importance of mythological tales

In my opinion, the utmost importance attributed by our ancestors to mythological tales in general can be seen from the fact that there exists such tales from all people from all over the world. With some extremely seldom exceptions (see right), these tales were transmitted orally from generation to generation over millenia. I assume that the content of these stories represented an essence of the belief and value system of a community. A central part was the position of mankind in the Universe. The myths transmit all the accumulated knowledge (as “astronomy”), often encoded in “stories” of relations between the “star” gods. The storytellers, the keeper of the communal memory, projected sometimes the myths onto historical persons. At the end, there are now many layers to penetrate to get to the fundamental messages. A modern example: Brecht “Leben des Galilei”

The most prolific modern creators of “mythological” stories are found in the movie industry. But sometimes, reality is catching up. The couple of archaeologists Darnell used the publicity campaign to publish an expensive book describing their discoveries of petroglyphs at Gebel Tjauti. Also the digs of Günther Dreyer in Abydos got much media interest by presenting a tomb (possibly) as the one of King Scorpion. If these scholars are right, “written” history might date back to about 3300 BC, and the history of Egypt starts with a Dynasty 00.
What is our position in the Universe?

The majority of cosmogonies is based on the conception of a finite (very) small world existing for some thousand years. Well known is Archbishop Ussher, who had calculated that the world was created by God Oct. 23, 4004 BC. A belief still widespread in the US. [But, 6000 years later in 1996 AD, the Messiah ought to have returned.] Some ancient people believed in a finite number of cycles, the Etrurian priests had attributed their people 10 cycles, the last one ending with the death of Emperor Claudius 54 AD. The Hindus believe in an eternal world, without beginning nor end.

And, evidently, Homo sapiens (sapiens) is unique!

I do not know what religious/philosophical turmoil will arise if the SETI Project really deciphers a message from outer space or if there will be found at least very primitive life forms on Mars. In our times, I hope, the reaction of religion will be different from 1600 AD.

"Innumerable suns exist; innumerable worlds revolve around these suns in a manner similar to the way the seven planets revolve around our sun. Living beings inhabit these worlds."

Dell' infinito universo e dei mondi, Giordano Bruno, 1584

http://www.bigear.org/wow.htm
Mythology, Cosmology, Cosmogony

But man is not only concerned with everyday life, but wants to gain an understanding of his position in the Universe and especially of the origin and future of the World and of Humanity. All people on Earth have developed world views encompassing a unified explanation of these basic questions. They are expressed and transmitted from generation to generation in the form of myths. Teachings on the origin of the Universe are called cosmogonies interwoven with explanations of the structure: cosmologies.

Modern answers to a part of these questions will be presented the following days, no longer called myths but scientific theories with names like “Big Bang”, Inflationary Universe, Ekpyrotic Theory. But one should keep in mind that these scientific explanations date back no longer than a century.

In the domain of science it is general assumption that there is no cultural influence on the theories. But what about the scientists?

Can we really separate us totally from the influence of the socio-cultural environment in which we were brought-up? And one of the ingredients are myths, even in the form of fairy tales we liked to hear in our childhood.

I am a physicist, so do not expect me to present you a sociological study. I will try to show you in a few cases influences of mythological thinking in the history of science, as a sort of amateur astronomer I chose examples from astrology/astronomy. And as an amateur astronomer and physicist one quite often gets in contact with people proposing theories which are (let’s express it politely) not directly “mainstream”.

Camille Flammarion, 1888

World view of the Bronze Age
Velikovskians, Saturnalists, Neo-Catastrophists, etc.

Dr. med. I. Velikovsky  
(1895-1979)

From Ch. Lyell’s “Principles of Geology” c. 1830 to the work of Alvarez et al. on Ir in the CT-layer 1980, the uniformitarian dogma ruled Earth sciences and evolution. The concepts of the catastrophists as G. Cuvier were banned from mainstream science, opening the doors for wild speculations of every sort. The most (in)famous proponent of catastrophic events occurring during recorded history such as the ejection of the super-comet Venus out of Jupiter is Immanuel Velikovsky. He based his ideas on the Scripture and on interpretations of mythological tales and scarce records as clay tablets. Modern followers hide under names as the “Society for Interdisciplinary Studies”, which have journals like “Chronology and Catastrophism Review” and organize scientific workshops.

Velikovsky was practising as a psychiatrist in Palestine and since 1940 in Princeton and made important scientific contributions. And he stayed in contact with Einstein all the time (who refuted his celestial mechanics). I once looked for literature for a talk in our amateur astronomers association in Mainz and found a cryptic idea in Napier, Clube, Rep. Prog. Phys. 60 (1997) 293. Clube then send me some reprints, which I did not understand. I still have no idea what the refutation of the monophysitic heresy by the council of Chalcedon 451 AD has to do with disintegrating huge comets and the Beta Taurides meteor streams.

One has to admit that there are people engaged in such groups who are really insane. But many of them are rational thinking and acting people like you and me, who follow some convictions which are regarded by the majority as a bit strange.

I will try to minimize these ideas in the following!
Cosmologies around the world

A Pennsylvania school district is being sued for allegedly teaching Christianity as a science under the guise of "intelligent design". Why not teach all religions at school? To help out with this dilemma, we present a list of those Creation Myths that helped define civilizations both past and present.

Reading cosmologies from around the world, one is astonished over the many similarities. Should one accept the thesis of some scholars, that the "nucleus" of these tales goes very far back in time before the spread of Humanity over the world?

http://www.livescience.com/history/top10_intelligent_designs.html
But how to explain the similarities in the belief system of people at vast geographical separation? In all the highly developed civilizations of Meso-America, turquoise was in high esteem as “nurture of the Gods”. But there are no deposits of high-quality turquoise in central America. The high quality variant was mined in New Mexico and traded to the Meso-American states. At Taos, the pole climbing is performed on San Geronimo Day. The Christian feast replaced a trade fair with attendants from South to North America.

And with the merchandize traveled ideas!

It should be mentioned that for other scholars there exists too many similarities all over the continent to be explained by “recent” exchanges. For them, the myths had arrived already with the first humans from Asia.
But how were the mythological tales remembered for so long time?
Oral transmission of information through the Ages

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Our Sun has left us: He has left us in the shadows. We know he will return to illuminate us once again. While he dwells in the house of the dead, let us be passionately united . . .

**Fathers and mothers must teach their children, that they may teach their children's children,** how one day we shall rise reunited gaining strength from the **New Sun** to fulfill our destiny.

*Prophecy of Cuauhtémoc (Falling Eagle) - the last Aztec emperor, as related by a “generales” of the Conchero dancers.*

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In pre-touristic times, the dances were performed in connection with the pilgrimage to “Nuestra Madre de Guadeloupe”. The Catholic Church did not (or did not want) to perceive the pagan background in all traditional ceremonies, resulting in a “strange” syncretism of pre-Columbian and Christian believes in Latin-America.

Are the expressions “SUN” and “NEW SUN” above referring to the Indian belief in cyclic Ages, as expressed in the famous “Calendar (Sun) Stone”?
The creation myth of the Quiche Maya from the Popol Vuh (Book of Council) c. 1550

THE CREATION
Here is the story of the beginning, when there was not one bird, not one fish, not one mountain. Here is the sky, all alone. Here is the sea, all alone. There is nothing more –no sound, no movement. Only the sky and the sea. Only Heart-of-Sky, alone. And these are his names: Maker and Modeler, Kukulkan, and Hurricane. But there is no one to speak his names. There is no one to praise his glory. There is no one to nurture his greatness. And so Heart-of-Sky thinks, "Who is there to speak my name? Who is there to praise me? How shall I make it dawn?" Heart-of-Sky only says the word "Earth," and the earth rises, like a mist from the sea. He only thinks of it, and there it is. ….

Hurricane makes a great rain. It rains all day and rains all night. There is a terrible flood and the earth is blackened. ….

The wooden people scatter into the forest. Their faces are crushed, and they are turned into monkeys. And this is why monkeys look like humans. They are what is left of what came before, an experiment in human design.

For the creation of men, four attempts were needed until humans made from maize had the desired character.

Russbach05 Creation by “only thinking of it” resembles Genesis. The Codices seem to tell a different story.
Start of actual Age in Maya mythology August 11, 3114 BCE

The Milky Way around August 11 at sunset is nearly vertical. In the next hours it rotates to horizontal position. At the same time the Big Dipper sets below the horizon. The rain god Hunrakān (1 Leg) by shooting “7 Macaw” from the “World Tree” is “causing” the flood. He is also related to the Maize God, who needs the rain. This coincides with the begin of the hurricane season (named after Hunrakān) and might be the reason to start the new Age in mid August.

But why 3114 BC?

For the new Age, the gods had to sacrifice themselves. The “World Tree” grows out of the Maize god.

An “Age” lasts 13 “baktun” or 13*144,000 days (c. 5125 y). So what will happen December 21, 2012 AD?

“For the new Age, the gods had to sacrifice themselves. The “World Tree” grows out of the Maize God.”

“Seven Macaw”, the ruler of the old Age is shot from the World Tree by Hunrakān. The Wooden People perish in a general flood. The Quiche Maya see “Seven Macaw” in the stars of the Big Dipper, Hunrakān could be similar to ORION.

Regularly, the rulers had to sacrifice their blood to maintain the cosmic order. This is Lady “6 Heaven” of Naranjo. Male rulers had to pierce another organ.

Remark the zeros!
Freaks who missed the end of the world in 2000 are already gathering in Guatemala in order to be in time for the next end of the world scenario in 2012.

Aztek calendar stone with the 5 “Suns” in the center

The Maya “long count” calendar starts Aug. 11, 3114 BC and ends Dec. 21, 2012 AD.

The 5125 years are c.1/5th of a precessional cycle. The Maya priests believed that the world lasts 5 Ages or Suns. Some people take 2012 as the end of the 5 Ages. Astrologers have long sought for special celestial patterns at the beginning or end of the cycle. With modern knowledge of our Galaxy, they found that at the winter solstice of 2012, the ecliptic will intersect the Galactic plane (close to the center) in the rising Sun. By forces unknown to science, all the cosmos will get into resonance and the world will end.

Presumably, after extensive bloodshed, the Maya priests would simply have started a new cycle.

Other historians take 1 pictun = 20 baktun, so that the end will come Columbus Day Oct. 12, 4772 AD.
Ancient knowledge hidden in allegorical drawings?

Some people believe that ancient civilizations had knowledge on our position in the Galaxy. One argument is that the arrow of SAGITTARIUS is pointing to the Galactic center. But the arrow point is not 3 Sgr, but 10 (γ) Sgr [Quae in ferro sagittae, Almagest].

Depending on the weather, one should have a look at the Milky Way. Everyone has the impression to be standing in the center of a semiarc, to be the center of the Universe.
Clashes between Indian mythology and modern technology

For the Indian tribes in the South-West, Avanyu, the horned water snake, is of great importance as bringer of rain clouds and guardian of the springs. This is reflected in the local pottery (here works from the pueblos San Ildefonso and Santa Clara). The Los Alamos Laboratory has (unintentionally, I presume/hope) used sacred prayer sites as waste deposit, blocking the access for the surrounding pueblos.

*It seems to me that Avanyu might be related to the “Feathered Serpent” Kukulkan of the Mayan and Quetzalcoatl of the Aztek creation myths. And as the Maya, the Hopi believe that we are living in the 4th Age.*

In the TV documentary “The Secret and the Sacred. Two Worlds at Los Alamos” ([www.denkmalfilm.com/abstracts/Secret.html](http://www.denkmalfilm.com/abstracts/Secret.html)), the Santa Fe artist (and modern witch) Erika Wanenmacher equates the transformation of materials at the Trinity Test Site with the alchemistic purification of metals in the fire. Although afraid of radiation from her own works of art, she is confident in the declaration of nuclear scientists that α-particles are stopped in a sheet of paper.

Mount Graham in Arizona is regarded by the local tribes as a sacred place. The high altitude with the semi-aridic climate makes it, on the other hand, an ideal place for astronomers. There are at least 3 huge installations: the Heinrich Hertz submillimeter, the Vatican Advanced Technology and now the Large Binocular Telescope. The relations to the indigenous populations are often quite tense.
“Global” trade networks and the spread of ideas with metallurgy

Although there are indications of mining and trade of high-quality flint already in Neolithic times, the advent of metallurgy lead to dramatic changes in society. The technological developments for extracting metals from ore and then producing tools and weapons were held secret in a group of specialists who attained an elevated social status. As the raw materials were found only in a limited number of places, long-distance trade routes had to be established. This lead to structured societies with chieftains, specialized craftsmen, traders. These peoples were moving around in Europe (and other parts of the world) spreading their technological knowledge leading to a “globalised” civilization in the early Bronze Age. A striking example is the “Amesbury Archer”, an artisan borne in the Alps in a region with ancient copper mines and buried near Stonehenge. And one has to presume that not only technology and style of pottery and bronze artifacts were interchanged, but also abstract ideas and even religious views as manifested in burial rites common to extended regions.

It is therefore (perhaps) not very surprising that mythological themes are often shared by many peoples distant from each other in time and space. The sky disc and the swords indicate of relations as well to Greece and Scandinavia. The (disputed) latest addition of a boat carrying the Sun at night through the underworld might even hint to connections to Egypt.

The region of birth of the archer was derived from O-isotope ratios in his teeth. Such trace element detection is standard in cosmo-chemistry and now applied to archaeometry. The copper used for the bronze of the sky disc was mined in the same alpine region.
The Pleiades and the growth period

Most ancient people had not developed “scripture”, so interpretation of their symbolic “language” is based on (more or less questionable) analogies to more recent civilizations with written mythology.

When the Pleiades, daughters of Atlas, are rising, begin your harvest, and your ploughing when they are going to set. Forty nights and days they are hidden and appear again as the year moves round, when first you sharpen your sickle.

Hesiod, Works and Days, c. 850 BCE

Observations of the Pleiades by peasants are known up to recent times. In Lithuania, the displacement by precession is partly compensated by the later onset of springtime. The autumnal observations are now used to predict the next spring.

The Pleiades serve even in the Andes as indicator for the next harvest. But in this case it is the visibility which is influenced by the humidity of the air depending on the strength of “El Niño” events.

This is the most “conservative” interpretation!
When the Pleiades, daughters of Atlas, are rising, begin your harvest, and your ploughing when they are going to set. Forty nights and days they are hidden and appear again as the year moves round, when first you sharpen your sickle. This is the law of the plains, and of those who live near the sea, and who inhabit rich country, the glens and dingles far from the tossing sea, -- strip to sow and strip to plough and strip to reap, if you wish to get in all Demeter's fruits in due season, and that each kind may grow in its season. Else, afterwards, you may chance to be in want, and go begging to other men's houses, but without avail; as you have already come to me. But I will give you no more nor give you further measure.

Foolish Perses! Work the work which the gods ordained for men, lest in bitter anguish of spirit you with your wife and children seek your livelihood amongst your neighbours, and they do not heed you. Two or three times, may be, you will succeed, but if you trouble them further, it will not avail you, and all your talk will be in vain, and your word-play unprofitable. Nay, I bid you find a way to pay your debts and avoid hunger.

*Works and Days, verses 383 – 404 by Hesiod (c. 850 BCE)*

*Remark: The poem is addressed to his brother Perses.*

http://sunsite.berkeley.edu/OMACL/Hesiod/works.html
Horizon arcs on the sky disc
Can sacred sites in the Harz mountains be traced back to the Bronze Age?

Winter solstice  Pagan spring celebrations (as Baltain) demonized to “Walpurgisnacht”  Kyffhäuser  May 1  Sommer solstice  Brocken

Winter solstice  Sunset at winter solstice  Sommer solstice  Sunset at summer solstice and Brocken

55:17 (He is) Lord of the two Easts and Lord of the two Wests
A German Stonehenge?

A nearly 7000 year old “astronomical” observatory has been studied by an international team of archaeologists at Goseck, about 15 miles distant from Nebra. The upper 2 gates are aligned to the solstices and span the same angle as the horizon arcs on the disc.

Whereas the alignment of neolithic and bronze age buildings with the solstices is often quite evident, many “researchers” want to **find alignments at every site in any case**. To demonstrate the difficulties, I have shown the angle span by a gate at Goseck in moon diameters (ca. 30 arcsec). The gate is far too wide for an alignment with a single star, an asterism as the Hyades (with the bulls head) is a better choice. Precession would move the asterism out of the gate in about 500 years. It is dangerous to use such “alignments” as basis for dating the sites.

Russbach05
Famous alignments of buildings with the Sun

A lot of “myths” are created around Stonehenge. The (true) Celtic Druids most probably already had no idea of the use of this monument. Some “specialists” take it as an analogue computer to predict eclipses, as Fred Hoyle, “On Stonehenge”, 1977

Abu Simbel
Feb. 22 and Oct. 22
birthday and coronation day
of Ramses the Great

Newgrange, Ireland

Often the alignments last for several days and dates derived from precession are meaningless.
Revision of Pharaonic chronologies by effects of precession?

Figure 1. The night sky in ancient Egypt. Kate Spence argues on page 320 of this issue that Egyptian pyramid builders used the vertical alignment of two bright stars in the constellations of the Big and Little Dipper to align their pyramids north–south. In around 2500 BC, the star Mizar in the Big Dipper and Kochab in the Little Dipper were located on opposite sides of the north celestial pole — the fixed point in the sky around which all the stars rotate. In 2467 BC an invisible line linking these two stars, when they are vertically aligned, would pass precisely through the north pole. A plumb line intersecting these stars would then point straight to north on the horizon. A similar observation made before or after this date would include a systematic error caused by the alignment being offset slightly from true north (as is the case here). Such astronomical errors show up in the orientations of the ancient pyramids of Giza.

<table>
<thead>
<tr>
<th>Pharao</th>
<th>(One) Traditional dating</th>
<th>Revised dating</th>
</tr>
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<tbody>
<tr>
<td>Khufu</td>
<td>2554 BC</td>
<td>2480 ± 5 BC</td>
</tr>
<tr>
<td>Khafre</td>
<td>2522 BC</td>
<td>2448 ± 5 BC</td>
</tr>
<tr>
<td>Menkaure</td>
<td>2489 BC</td>
<td>2415 ± 5 BC</td>
</tr>
</tbody>
</table>

Kate Spence, Nature 408, 320 (2000)
In regions of the Earth with strong yearly variations of weather patterns, a mastership of calendars is essential for survival, not only for sedentary agricultural societies but also for (semi)nomadic hunter-gatherers. If one can trace this back even to Homo Erectus in Thuringia or to cave dwellers in the Schwäbische Alb, I do not know?

All over Western/Central Europe were found gold hats, craters and capes c. 3000 years old. They are decorated with regular circular patterns. On the gold hats, one counts 1737 / 1739 symbols. Some archaeologists take this as roughly one quarter of 6940. What is the importance of this number? This corresponds on the one hand to the number of days in 19 solar years and is nearly identical to 235 lunations (mean synodic month: 29 d 12 h 44 m). A period of 110 months of 29 and 110 ones of 30 days comprises 6940 days. This is called the Metonic cycle (Meton of Athens, c. 432 BC). Might be it was already known in Europe long before?

Luni-solar calendars were also used in Mesopotamia and in ancient China already 4000 years ago.

The knowledge about calendars was kept secret by a cast of “priests”, who derived their influence from this. Are these hats the origin of the wizard’s hats still in use by magicians? And are astronomers not also somehow descendants of the “μαγοι”, the priest-cast of old Persia venerated as the “Three Kings“ who are supposed to have visited the staple in Bethlehem?
Calendars and political power

The control over the calendar often was disputed between priests and politicians:

**Canopus Decret, March 7, 238 BC**
Ptolemaeus III Euergetes and Berenike intended to replace the old Egyptian calendar with 365 days. To keep festivities synchronized with the seasons they wanted to add a leap year every 4 years. The conservative priests simply did not apply the decret.

**The Roman Calendar**
The Romans had a complex luni-solar calendar tied to important holidays (*fasti*) associated with specific seasons:
• 10 lunar months, with extra months and days added to keep it aligned with the seasons.
• The priests in charge of it were continually tweaking it for religious and political reasons.
• They usually got it wrong!

*Annus confusionis*
Caesar on the advice of Sosigenes of Alexandria started a new calendar in 46 BC according to the above decret:
• He had to add **80 extra days** to 46 BC so that 45 BC would start correctly aligned with the seasons.
• 46 BC had 445 days in it!
Caesar called 46 BC the *ultimus annus confusionis* ("The final year of confusion")
Roman wits, however, called it the *annus confusionis* ("Year of Confusion").

Presumably to sabotage the “Julian” calendar forced upon the priests by Caesar, they applied a leap year every 3rd year till 8 BC. Augustus had to reform the “reformed” calendar dropping the leap years until 8 AD.

The Gregorian calendar was not applied by the protestant states. Even when the German protestant regions adopted the “Ameliorated Imperial Calendar” in 1700, they decided to determine Easter with a different method, just by principle. They were totally surprised that their method could give different dates, as happened in 1724 and 1744. Frederik the Great ended this nonsense.
The Swedish were so confused in changing to the new calendar that they had to introduce a **February 30** in 1712.

What will happen in the future Mars colonies?
The control center of the rovers already runs on “sols”, Martian “days”.
Numerals and Pictography in the Bronze Age?

As offerings for the Gods, ensembles of bronze artifacts were buried. Many of these “treasure troves” contained sickles with marks. And whereas the interpretation of the symbols on the gold hats as calendar markings is quite controversially debated, one part of the marks on the sickles evidently represents numerals ranging from 1 to 29, numbering the phases of the Moon, a full lunation.

The meaning of the other symbols is more speculative. Three of them can be later found in runic inscriptions, comprising symbols that cannot be traced back to the Etruscan alphabet. They might be interpreted as “Offering”, “(Good) Year”, “God of the Fertile Year”.

Had the Bronze Age Europeans started to develop script and number systems? And why did they not finish the development?

The custom to bury “treasures” ended around 1500 BC. The runes appear much later in Northern Europe. How were the symbols transmitted?
Hindu Cosmogony: Perpetual Cycles

"Indestructible is the presence that pervades all this; no one can destroy this unchanging reality. It is not born, it does not die; having been, it will never not be; unborn, enduring, constant, and primordial, it is not killed when the body is killed." (Second Teaching, Verses 14-18)

From Bhagavad-Gita ("Song of Lord Krishna") [Mahabharata, Buch 6, 23-40]

Hindu cosmologies are based on the conviction that the Universe is eternal, without beginning nor end. But nevertheless it progresses in cycles of "creation" and "destruction". And everyone, gods and men, have to contribute their part in forming a new order from chaos and maintaining the order continually.

These ideas are exemplified in the statues of Tandava (Cosmic Dance) depicting Shiva Nataraja as Creator, Preserver, Destroyer of the World. [His drum serves as a "master clock", to be compared with "absolute time" of Newtonian mechanics?]

R.J. Oppenheimer
Trinity Test Site,
16.7.1945
Bhagavad-Gita 10:34

"I am become Death, the Destroyer of Worlds"
"We knew the world would not be the same. A few people laughed, a few people cried, most people were silent. I remember the line from the Hindu scripture, the Bhagavad-Gita... Vishnu is trying to persuade the prince that he should do his duty, and to impress him takes on his multi-armed form, and says 'Now I am become Death, the destroyer of worlds'. I suppose we all thought that, one way or another."

_Bhagavad-Gita 10:34_ 

The source of this often disputed citation is an interview by Robert Jungk just prior to the death of Oppenheimer. (There exists a sound registration.) Jungk took a citation of Oppenheimer from the Bhagavad-Gita describing the fireball as cover of his book.

_If the radiance of a thousand suns were to burst forth at once in the sky, that would be like the splendour of the Mighty One._

The code name Trinity for the test was chosen by Oppenheimer. Does it derive from the Hindu Trinity “Brahma, Vishnu, Shiva” or from “Trinity College”, where Oppenheimer worked with Rutherford?

Recent translations prefer: „I am mighty, world-destroying Time…“
Some modern scientists are attracted to Hindu mythology, as Oppenheimer. The following ideas might be compared to the “Steady-state” cosmologies §:

Some foolish men declare that a Creator made the world. The doctrine that the world was created is ill-advised, and should be rejected. If God created the world, where was he before creation?... How could God have made the world without any raw material? If you say He made this first, and then the world, you are faced with an endless regression...

Know that the world is uncreated, as time itself is, without beginning and end. And it is based on principles.

The Mahapurana (The Great Learning) by Jinasena, 9th century Hindu scripture

The concept of eternal cycles can be compared to Poincaré’s Recurrence Theorem of 1890. A finite system, only with conservative forces, will return to every point in phase space again and again. No historical development! Fortunately, there are non-conservative, dissipative forces. And living systems operate far from equilibrium, leading to self-organization.

§Hoyle and Bondi-Gold, MNRAS 108 (1948)
The “Greatest Year” (“Platonic” Year†)

- Common multiples of planetary revolutions (idea known in Greece, Mesopotamia, India, China)
- Basic units “Maha-yugas” of 4,320,000 years
- 1000 Maha-yugas are 1 “day” in the life of Brahma
- Destruction of world after 100 “years” of Brahma and new creation after 100 “nights” (around 300 Ta).

Maha-yugas are comprised of 4 Yugas.
Actually last period Kali-yuga, dark age of moral decline.

Aryabhata (476-550) / Abu Ma‘shar (787-886):
Start of cycle with conjunction of the 7 classical planets at 1° ARIES (until a further conjunction at 30° PISCES).

*Abu Ma‘shar took it as the date of Noah’s flood (contrary to Usher’s Sunday Dec. 7 2349 BCE). The Maya priest-astrologers took the year 3114 BCE.*

Western scholars had the conviction that the Hindu astronomers were only dealing with religious/philosophical speculations on extremely long aeons without performing observations. Especially, as their mathematical and astronomical works were written in verses in the style of the ancient vedic literature.

Clarification was only possible with the application of probabilistic methods by astronomers with interest in history and solid mathematical background.

Roger Billard: “Aryabhata and Indian Astronomy”;
Indian Journal of History of Sciences 12 (1977) 207

† The Platonic year nowadays refers to the precession of the equinoxes.
Dogma versus Reality
A priori assumptions versus long-time observations

From Aryabhata (I) onwards, many Indian astronomers derived their planetary canons under the assumptions that
• there exists a common multiple of the planetary revolutions and
• that all planets had been at 1° ARIES on February 17/18, 3102 BC (start of Kali-Yuga).

Diff. ancient and modern calc. of mean ecliptical longitudes

Aryabhatiya (early 6th century AD):
Observations c. 500 AD + “yuga dogma”

Ptolemy’s Almagest:
Observations from 721 BC – 141 AD

Russbach05

Years are given in astronomical notation following Cassini
Slowing down of Earth's rotation

A simultaneous statistical analysis of the epoch and geographical longitude of the observations yields Febr. 19 499 AD (that is 60*60 years after the start of Kali-Yuga) and the meridian 57°. It is known that the canons were calculated for the meridian of Ujjain 75.767°. The difference corresponding to 1.3 h could be caused by the slowing-down of Earth’s rotation due to tidal friction. This effect was recently determined from Chinese eclipse observations and amounts to 1.6 h for c. 500 AD (with a large scatter).

The “secular acceleration of the Moon” was suspected already in 1695 by Halley, but the breakthrough was achieved in the last decades. The wild speculations of the “new chronologers” of faked Hindu canons are therefore complete nonsense! And not only these canons. All written down astronomical observations from Mesopotamy until now are internally consistent and a solid backbone of chronology. Unfortunately, such charlatans find a broad public in talk shows and as bestseller authors.
Overzealous disciples

Aryabhata (the Elder) was heavily criticized by Hindu astronomers (as Brahmagupta 598-698) for his conviction that the Earth revolves around its axis instead of a daily revolution of the sphere of the fixed stars. His disciples later-on “corrected” his works to save his reputation from what they thought were stupid errors. The same fate had his idea that the orbits of the planets were ellipses!

Unfortunately, very often ideas of important persons ahead of their times are suppressed by relatives or disciples after their death. Last year I mentioned some unconventional ideas of Sir Isaac Newton. His nephew closed away nearly the totality of his manuscripts, parts of which getting only now available for scholars.

Remark: The works of Brahmagupta were brought to Bagdad and on the demand of Caliph Al-Mansur were translated into arabic.

The Brahmasphutasiddhanta of 628 AD is the earliest known text (other than the Mayan number system) to treat zero as a number in its own right. It goes well beyond that, however, stating rules for arithmetic on negative numbers and zero which are quite close to the modern understanding.

Latin translations of a textbook on the new Indian numerals by Al-Khwarizmi (c. 820) brought this “Arabic” numbers finally to Europe in around 1150.
“Urban legends”: Y2k-hype

Through all history, conjunction of planets were regarded as “signs from the heavens”. If all clustered together, something very special had to occur (e.g., in China changes of dynasties). Modern doomsday prophets are aware of the heliocentric system and the effects of gravity. Many of them prophesized disasters as a result of the combined gravity, as changes of the polar axis, displacement of the continental plates etc.

And all 6000 years after the creation of the world according to Ussher!

View from Mainz: only Sun visible! (@SkyMap Pro9)

LASCO Coronograph on SOHO

“Conjunctions that changed the world” B.F. Schaefer
Sky & Telescope 99(5) May 2000, 28
How to preserve and transmit knowledge through the Ages?

Since the invention of script in several advanced civilizations, acquired knowledge can be transmitted from generation to generation without treacherous memory. But, there are not only advantages. Depending on the material used the “lifetime” can be very long or quite short. Granite (as used by Chinese monks to withstand the end of the world) or fired clay tablets are nearly indestructible. But parchments and paper can be eaten by mice and they burn. And through all history, libraries were destroyed by fire, often (sometimes unintentionally) during sieges of towns.

- Carthage 146 BCE
- Great library of Alexandria
  - Julius Caesar 48-47 BCE (partly)
  - Christian mob 391 AD Serapeum with library
  - Arabs? (most probably Christian horror propaganda)
- Reconquista of Spain: public libraries in Toledo etc.
- Baghdad: Hulagu Khan destroyed the complete town in 1258 including “House of Wisdom” founded by Caliph al-Mamun. A collateral damage in “war against terror”. 1256 the Mongols had destroyed Alamut (with the library), the stronghold of the shiite assasins.
- Meso-America: Maya and Aztek codices
- 1755 Lissabon: Earthquake and subsequent tsunami

Many religions, as the Hindus and also the Druids, forbade to write down their knowledge, the “priests” had to memorize all! And what prior to script?

Some scholars discuss the possibility that (astronomical) knowledge was transmitted through myth, even fairy tales over long periods. Controversial discussions rage on the question if precession of equinoxes as a nearly imperceptible change of the heavens might have been encoded in myth:

Hamlet’s Mill: An essay investigating the origins of human knowledge and its transmission through myth
G. De Santillana and H. von Dechend

http://phoenixandturtle.net/excerptmill/santillana.htm

Magnus ab integro saeclorum nascitur ordo.
Virgil, Eclogue IV, c. 37 BC

Novus ordo seclorum.
AQUARIUS (Hair)
When the Moon is in the seventh house,
and Jupiter aligns with Mars,
Then peace will guide the planets,
And love will steer the stars.
This is the dawning of the age of Aquarius,
The age of Aquarius, Aquarius, Aquarius.

Harmony and understanding,
Sympathy and trust abounding.
No more falsehoods or derisions,
Golden living dreams of visions,
Mystic crystal revelation,
And the mind's true liberation.
Aquarius, Aquarius.

When the Moon is in the seventh house,
and Jupiter aligns with Mars,
Then peace will guide the planets,
And love will steer the stars.
This is the dawning of the age of Aquarius,
The age of Aquarius, Aquarius, Aquarius.

Original publicity poster for Hair
Hipparchos found this “discrepancy” also for other stars. In addition, the observation of a nova had convinced him that there might be changes in the heavens over time scales longer than a human lifespan. Therefore he determined the positions of all stars. Brad Schaefer recently reported that this catalogue is depicted on the “Atlas Farnese”.

Hipparchos compared his value to literature values as from the lost star catalogue of Timocharis. From observations as the one depicted at the right, Timocharis had determined the ecliptical longitude to $172^\circ$. Hipparcchos measured the angular distance of Spica to the (partly) eclipsed Moon. Sun, Earth and Moon are on a straight line and the longitude of the Moon can be determined with high precision from the well-known longitude of the Sun.

Hipparchos measured the equinoxes with state-of-the-art methods. During a lunar eclipse (154 and/or 135 BC), Hipparchos determined the ecliptical longitude of $\alpha$ Vir (Spica) to $174^\circ$, or $6^\circ$ distant from the autumnal equinox against the direction of the signs. (Cited from a lost work of Hipparchos in Almagest VII 2)
Since Newton, we know the physical explanation: Equinoctial precession is a circular motion of Earth's rotational axis with respect to the "fixed" stars, also known as luni-solar precession. It is caused by the torque of the Sun and Moon on the Earth's rotational bulge. The axis precesses with a period of ca. 25,770 y.

Prior to Newton, only the effects were known, as the difference in tropical and sidereal year already known to the Babylonians as Kidinnu. But partly due to imprecise measurements, some thought of an oscillatory movement (trepidation) with a period of 7000 years (as Thabit ibn Qurra (826-901)). This can be found up to the time of Copernicus.

“Platonic year” is divided in 12 “months” of ca. 2150 years. These are called Ages, named after the zodiacal constellation visible in the morning dawn at beginning of spring. Actually Age of PISCES, will be followed soon by Age of AQUARIUS (Musical Hair!)

The effect had been first observed by Hipparchus determining the ecliptical longitude of Spica. In 2300 years, the shift of 32º corresponds to 1 zodiacal constellation, the reason why the Signs of astrologers following Ptolemy’s Tetrabiblos (and Almagest) do not agree with constellations of astronomers.
Astronomical basis for the mystery cult of Mithras?

Since about the 1st century AD near-eastern mystery cults as the one of Isis and Mithras were taking root in the western part of the Roman Empire, in concurrency to Christianity.

The teaching of these cults (a body of secret wisdom) was only revealed orally to disciples who had undergone initiation rituals. Therefore, nowadays there exist only wild speculations often going back to roman times.

In the case of the Mithras cult, beside scarce written sources there exist still numerous Mithraea and sculptures. The meeting places were caverns with depictions of the Tauroctony at the front end.

Following roman sources and the presence of stars and zodiacs, the cavern represents the cosmos.

Recently, Ulansey has interpretated the central icon as depicting the transit from the age of TAURUS to the one of ARIES due to precession of the equinoxes.

This celestial phenomenon was discovered by Hipparchos at about the time of the first mentions of the Mithras cult.

David Ulansey, "The Origins of the Mithraic Mysteries" (1991), see www.well.com/user/davidu/mithras.html
The “Mainz Globe”

Beneath the bull, the constellations Canis Minor, Hydra, Scorpius, Corvus, Leo, Crater could be identified. But it is difficult to find a time in the past, when these constellations were situated at the equator. Some authors propose 6000 years ago‡.

In preparing the talk, I found a web-page addressing this problem. A small celestial globe displayed in Mainz puts these constellations at the equator. In case it is not a forgery, the tauroctony is in accordance to contemporary depictions. The 2 torch barers on either side then ought not to be identified with the constellation Gemini, they might stand for the equinoxes.

‡ E. Bon et al., AN 323 (2002) 579
The Mithras cult, an “artificial” religion?

In classical Graeco-Roman star lore (and allegorical representations thereof on old star maps) there is no connection between Perseus and Taurus. Perseus holds a sword above his head and the Medusa in the other hand, and turns his back to the bull. And the bull is hunted by Orion.

The name Mithras could indicate a relation to the ancient Zoroastrian religion of Persia. But up to date, no scholar could find any trace of a connection of the sun god Mitra to a bull.

And there are no mentions by antique authors of the cult of Mithras prior to the midst of the 1st century BC, when it was practised by Cilician pirates. [They are still remembered for having captured Julius Caesar in 75 BC, who insisted on a higher ransom.]

It seems that neo-platonic philosophers from Tarsis (in Cilicia) “borrowed” the name of an old deity in order to make their new cult look very old, as believers are seeking for age-old wisdom. 

*The Roman authorities were reluctant to accept newly created cults. The hellenized Christianity therefore pretended being the real Mosaic religion: Verum Israel.*
The persistence of religious cults

In late Roman times, Christianity rivalled with the cults of Mithras and Isis (and some philosophical schools) for domination and acceptance as state religion. Prior to exterminate the rivals, the Church incorporated key parts of their rituals to ease conversion. The old state cult of Sol Invictus and the Mithras cult both celebrated the rebirth of their central deity in the night of December 24 (around the winter solstice) with a common meal. Since the midst of the 4th century, Christmas also was celebrated at the corresponding date [Pope Julius I c. 350 AD].

In February 380, Emperor Theodosius I (the Great) declared Christianity in the interpretation of the bishops of Alexandria and Rome (that is to say “Catholicism” instead of the widespread Arianism) to state religion. Quasi instantaneously, Arianism and non-Christian religions were persecuted. Christian mobs led by fanatic monks (Christian “talibans”) destroyed temples and burnt down the Serapeum with the library of Alexandria. For astronomers, the Dark Ages begin 415 with the brutish slaughter of Hypatia, the last director of the Alexandrian academy, by followers of St. Cyril (presumably not even on religious reasons).

"Hymn to King Helios."
"For that the planets dance about him [the Sun] as their king, in certain intervals, fixed in relation to him, and revolve in a circle with perfect accord, making certain halts, and pursuing to and fro their orbit, as those who are learned in the study of the spheres call their visible motions...“

Emperor Julian Apostata (362 AD), Oration IV

Did the Neoplatonist philosophers believe in a heliocentric system?

The cult of Isis was incorporated into Christianity by simply renaming Isis and her son Horus to Mary and Jesus. Some of the very old Black Madonnas are statues of Isis. (In most cases, however, the black teint is soot from candles!)  

A part of the participants have already or soon will receive a diploma on paper with a watermark as shown on the right. 

Question to our Catholic colleagues:

Did she really resurface in the 10th century as Ste. Catherine of Alexandria?

Last year, I mentioned Newton’s studies on “Arianism”.
“Elements” and “Novae”

During this week, our lecturers will explain you how the elements are made in stars and in star explosions.

But it should not be forgotten that the word “elements” had quite a different meaning in the past: In the 5th cent. BC, Empedokles of Agrigent stated that all things are composed of only 4 basic constituents (later, a fifth element was added – quintessence):

- Fire
- Water
- Quintessence
- Air
- Earth

The division into 4 units was also applied to alchemy, astrology, medical science, psychology, etc.

The division into 4 units was also applied to alchemy, astrology, medical science, psychology, etc. The 12 signs of the zodiac were assembled into four “trigons”.

For the following one has to know that the faster moving planet Jupiter overtakes Saturn every 19.85 years and that each “great conjunction” is displaced by 117°, so that 3 consecutive conjunctions happen in the same trigon. After about 200 years, the conjunctions move into the next trigon.

Astrologers regularly predicted catastrophes at these conjunctions, and the sort of desaster depended on the trigon. In the 15/16th century normally floods were predicted, as can be seen on the woodcut at left.

Leonardo Da Vinci has grouped the 12 disciples in 4 groups, which form independent units not facing Jesus in the center.
The influence of the Great Conjunctions in the 16th century

At the end of the 15th century, the printers had added illustrations on woodcuts to text. Very popular were “Einblattdrucke”, a predecessor of our newspapers. Predictions of catastrophes were bestsellers, as the depiction of the great conjunction of June 1504 in the sign of CANCER from the famous editor Sebastian Brandt. [Pepped-up news are no characteristic of our time, in reality Mars was far away!]

But there were also astrologers/astronomers who were measuring the (relative) positions of the planets and compared them with their tables, as the Alfonsine Tables. One young astronomer who had just returned from his studies in Italy was surprised of the considerable differences and, might-be, decided to look for a better theory.

60 years later, when the conjunction returned to the same sign, the astrologers were in trouble. It was predicted to occur at 29° in CANCER, so a disastrous flood had to be predicted. But the uncertainties in the tables were so big that it might just slip into LEO, part of the fiery trigon. (And unfortunately, the new theory of our man from above was not of great help!)

Another young man had followed the public debate (it was even brought to the stage by Shakespeare) and decided that without new high-precision measurements no theoretical progress would be possible.

He got famous with his observations of a “new star” in the constellation CASSIOPEIA in 1572, which demonstrated that the (super)nova was part of the immutable sphere of the fixed stars, contrary to the teachings of Aristoteles.

For the astrologers on the other hand it was important that the heavens had given a sign confirming that the transition from the watery to the fiery trigon had taken place.

In 1603, Kepler observed a conjunction. Based on Arabic astrology, he and other astrologers predicted fire from heaven for the following year, as the conjunction occurred in the fiery trigon.

And in October 1604, a nova was observed c. 9° distant from the position of the conjunction.

Kepler knew about prophesies of rabbinic astrologers as Abrabanel ‡ that the return of the Messiah would be announced by a great conjunction, as had been the case with Moses. He also knew that the trigons had a periodicity of 794 years.

He calculated that a rare triple conjunction had occurred in 7 BC, which was followed in 6 BC by a massing of Jupiter, Saturn and Mars, as in 1603/4.

He then concluded that also in 7/6 BC a nova had occurred alarming the magi.

‡“The Wells of Salvation”, commentary on the book of Daniel by Don Isaac Abrabanel, 1497
The Star of Bethlehem?

It is said that the sign of PISCES represents the “fertile crescent” and the position in the last third indicates Palestine. The conjunction of Jupiter and Saturn could be interpreted as the birth of a king of the Jews. The conjunction of Jupiter and Mars in ARIES, part of the fiery trigon, announced a military leader, the long awaited Messiah who would liberate the Jews from the Romans. 

[Triple conjunction favoured by European planetarium shows.]

Precession had moved the vernal equinox from ARIES into PISCES. This is interpreted as the beginning of a new Age. As the Mosaic laws replaced the worship of the Golden Calf (TAURUS), Paulus predicated new laws. In Renaissance art, Moses is shown with the horns of a ram (ARIES), whereas two connected fishes (as the allegorical depictions of PISCES on old star maps) are a widespread sign of early Christianity.

“De vero anno quo Aeternus Dei Filius humanam naturam in utero Benedictae Virginis Mariae assumpsit”, Kepler 1614
Astrophysicists view of Kepler’s Supernova Remnant

Kepler’s Supernova Remnant
SN 1604
Chandra X-ray Observatory
Hubble Space Telescope
Spitzer Space Telescope

SST MIPS 24μm
HST 658nm Hα
CXO 0.3-1.4keV
CXO 4-6keV

3.8 light-years
1.2 parsecs 60"

Russbach05
The Earth as a flat disc? An example for modern mythology.

Nearly all modern textbooks state that people in medieval Europe believed in a flat Earth and that this was enforced on them by the Catholic Church. But, is this view of the “Dark Middle Ages” a realistic description of the past, or is it simply a projection of our prejudices onto that period?

May I tell you a personal experience? Following an evening in downtown Mainz with some of our lecturers, I later-on visited the Mainz observatory. An amateur astronomer with strong interest in history told the visitors (who had gathered for a lunar eclipse) that the monk Berthold of Regensburg had predicated to the ordinary people that the Earth was a sphere. Nobody (myself included) believed him!

I then asked a professor of theology if this was correct. He was of the same order and declared that a franciscan could not have preached this, but that it could have been “this domenican”.

But it was his confratre:

„Wan diu erde ist rehte geschaffen alse ein bal“
Sermon „Saelig sint die reines herzens sint“

http://sps.k12.mo.us/khs/gmcling/bert.htm

This time the “black magician, sorcerer, alchemist, astrologer” St. Albertus Magnus [who had been bishop of Regensburg for 2 years (1260)] was innocent.
Astronomy at the medieval universities

From the greek astronomers onward at least the quasi-totality of educated people knew about the shape of the Earth as a globe. The reasons were summarised by Ptolemy:

And so, in general, we have to state that the heavens are spherical and move spherically; that the earth, in figure, is sensibly spherical also when taken as a whole; in position, lies right in the middle of the heavens, like a geometrical centre; in magnitude and distance, has the ratio of a point with respect to the sphere of the fixed stars, having itself no local motion at all. And we shall go through each of these points briefly to bring them to mind.

Ptolemy, *Almagest*, Book I, Chapter 2

Astronomy as part of the quadrivium was an obligatory introductory study at all universities.

One of the most widespread textbooks for beginners was “De Sphaera”:

THE EARTH A SPHERE. -- That the earth, too, is round is shown thus. The signs and stars do not rise and set the same for all men everywhere but rise and set sooner for those in the east than for those in the west; and of this there is no other cause than the bulge of the earth. Moreover, celestial phenomena evidence that they rise sooner for Orientals than for westerners. For one and the same eclipse of the moon which appears to us in the first hour of the night appears to Orientals about the third hour of the night, which proves that they had night and sunset before we did, of which setting the bulge of the earth is the cause.

*Tractatus de Sphaera Mundi*, Ioannes de Sacrobosco, c. 1230

The 7 “Artes Liberales” lead to Philosophy

The Middle Ages in reality were not as dark as we believe them to be!
Excerpt from “De Sphaera” and 16th century illustrations

SURFACE OF THE SEA SPHERICAL. –
That the water has a bulge and is approximately round is shown thus: Let a signal be set up on the seacoast and a ship leave port and sail away so far that the eye of a person standing at the foot of the mast can no longer discern the signal. Yet if the ship is stopped, the eye of the same person, if he has climbed to the top of the mast, will see the signal clearly. Yet the eye of a person at the bottom of the mast ought to see the signal better than he who is at the top, as is shown by drawing straight lines from both to the signal. And there is no other explanation of this thing than the bulge of the water. For all other impediments are excluded, such as clouds and rising vapors.

Also, since water is a homogeneous body, the whole will act the same as its parts. But parts of water, as happens in the case of little drops and dew on herbs, naturally seek a round shape. Therefore, the whole, of which they are parts, will do so.

The Middle Ages in reality were not as dark as we believe them to be!

The expression “Dark Ages” is used by British historians for the early stages of the Middle Ages. At the end of this period, Alfred the Great (849-899) was popularizing antique knowledge as the Earth as a globe.
The Flat-Earth Society etc.

But we should not ridicule the common people of the past. There were and will always be persons who do not accept common knowledge (and *sometimes they are right*). The low standard of scientific knowledge (not at least of the “elite” of our society) leads to widespread fellowship of maverick ideas as astrology, creationism etc.

Television talk shows and, last not least, the internet offer everybody an opportunity to express their ideas.

In a certain period of German history, such maverick theories had highest protection, as the “Glazial-Kosmogonie” of Hörbiger/Fauth and the Hollow-Earth Model. They got totally discredited by merging with racial theories (partly against the will of the authors!). Nevertheless, the Internet is full of zealous pages and the blinded followers misinterpret nearly every fact to their sinister purposes. As an example, there are circulating numerous satellite pictures showing the entrances to the Hollow Earth at the North and South pole.

Evidently, we have to leave the “ivory tower” and communicate our science to a broader public.

Russbach05  http://www.flat-earth.org/  http://www.alaska.net/~clund/e_djublonskopf/Flatearthsociety.htm  etc.  BP
All people at all times have developed theories on the origin of the Universe and the origin and position of mankind in the Universe. In the pre-scientific age, these theories were expressed as mythology:

**Cosmogonies**

Nowadays, we use as language mathematics. But the most advanced forms of Cosmologies are, at least for the moment, still very far from verification by experiment. In a recent TV documentary of Brian Greene on String Theory, Shaldon Glashow raised the question if we should not call these theories again “Natural Philosophy”.

I found a series of short articles accompanying a TV documentary by Hawking, which give an overview over recent cosmological models [not the very fanciful ones].

http://www.pbs.org/wnet/hawking/html/home.html
The equations of General Relativity have a multitude of (mathematical) solutions governed by the matter-energy density $\Omega$, a parameter to be determined experimentally. One ought to find for all mythological cosmogonies a corresponding mathematical Cosmology.

The latest observations of SNII and of the Cosmic Background Radiation are not treated in the TV documentary. We seem to live in a flat and open Universe whose structure is determined by “Dark Matter” and “Dark Energy”, of which nature we have no experimental knowledge.
In an article in the weekly journal “Die Zeit”, these concepts were simply called “Black Magic”. [After an interview with Bruno Leibundgut.]
“Big Bang”:
A Catholic or a scientific concept?

Searching for a picture of Einstein and Lemaître at Mt. Wilson, I found in an internet discussion group the question above. Based on works of Friedmann and Hubble, the justly appointed professor at the “Université Catholique de Louvain” Lemaître proposed 1927 that the expansion of the Universe must have started in an extremely dense spot, which he called “Primæval Atom”. He believed that this “atom” had been created by God.

Einstein refuted this notion at first, as he believed in a static Universe. To maintain the Universe in such a state, he invented the (in)famous “Cosmological Constant $\Lambda$“. Lemaître decided to join Einstein and Hubble 1931 at Mt. Wilson, and they could convince Einstein: “Größte Eselei meines Lebens”.

The question, if Lemaître was influenced by his belief, is difficult to answer. The “Big Bang” can open the door for a creator deity. Some scientists therefore refute this idea. Even the Catholic Church needed some time to finally embrace it. But is it therefore a Catholic concept?

**The Expanding Universe.** By Abbé G. Lemaître.

*(Communicated by Sir A. S. Eddington.)*

MNRAS 91 (1931) 490

*Louvain, le 7 mars 1931.*

Contrary to many textbooks, George Gamow enters the scene much later: “On Relativistic Cosmogony”, Rev. Mod. Phys. 21 (1949) 367
Contemporary disciples of Steady-State Theory

Some scientists refuse to accept the Standard Model of Cosmology – the Big-Bang. Most prominent are Hoyle and the Burbidges. Often, their cosmological theories are presented together with alternative theories on the origin of life, as the Panspermia theory (Wickramasinghe, Hoyle).

A common theme is the refusal of the red shift as distance indicator, as can be seen below. Whereas the main-stream interpretation of the 2 objects with red shift 1.26 symmetrical to ARP220 is gravitational lensing, Arp et al. interpret them as ejected from the nucleus of the Seyfert Galaxy.

By this mechanism, they want to keep constant the matter density in an expanding Universe.

July 1971, Fowler’s 60th birthday

After the death of Fred Hoyle, Margaret and Geoffrey Burbidge are continuing the fight against Big-Bang alone. William Fowler was not part of this gang!

Athene emerges from the head of Zeus. [Modern version, not conform to Hesiod.]

ARP(AGP)220: Merging galaxies

Ultraluminous infrared galaxy IC4553 (Arp220 IRAS 15327+2340)
The Quasi-Steady State Cosmology

Geoffrey Burbidge continues the fight against "Big Bang" nucleosynthesis. An introduction to an alternative way of synthesizing the lightest elements can be found on his homepage:
http://casswww.ucsd.edu/personal/gburbidge.html

Further reading:


A universe that is finite in size but did not begin with a singularity is the result of one attempt to combine aspects of general relativity and quantum mechanics. The history of this no-boundary universe in imaginary time is like the surface of Earth, with the Big Bang equivalent to Earth’s North Pole and the size of the universe increasing with imaginary time as you head south toward the equator.

No boundaries in space and (imaginary) time have the consequence that (mathematically spoken) one has to deal with an eigenvalue problem instead of the initial value problem of the “Big Bang”. The initial value could be “tuned” by a creator deity, in the case of the eigenvalue problem there could be only one solution.

The Universe could be as it is, not because of an act of creation, but because there is no other choice.

The Catholic Church prefers the “Big Bang” theory.

In “A Short History of Time”, Hawking mentions that he became aware of this consequence just after an audience of the Pope for the participants of a conference on Cosmology. The Pope had asked the scientists not to deal with the instant of the Big Bang.
While other universes either expand too quickly and flatten (top) or close before life can evolve (bottom three), our universe (second from top) seems perfectly poised to support life.

The “Strong” Anthropic Principle has opened a door for the discussion if our Universe has been fine-tuned with the purpose to accommodate Humans. This leads then to the question of a creator. Such arguments are also used by the anti-darwinists with their alternative “scientific” theory of “Intelligent Design”.

Astrophysical alternatives are (highly speculative) Multiverse models.

Remark: The Cosmological Principle was developed around 1970 for cosmological purposes. At the beginning, there was no connection to the triple-$\alpha$ process.
The future of the Universe is no longer a question of mythology, but depends on the matter/energy density: the sum of the density of light-emitting and “dark” matter $\Omega_M$ and of “dark energy” $\Omega_\Lambda$. These values can now be determined experimentally.

Questions concerning the far future (“Big Rip” / “Big Crunch”) cannot be answered until physicists find out what the nature of “dark energy” is. A majority of cosmologists seem to prefer the “Constant Dark Energy” scenario, at least for the moment.

Listening TV interviews and talks of the 2 groups that discovered the accelerated expansion rate, I got the impression that these astronomers were deeply shocked by their results. They longtime checked thoroughly their measurements and assumptions before they published a result contradicting their expectations.

Is this a sign of an influence of cultural background?
In close double-star systems with a White Dwarf and a Red Giant matter is accreted on the dwarf until it reaches the Chandrasekhar limit and ends in a SN Ia explosion. As they all have the same mass, the energy released is also the same. These supernovae are regarded as standard candles and can be observed from the edges of the Universe. The most distant were about 10 Gly afar.
Proposition to test new theories of gravity

At the AAAS meeting in February, Georgi Dvali from NYU theorized that the accelerated expansion might be explained by unknown properties of gravitation at large distances instead by the introduction of a mysterious “Dark Energy”. String Theories have extra dimensions and gravity might leak into these extra dimensions.

Changes in the behaviour of gravity should show up in the orbits of celestial objects, as the Moon. He proposes to use data on the distance Earth-Moon obtained from laser ranging. 3 Apollo and 2 Lunochod missions left arrays of retro-reflector prisms on the Moon. The uncertainty of about 1.7 cm obtained with the actual equipment is limited by the extremely low detection efficiency:

just 1 from $10^{19}$ photons beamed up is detected.

An upgrade is foreseen. Project APOLLO will use a 3.5 m telescope instead of .7 m ones. Together with advanced laser equipment, a detection efficiency of 5 out of $10^{17}$ and a time resolution of pico-seconds is expected. This would result in an uncertainty in the Moon-Earth distance of 1 – 2 mm!

The primary goal of project APOLLO is a verification of the equivalence principle underlying the Theory of General Relativity.

In order to test different gravitation theories, the orbit of the Moon has to be calculated to the same uncertainty. The ephemerides in use are not sufficient. One foresees, as an example, to take the influence of 1000 asteroids into the derivation of new ephemerides (the actual ones apply already 100 asteroids).
As already mentioned, there exist a multitude of new theories, most based on the concept of strings. These models (known as TOE “Theory of Everything”) try to unite General Relativity and Quantum Mechanics. Until now, these are pure mathematical models and the proponents cannot even propose an experiment to verify them. They like to argue on the “esthetic” of the equations. Therefore, physicists (as Sheldon Glashow) propose to classify these theories as natural Philosophy and I asked in the first page if we are going back to mythology!
Interviews with the Astronomer Royal Sir Martin Rees

**Our Cosmic Patch**

http://www.astrobio.net/news/modules.php?op=modload&name=News&file=article&sid=1369&mode=thread&order=0&thold=0

**Before the Beginning**

http://www.astrobio.net/news/modules.php?op=modload&name=News&file=article&sid=1373&mode=thread&order=0&thold=0

**Our Cosmic Self-Esteem**

http://www.astrobio.net/news/modules.php?op=modload&name=News&file=article&sid=1381&mode=thread&order=0&thold=0

"...an insect is more complex than a star... and is a far greater challenge to understand." --M. Rees

*Credit: NASA*

Higher dimensional universe of complex topologies, loops and strings

*Image Credit: The ATTIK, NY*

“And also when adventurers are prepared to accept much higher risks. I believe the first people to go to Mars may go with one-way tickets, but they'd be pioneers.”

Russbach05
The Soccer-Ball Universe?

For Platon and Aristoteles the five regular bodies represented the four elements and quintessence / Universe. The neo-platonist Kepler wanted to explain the distances of the planets by nested Platonic bodies.

Recently, J.-P. Luminet et al. have studied the signature of a finite Universe with Poincaré-Dodecahedron topology on the anisotropies in the CMB observed with WMAP. In the case of a finite interconnected Universe circular mirror images from reflections of “sound” waves in the early phase ought to be detectable. The WMAP data exclude finite space with a diameter less than c. 156 Gly. A definitive answer is expected from the future Planck satellite.

FAQ: What was prior to the Big Bang?

The standard answer of “standard model” cosmologists is that the question is senseless, as also time came into being with the Big Bang. Many of them also make reference to the Fathers of the Church who had to deal with the question: “What did the eternal God do prior to Genesis and what will he do after the apocalypse? Already St. Augustine gave the same answer. Admittedly, as an agnostic physicist, I am not competent in theology. But what is the meaning of “before all ages” in the Credo?

And in one Lord Jesus Christ, the only-begotten Son of God, begotten of the Father before all ages; Light from Light, True God from True God; begotten, not made, of one essence with the Father, through Whom all things were made:

τὸν ἑκ τοῦ πατρὸς γεννηθέντα πρὸ πάντων τῶν αἰώνων,

quam ex Patre ante omnia sæcula

Niceno-Constantinopolitan Creed (AD 381)

Physics or philosophy?

And there is a growing number of scientists who are not content with the standard answer and do not want to follow the advice of the Pope not to inquire into the moment of the Big Bang and the time before. Based on String Theory, models like the Ekpyrotic Universe and the Cyclic Theory are developed. But until now, experimental verifications are missing. Therefore, physicists (as Sheldon Glashow) propose to classify these theories as Natural Philosophy and I asked in the first page if we are going back to mythology!
Some local color:
Mainz, Salzburg, the antipodes and Galilei

Apologists of Galilei made references to a letter of Pope Zacharias to Bonifacius. In 748, St. Bonifacius, archbishop of Mainz, had accused St. Virgil (later bishop of Salzburg) of heresy because he hold the Earth as a sphere and believed in the existence of the antipodes (and the necessity of different Redeemers). Pope St. Zacharias condemned the ideas of Virgil based on Augustine. He had refuted the sermons of Lactancius on the form of the Earth as a disc, but had insisted on the non-existence of further continents inhabited by men not descended from Adam based on the Scripture. Citing Psalms 19:4, Paul had declared that the Gospel had been preached to all men on all continents:

Book of Romans 10:18
But I say, Have they not heard?
Yes verily, their sound went into all the earth,
and their words unto the ends of the world.

But, the discovery of America and the Indians had shown that the antipodes existed notwithstanding the interdiction of Pope Zacharias. After the condemnation of Galilei, leading philosophers as Blaise Pascal and Descartes expressed their conviction that the interdiction of the heliocentric system by Urban VIII would not prevent (eventually) the discovery of facts in favour of this system as had been the case with the antipodes.

There were truths derived from the Scripture and truths derived from the “book of nature”. **But there can be only one truth!**
The Literal Meaning of Genesis

Although there are several citations from the Scripture on the immovability of the Earth, as the famous Joshua 10:12-13, or

**Psalms 104:5** Who laid the foundations of the earth, that it should not be removed for ever.

the Church ought to have followed the insights of the Fathers as St. Augustine:

*Often a non-Christian knows something about the earth, the heavens, and the other parts of the world, about the motions and orbits of the stars and even their sizes and distances,… and this knowledge he holds with certainty from reason and experience. It is thus offensive and disgraceful for an unbeliever to hear a Christian talk nonsense about such things, claiming that what he is saying is based in Scripture.*

St. Augustine, *De Genesi ad litteram, libri duodecim*

But Galilei was too far ahead of his time in questioning a literal interpretation of the Scripture:

„*Though the Scripture cannot err, nevertheless some of its interpreters and expositors can sometimes err in various ways……*  
It would seem to me that in disputes about natural phenomena, it [Scripture] should be reserved to the last place. For the Holy Scripture and nature both equally derive from the divine Word, the former as the dictation of the Holy Spirit, the latter as the most obedient executor of God's commands; ……  
I think it would be prudent not to allow anyone to oblige scriptural passages to have to maintain the truth of any physical conclusions whose contrary could ever be proved to us by the senses.“

Letter to Rev. B. Castelli, 1613; http://www.law.umkc.edu/faculty/projects/ftrials/galileo/lettercastelli.html

**Questioning the monopoly of the Church of interpretation of the Scriptures was not a good idea!**

Russbach05 Also: Letter to the Grand Duchess Christina of Tuscany http://www.fordham.edu/halsall/galileo-tuscany.html
Then spake Joshua to the LORD in the day when the LORD delivered up the Amorites before the children of Israel, and he said in the sight of Israel, Sun, stand thou still upon Gibeon; and thou, Moon, in the valley of Ajalon.

And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies. Is not this written in the book of Jasher? So the sun stood still in the midst of heaven, and hasted not to go down about a whole day.

And there was no day like that before it or after it, that the LORD hearkened unto the voice of a man: for the LORD fought for Israel.

Immanuel Velikovsky tried to explain the standstill of Sun and Moon by the fly-by of a super-comet (ejected from Jupiter) close to Earth, which then became the planet Venus. He was discussing such topics with Einstein in Princeton for a long time. Velikovsky was the last visitor of Einstein in his home.
Why no full rehabillitation of Galilei?

In a letter of Galilei to a friend in Rome can be found the demand to cauteously inquire on an accusation to the inquisition concerning comets. Pietro Redondi managed to get access to the archives of the inquisition. Instead of an accusation concerning astronomy, he was shown a letter in which Galilei was suspected of holding heretic ideas concerning eucharisty. The anonymous writer found atomistic theories of Demokritos and Leukippos in the 1623 “Il Saggiatore”. Galilei treats matter as composed of “atoms” with geometrical forms which are conserved in all sorts of reactions. In Aristotelian terminology this would mean that the “substantia” cannot be changed. This is a contradiction to the dogma of transsubstantiation:

\[\text{mirabilem illum et singularem conversionem totius substantiae panis in corpus et totius substantiae vini in sanguinem, manentibus dumtaxat speciebus panis et vini.}\]


This was Lutheran heresy!

Redondi suspects that the accusation was written by Orazio Grassi, professor of mathematics at the Collegium Romanum. Under the pseudonym Lothario Sarsi he had published parallax measurements on the great comet C/1618 W1, proving without any doubts that the orbit of this comet was far beyond the orbit of the Moon (as had already been shown by Brahe 1577 and 1585 with less precise data). Galilei had polemically refused this measurements on the basis of Aristoteles. Grassi was also a well-trained theologian and accused Galilei of a deadly heresy.


After the opening of the archives of the inquisistion it was found that the letter was not written by Grassi, but it has the watermark of an insider of the Vatican with relations to the Jesuits. It could have been written by rivals of Pope Urban VIII, who attacked Galilei as a favourite of the Pope. [But is it the original letter?]

The trial of 1633 was influenced by the irrational atmosphere in Rome. When in 1632 the Swedish armies had left their winter quarters in Bohemia marching south, Rome was remembered all the invasions from northern people throughout history. The campaign of 1632 ended with the death of Gustav Adolf in Lützen, not in Italy.
A show trial against Galilei?

Some historians are discussing the possibility that the trial against Galilei on behalf of Copernicanism was a pretext in order not to accuse him of the “atomistic” heresy, which would inevitably have ended in a death sentence.

In exchange for sparing his life, Galileo was ordered to publicly renounce his beliefs, on his knees. Hawking includes a full translation of the text of abjuration. This included the **elegant and lawyerlike** sentence,

“I did write and cause to be printed a book in which I treat of the said already condemned doctrine, and bring forth arguments of much efficiency in its favor, without arriving at any solution.”

This does not really sound like a full-fledged condemnation of Copernicanism!

And one should keep in mind that the papal commission working out the calendar reform had based their propositions not at least on the Tabulae Prutenicae calculated by (the protestant professor at Wittenberg) Erasmus Reinhold applying the Copernican system.

“De revolutionibus” was taken from the index immediately after the parallax measurements of Bessel, Struve and Henderson ca. 1838!

Galilei was placed under house arrest near Florence. He could receive visitors (that is people who were not afraid of disadvantages for their career or non-catholics as John Milton) and he continued his studies on mechanics culminating in the “Discorsi e dimostrazioni matematiche”, which were smuggled to Holland and published 1638 by Elsevier in Leiden.

http://www.liberliber.it/biblioteca/g/galilei/discorsi_e_dimostrazioni_matematiche_intorno_a_due_nuove_etc/html/
Persistence of Myths into Modern Astrophysics
From Myth via Science back to “Natural Philosophy”?

Instead of a conclusion

"Religion disperses like a fog, kingdoms perish, but the works of scholars remain for an eternity."
Attributed to Khan Muhammed Taragai Ulugh Begh (1394 – 1449)

Hadith at madrassah at Bukhara, 1417
"It is the duty of every Muslim man and woman to acquire knowledge."

Observatory at Samarkand 1428