

Year 2012: Will the World Really Come to an End?

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For the past one year or so, a news item has repeatedly appeared in the electronic and print media: Some soothsayers have found out that the doomsday is near. The world will be destroyed in the year 2012. Even the date seems to be known: 21 December. A video CD has been in circulation, showing what will happen on that fateful day; even a “2012 survival guide” is in the market.

What made them conclude that the end was near? How did they know that it would happen in the specific year 2012? What the proponents of the doomsday are telling us is something strange. Archeologists have discovered a calendar in the remains of the ancient Maya civilization of the South America. That calendar ends on the 21st of December, 2012. Apparently the creators of that calendar did not proceed beyond that date. Why didn't they? Simple answer: They knew that the world would not exist beyond that date. It is thus meaningless to keep track of dates, months and years after that day.

But what exactly will happen on 21st December 2012, which will destroy the whole world? On this issue, however, we see different eventualities. Some are saying that a large asteroid is now heading towards us, and on that very date it will impact with the Earth. Some are saying that the magnetic field of the Earth will reverse that day; what is now the North Pole will become the South

Pole, and the magnetic South Pole will go close to the geographic North Pole. That will destroy human civilization. Some others are saying that it is not a case of asteroid or magnetic pole: the very rotation of the Earth will change. Our planet rotates around its own axis as it revolves round the sun. That axis of rotation itself will change, and as a result India, which now has a temperate climate, may suddenly find itself situated on the North Pole. Cold regions may move closer to the equator. This will cause a very large scale climatic change. Still others are saying there will be a gigantic volcanic eruption; or, that there will be a super-earthquake. But all these foretellers are unanimous in saying that whatever happens will happen on 21st December 2012, because there is no date after this in the ancient Maya calendar!!

However fictitious such possibilities may seem, their repeated appearance in the media seems to be making an impact on the lay people. It is creating a fear-psychosis among them. The impending catastrophe is becoming a point of discussion and speculation among school-children. Many are losing their interest in learning (what is the point in learning if we are to die soon?). In such a situation, the Hollywood film-makers are seeing a great business opportunity. We know their penchant for capitalizing on peoples' inner sense of insecurity and fear; recall how they made more than a hundred films on a single theme: the attack of aliens from Mars, and earned billions of dollars. It can be expected that a few films will soon appear in the

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Fig. 1 : The map of the area of Maya Civilization

market, capitalizing on people's fantasy and fear of the events of the year 2012. That will further fuel the fear psychosis.

In this situation it has become necessary to present a scientific dissection of the arguments forwarded by the doomsday theorists. That is the purpose of the present article.

On the Maya civilization and its calendar

A long time ago, in the Old Stone Age, a few groups of mongoloid tribes of Asia crossed the Bering Strait and reached Alaska. With time they spread over the whole of the two American continents. Initially they were hunter-cum-gatherers. When they reached Mexico and Central America, some of them invented agriculture in the fertile land they found there. With land suitable for cultivation, they created a settled agrarian culture, which in course of time led to urban life around the capitals of the kingdoms. Inca, Maya, and Aztec civilizations developed in this manner at different times, and in different parts of Central and South America.

Among them, the Maya civilization seems to have advanced the most, as evidenced by the small pyramid-type structures, temples, utensils, artwork, etc., that the archaeologists have found. These evidences indicated that the Maya civilization advanced the most in the period from the 7th to the 9th century AD. They had a written language and had well developed traditions in art. But they were far behind the contemporary civilizations in China (the Tang dynasty), India (the Pala dynasty), or Europe (the Charlemagne rule).

Theirs was a society dominated by the priests.

Human-sacrifice was common at the time of sowing the seeds (in the hope of getting a better yield by pleasing the gods). They had not discovered the extraction and use of iron; so they were still in the bronze-age. The Indus-valley civilization and the Egyptian civilization are two thousand years older than the Maya civilization. The Greek civilization, the Chinese and Roman empires, the time of Buddha and Ashoka in India – these are also more than a thousand years older than the Mayans. So it can be said that when civilizations in the other parts of the world had advanced significantly, the Mayans remained far behind, which they could not overcome through exchange because of the geographic isolation.

But wherever a civilization had engaged in agriculture, it had to solve one practical problem: At what time of the year should seeds be sown? For this, it is necessary to specify a definite time each for every crop round the year; that is, one needs a calendar. That is why all agricultural societies had to invent some kind of time-keeping system within the year. In order to measure time, one needs a unit of measurement – something that happens cyclically in the

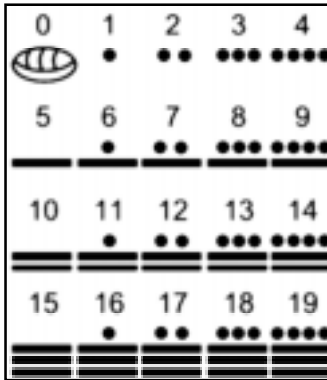


Fig. 2 : The 20 digits of the Maya number system

same interval. We can easily identify three such cyclical events which could serve the purpose: 1) the rotation of the Earth around the sun, 2) the rotation of the Earth around its own axis, and 3) The rotation of the moon

around the Earth. If these times were multiples of one another, there would be no problem. One could simply call one the day, another month, and the third the year. But actually this does not happen. The duration of the day times a whole number does not give the year; the time in a year divided by the time in a month does not give a whole number either. That is why the solar year does not contain a whole number of moon-months, nor does it contain a whole number of days (a year = 365.242199 days). That is why making a calendar is not a trivial affair.

The thinkers of different societies tried to solve the problem in different ways. The English calendar (called the Gregorian calendar) has 365 days in a year, and the remaining part is accounted for by adding a day once every four years (the leap-years). That also does not complete the story; another correction becomes necessary once every 400 years. The Indian calendar has become very complicated because it tries to combine the solar year with the moon-month. As a result, every year the calendar is different, religious events happen at different times in different years, and the dates of events given by different calendar-makers often do not match.

The Mayans also tried to solve the problem in their own ways. In the Maya society it was the priests' job to fix the dates of various activities. In doing so, the

priesthood had to devote a great deal of thought to calendar-making, and proposed two different types of calendars. In one, the year had 260 days, and in the other it had 365 days. The first one, based on the average human gestation period, was used mainly in religious events while the second one, based on the solar cycle, was used in day-to-day life including cultivation.

There was an important difference between the ways we write numbers and the way the Mayans did. We use a decimal system, in which there are 10 basic digits (0 to 9). We need two digits to write numbers bigger than 9, three digits for numbers bigger than 99, etc. In contrast, the Maya used a base 20 number system, that is, it had 20 digits. So the numbers were written in steps of 20.

The calendar with 260 days in a year was called Tzolkin, and its division was 13 times 20. It is composed of 20 day-signs, each of which has 13 variations, and was used to determine character traits and time harmonics, in a similar way to Western astrology. One would count days 1 to 13, and then the second cycle would start. When 20 such cycles are completed, a new Tzolkin starts.



Fig. 3 : The time cycle of the Maya calendar



Fig. 4 : The Maya pyramid

The other one, nowadays called the “long count calendar,” had 365 days. One problem can immediately be noticed: the number 365 is not divisible by 20. That is why their cycle was actually of 360 days (18 times 20), after which the remaining 5 days were added. A 360-day cycle was called a “Tun”, and the 20-day months were called “Uinals”. Each day of a Uinal was marked by a separate digit, since they had 20 digits. Larger times were measured by multiples of those Tuns. 20 Tuns (7200 days) made a “Katun”, 20 Katuns (144000 days) made a “Baktun”, and 13 Baktuns added up to a “Great cycle” of 1872000 days. Thus this great cycle has 5200 Tuns. Now if we consider the additional 5 days in a year, there are 5126 years in a great cycle.

Today’s doomsday theorists are pointing at this 5126-year cycle. The Great Cycle of the Maya long count calendar started on 11 August 3114 BC. From that day, the 5126-year Great cycle is to end on 21 December 2012 (when the Mayan date will be 13.0.0.0.0). Hence the simple conclusion: The world must end on that day!!

Yet, a little bit of rational thought will tell you that, when a millennium ends the world does not come to an end, another millennium starts. In the same way when a great cycle

ends, another great cycle starts. In fact, the Maya had names for time units larger than the great cycle: 20 Baktuns made a Piktun, 20 Piktuns made a Kalabtun, 20 Kalabtuns made a Kinchiltun, so on and so forth. When the Mayans had given these names for larger time units, they surely did not imagine that the world would come to an end after the end of the great cycle. This is just a fruit of imagination of the fear-mongers.

Moreover, some people always try to tell us that the ancient civilizations were more advanced than ours. They knew what is known today, and in addition they knew many things that are yet to be discovered by the modern societies. Based on this belief, the articles published repeatedly in newspapers are telling us that when the Mayans said that a great cycle will end on 21 December 2012, they must have known that the world will come to an end on that day. Given that they were such an advanced civilization, their beliefs must be true.

But actually, like biological evolution, the evolution of human society is unidirectional. In the history of human society, man has learnt about nature bit by bit, through struggle with nature. A generation has inherited what the preceding generation had discovered, asked new questions on the basis of what is known up to that time, and tried to learn new things. Whatever a generation could learn became a part of the collective knowledge on the basis of which the next generation tried to advance further. The formation of knowledge is a continuous process in which the experience of the present generation adds to the collective experience of all the past generations, and the society advances by the incremental

addition of knowledge. That is why it is unidirectional. This means that, though it is possible for a culturally isolated community today to remain more backward than some of the societies of the past, it is not possible for a civilization far back in time to have been more advanced than the advanced societies of today. That is why, one should not blindly believe in the romantic imagery of the Egyptian civilization, the Mayan civilization, or the Vedic age in India, and count on hard archaeological evidence to decide exactly how far those societies had advanced.

What can happen that day?

The doomsday theorists did not just say that the world would end in the year 2012; they also had to present some apparently believable ways in which the world would be destroyed. Let us now turn our attention to those “possible doomsday events.”

The theory of asteroid collision

We are learning from the doomsday theorists that a large asteroid is now heading directly towards the Earth, and it will collide exactly on the 21st of December 2012. How did we know that? Somebody must have seen that asteroid with a telescope? Who has seen? Where exactly in the sky is it visible? Who has calculated its trajectory and has concluded that it is indeed in a collision course with the Earth? That it will collide exactly that day?

If you probe these questions, you will get no answer.

In fact, for a long time scientists have been keeping an eye on the nearby asteroids, taking note whenever a new asteroid is reported by any astronomer, and keeping track of their motion. There is a body of astronomers doing this work. There is a website that maintains the data for all those asteroids. Amateur astronomers from all over the world obtain the information of

asteroids from that site, keep eye on them, and regularly update the information. That is how we now have very concrete information about the asteroids that could possibly threaten the Earth. The “Near Earth Object Program” of NASA keeps track of their trajectories. None of the professional or amateur astronomers engaged in this work are saying that they have observed an asteroid that will hit the Earth on 21 December 2012. They are not saying this, because without a proper observation it is ludicrous to say so.

It is not difficult to understand the reason. It is not that an asteroid is coming straight at us, and moving in a straight line path, one day it will hit us. The Earth is not static; it is moving round the sun. The asteroid also cannot move in a straight line path; its orbit is determined by the gravitational attraction of the sun, Jupiter, and any other planet that happens to be close to it at a point of time. In order to determine the orbit, the scientists write differential equations following Newton’s laws, measure the present position and momentum of the asteroid, and solve the differential equations starting from that initial condition. Because of the attraction of multiple bodies which are themselves constantly in motion, the trajectory of an asteroid is generally very complicated. Slight error in estimating the initial condition amplifies fast, and renders the prediction inaccurate. Scientists know that, with the current accuracy in measuring the position and momentum of a distant object, the prediction beyond a time-frame of about six months is quite meaningless. That is why they do not make themselves ridiculous by predicting where the asteroid will be three years later.

Scientists know that there are three asteroids which can come close to the Earth at some point of time. But for each one it is impossible to say whether it will really hit the Earth or will pass by some three hundred thousand miles from the Earth. The closest

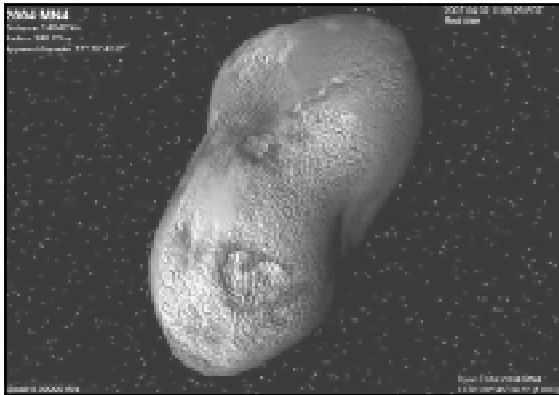


Fig. 5 : The asteroid Apophis

approach is expected from the asteroid named Apophis, in the year 2029.

Even if we assume that a few years later an asteroid is found to be heading for a direct collision, it is possible to send a rocket to intercept it, and to change its course by causing an explosion nearby. The technology to do that is already in man's hand. Way back in 1988 a satellite was sent to take close-up photographs of an asteroid. Now the technology is far more advanced than it was in 1988, and diverting an asteroid does not seem to be a big deal.

The theory of magnetic field reversal

We know that the Earth is a large magnet, whose North Pole lies close to the geographic North Pole and the South Pole lies close to the geographic South Pole. It is not that the magnetic axis is the same as the rotational axis, but they are close.

Was it always like this? No. Geologists have found that in the past the magnetic poles have reversed many times. At some point of time the South Pole existed where we now find the North Pole. Even earlier it was the North Pole again. How often do these pole reversals occur? Probing into this question, scientists have found that there is no order in these reversals. The time interval between two reversals changes randomly. There have been epochs when the changes occurred in 5000 years; there have

also been epochs when no reversal happened in 50 million years.

There are two stable positions of the magnetic poles with respect to the axis of the Earth's rotation. It is similar to a situation where a ball is released into a double-well as shown in Fig.6. It would have two possible stable positions. If it has some amount of energy, it would oscillate around one of the stable positions. If the energy is increased, it might jump from one well to another, and then would oscillate around the other stable position.

The Earth's magnetic field behaves in a similar manner. At present the magnetic north pole is undergoing small oscillations around the geographic North Pole. In the past also such a situation existed for millions of years. Then, the oscillations would begin to increase in amplitude, and at some point of time the North Pole crossed the equator and moved to the southern hemisphere. It then settled in its new position close to the geographic South Pole, and continued to oscillate around it for a long time. Then again, the time for another reversal would come.

Cannot such an event happen again? Yes, it can. The only problem is that it is impossible to predict such an occurrence. Especially, it is complete nonsense to say that a pole reversal will happen three years later, exactly on the 21st of December.

Moreover, it is not a fact that a geomagnetic pole reversal is accompanied by mass extinction. Some specific species may have problems. For example, the



Fig.6: The Earth's magnetic axis has two stable positions, the way the ball in such a container has two stable positions.

migrating birds navigate using the magnetic lines of force. Such birds may lose way when the magnetic field undergoes change. But nothing of such a magnitude can happen that may drive the human race to extinction. Some newspaper reports and internet websites are saying that during the pole reversal the Earth's magnetism will disappear, and so cosmic rays will fall on the Earth's surface. A little thought will convince you how baseless these propositions are. Ultraviolet rays and other electromagnetic waves are in no way affected by magnetic field. Ultraviolet rays are blocked by the ozone layer – not magnetic field. Magnetic field can affect the trajectories of only the charged particles. Such particles in the cosmic rays move along the magnetic field lines and enter the Earth's atmosphere close to the magnetic north pole. That causes a brilliant display in the night sky, called aurora borealis. But nobody has ever heard that the Eskimos or the polar bears died because charged particles had entered the atmosphere. The last pole reversal (the Brunhes-Matuyama reversal) is reported to have occurred around 7,80,000 years ago. This is a time when the immediate predecessor of man, the Homo Erectus, roamed on the Earth. They seem to have lived happily through the pole reversal. This essentially points to the fact that nothing catastrophic can happen during a pole reversal.

Shift in the Earth's rotational axis

Some doomsday theorists are saying that on that fateful day the Earth's rotational axis will shift. It is not that this axis never changes. Indeed it does. There is an easy way of understanding this. If you extend the axial line into the sky, it is supposed to meet the pole star. While all other stars are seen to move with time due to the Earth's rotation, only the pole star is not supposed to move. If you take a long-exposure shot aiming your camera at the night sky (it has to be mounted

on a tripod), you will see concentric circular tracks of the motion of the stars. The circles are centred at a point where the pole star is supposed to be; that is why it is not supposed to move. But if you really take such a shot you will find that the pole star is not at the centre, and it also moves in a small arc of a circle. Was it always so? No. Scientists have found that the Earth's rotational axis moves in an undulating motion, much like the motion of a rotating top. The pole star was along the axial line in the past, but now the axis has moved slightly away from it.

Citing this motion of the Earth's rotational axis, some people are imagining that the Earth's axis may move away from its mean position by a large extent. In that case the tropic of cancer, which now passes through northern India at about 23 degree latitude, will move away. The places on Earth through which the new tropic of cancer will pass will then have a climate similar to that of Northern India; and the climate of Northern India will either become too hot or too cold. There will be large scale changes in the climate of every place in the world. That will lead to the catastrophe.

Some people are saying that the axis of rotation, instead of changing with respect to the stars in the sky, may also change with respect to the Earth itself. In that case the locations of the geographic north and south poles, and the equatorial plane will change. One of today's temperate regions may become the new north pole, and the changed equator may pass through a place that is freezing cold today. That will again lead to a catastrophic climate change.

These two kinds of catastrophes are not entirely impossible though, if we consider time-frames of millions of years. But such an event cannot happen over short periods of time. The reason is simple: the rotational inertia of the Earth. Because of the inertia, no abrupt change can take place in its rotational motion – unless a large force is applied from outside, which is impossible in the case of the Earth. Small changes can

take place owing to the fact that the Earth is not a solid sphere. The inside of the Earth has soft and molten parts, whose rotation may not be the same as that of the outer crust. There can be small changes of the rotational motion of the planet due to the constant interplay between the motions of various layers, but large-scale changes cannot occur out of this.

That is why it can be said with confidence that no catastrophic disorientation of the Earth's rotation is going to occur on the 21st of December 2012.

Super-Earthquake and Super-Volcanism theories

Earthquakes and eruption of volcanoes are common events in many parts of the globe. The crust of the Earth is made of a few "plates," which move with respect to each other. That causes the earthquakes and volcano eruptions, and that is why such events mainly occur close to the plate boundaries.

Can a very large-scale earthquake or volcano eruption occur? Yes, that is possible. But such an event is always localized. A city, a district, or even a province may be affected. But an earthquake or a volcanic eruption cannot affect the whole world to the extent of driving the human race to extinction.

Moreover, the occurrence of such a super-earthquake or a large volcanic eruption cannot be predicted much in advance. Some geological and biological indicators do act as precursors to such an event, and can be used in prediction, but that is always over a short span of time. The increase in temperature of soil and groundwater, the swelling of land, the presence of specific gases in sub-surface water, and minor tremors often give forewarnings of an impending large earthquake, but only over

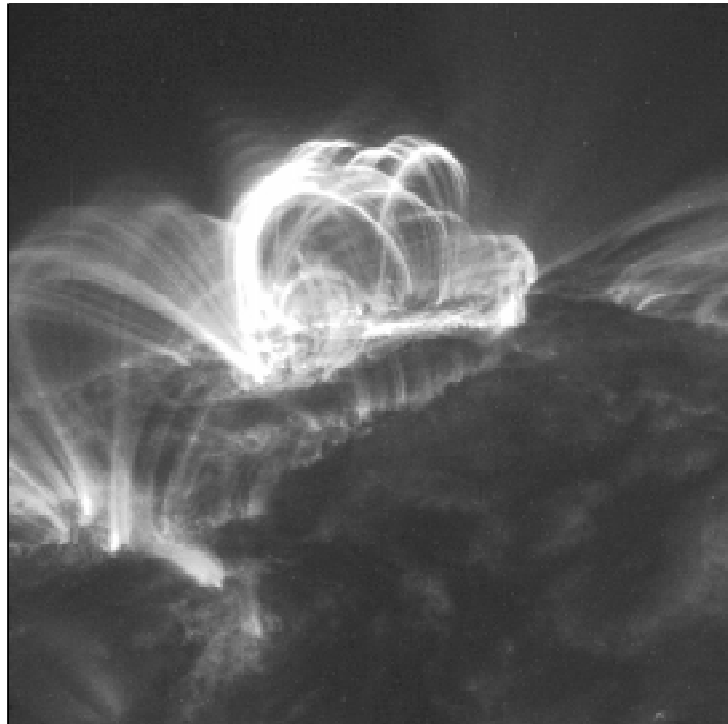


Fig. 7 : Solar flares on the Sun.

a period of a few months. That is why, in the year 2009, or even earlier, it is impossible to predict that a super-earthquake or a super-volcanism will occur on 21st December 2012. The Mayans foretelling such an event is simply ridiculous.

Pole reversals in the sun and solar flare theory

The sun has magnetism, which has its polarities. The dark spots that sometimes appear on the sun's body are indicators of the sun's magnetic activity. There can also be local magnetic fields due to the movement of hot ionized gas. Movement of charged particles means flow of current, and flow of current produces magnetic field. That is why local north poles and south poles can be created on the surface of the sun. When that happens, hot gases leap out of the sun's surface along the magnetic lines of force, and fall back at the local south pole. Where the gas has outward motion appear bright, and

dark spots appear where it has inward motion. This is what we see as sunspots.

The appearance of such sunspots does not occur uniformly over time. It has an 11-year cycle, when the number of sunspots increase, which indicates an increase of the number of local north- and south-poles and hence an increase in the sun's magnetic activity. At these times, large solar flares leap out of the sun, which can be seen with telescopes. Through this process, the overall north pole and south pole of the sun reverse their positions. Then again the activity subsides, and the sun settles in the new magnetic position for another cycle of 11 years.

When the activity of the sun increases, sometimes gigantic solar flares come out of the sun. Storms of charged particles emerge from the sun and move outward, passing over the planets. These flows of charged particles create their own magnetic fields, and the resulting "magnetic storms" affect the magnetic field of the earth.

This affects many things on the Earth. Many artificial satellites are affected. The aurora borealis becomes extraordinarily bright. The Earth's magnetic field undergoes rapid changes under the influence of the magnetic storms. We know that a change in magnetic field can produce voltages in conductors. At present there are many such long conductors on the Earth - which conduct electricity from one place to another. Such long electrical transmission lines experience over-voltage, which can damage equipment.

Citing such impacts of the increase of solar activity, the doomsday theorists are now saying that in the year 2012 a very large solar flare will swallow the Earth, and will cause a large-scale catastrophe.

In fact, the last solar pole-reversal event happened in the year 2001. Eleven years later, in the year 2012, the sun is again expected to experience increased magnetic activity. Thus far it is correct. But then, imagination spreads its wings.

Can you remember what catastrophic events happened in the year 2001? Or in the year 1990? I am positive that you won't be able to recall anything special that happened in those years. Those of us, who work in the field of engineering, know that certain things did happen. On 31 March 2001, a few artificial satellites malfunctioned, shutting down internet and TV transmission for some time. A transmission line from Seattle to Los Angeles in the USA experienced dangerous over-voltage, and had to be disconnected. As a result many places in the USA experienced power cuts. That year a solar flare was so large that the Earth passed through it.

Except for the engineers handling these equipments, nobody on this planet felt anything. Solar flares are so tenuous that nothing happens if the Earth passes through one. On the basis of these facts, the reader can now argue out how much "disaster" may happen when the solar activity again increases in the year 2012.

Galactic equator theory

If you surf the internet looking for homepages dedicated to the 2012 doomsday, another theory will attract your attention. It says that in that year, the sun will cross the galactic equator, and that will cause the catastrophe.

This probably needs some explanation. We know that the sun is an ordinary member of the billions of stars that form the gigantic conglomeration called the "Milky Way" galaxy. The galaxy is shaped like a disk, and has spiral arms. The sun is situated on a spiral arm, roughly two-thirds of the radius away from the centre. The sun is not placed on the equatorial plane of the galaxy. In fact, it and all the other stars in the galaxy oscillate around the galactic equatorial plane. Once the sun goes to one side of the equatorial plane, and then to the other side. It thus undergoes a harmonic motion with the equatorial plane in the middle. The

amplitude, that is, the distance between one end of this oscillation to the other, is about 230 light years. The sun covers this distance in about 33 million years.

So far it is correct scientific information. But then, the proponents of the doomsday hypothesis are saying that on that very day, the 21st of December 2012, the sun will cross the galactic plane. How did they know that? Simple answer: the Maya calendar makers had calculated that.

The fact is, for an event that happens once in 33 million years, it is impossible to say exactly in which year it will happen. To predict the date is as ludicrous as it gets. After a lot of observation through the modern telescopes, and after a lot of calculation, the scientists can at most say today that the sun takes about 900 years to cross the central part of the galaxy, and at some point of time in those 900 years, the sun crosses the geometric equatorial plane. Since there is nothing special in that equatorial plane – only void between stars – nothing special happens when it crosses. That is why it is impossible to say exactly when it crossed the plane.

Why do the “end of the world” theories appear again and again?

This is not the first time that theories predicting the destruction of human civilization have been in circulation. Every religion has fables and stories about the start and the end of human civilization. That is why, the idea that the world will come to an end becomes a part of the consciousness of those who believe in some religion.

For example, the Christians believe that one day the “final battle” between God and Satan will take place at a place called

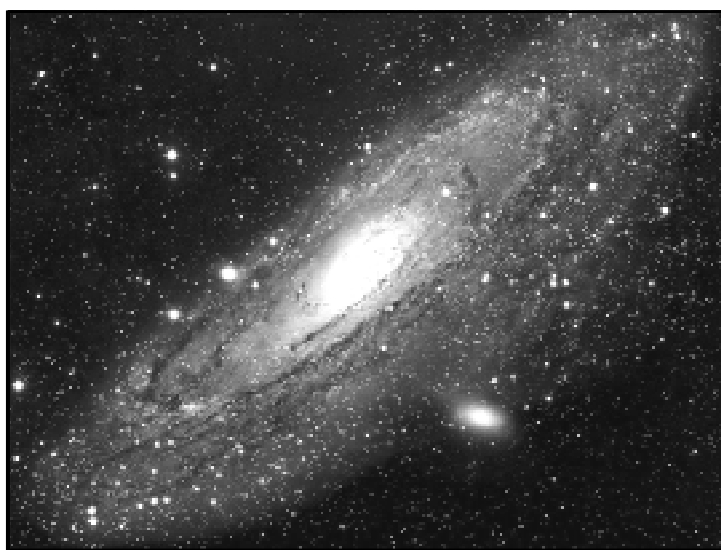


Fig. 8 : All stars are part of such Galaxies, and they oscillate around the equatorial plane.

“Armageddon”. That battle will finish off human civilization – an event called the apocalypse. The Islam religion also has similar ideas about the battle between the god and the evil, and the destruction of civilization. Hindus believe that when sin or “adharma” increases in the society, the god himself comes down and destroys everything. It is believed that in the past there were ages or “yugas” called *Satya*, *Treta*, *Dwapar*, etc., which ended in such destructive interference from god. At present it is the “kali-yuga,” and if sin, corruption, and adharma increase too much, it will also be destroyed in a similar manner. People hear about these stories from childhood, and thus ideas about the horrific “last day” enter their minds unconsciously. When they hear some apparently scientific-sounding theories predicting an impending doomsday, their minds tend to believe and not question.

There is another important aspect. Today’s youths do not have a bright future before them. Many students, who are looking forward to building a bright future, will not get entry into the world of higher education. The door to higher education is very narrow. Those who would overcome the hurdle of stiff

competition will also be deprived of the access to higher studies if their parents are poor. Today education is a commodity, which has to be purchased from the market. Those who are lucky enough to have parents who can afford it, may obtain a higher education degree. But the pain of unemployment awaits most of them. When this is the actual situation, the mind unconsciously sees an impending doomsday as a welcome event. That single event will make everybody equal, everybody will die together, and the hapless millions will not have to withstand the torment of deprivation. The unconscious mind looks forward to this possibility along with the fear of the “final day.” Instead of struggle against oppression and injustice, they dream of an alternative picture of a catastrophic event that will destroy the oppression and injustice, and the difference between the haves and have-nots. They are fed with this alternative picture. They believe. Their minds want to believe.

Among those who propagate such nonsense in the name of science, there are people who really believe in them. But most of them do this with an ulterior motive, with a design – to keep people away from the struggle against injustice and oppression, to keep them dreaming of a “final day” when their problems, along with everything else, will come to an end.

Sources of information:

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