
2012 - The End of the World - AGAIN??

- Liam McDaid

Over ten years ago, many people were convinced that something bad was about to happen. The collapse of the tech bubble? A terrorist attack? No, it was Y2K, otherwise known as the End of The World as We Know It. From shoehorning Nostradamus into the 21st century to warning of impending planetary collisions, TEOTWAWKI has now become an industry of wide reach in the United States, a multi-million dollar profit maker. The AIC (the Apocalypse-Industrial Complex, as I call them) have so many failed predictions, yet there is no accountability for the occurrences when doomsayers have gotten it wrong...and they have done so many times. The AIC seems to have something for everyone, and defying all reason it continues to grow with each passing failure.



Photos: National Geophysical Data Center, NOAA

Clearly Y2K did not end civilization, nor did four other predictions of cosmic doom that were publicized with varying degrees of effectiveness in the nine years since. For those who have been following the Apocalypse-Industrial Complex, their next date was obvious and telegraphed early on: 2012. This date is a convergence of many things that almost guaranteed widespread interest and now is the subject of a huge disaster film.

The Maya



Figure 1. General Extant of the Maya Empire.

A prediction by an extinct yet ancient civilization—the Mayan Empire (Figure 1) — is AIC gold. The Maya's best days were only about twelve hundred years ago (in Charlemagne's time), but for AIC purposes the Maya do quite well. Although a stone tech people, they were very advanced in other ways. Their mathematics and astronomy as well as their art and architecture was world class. They even had a form of written language.

To some, the most interesting thing about the Maya is their calendar. It was more advanced and accurate than the calendar of the people who invaded their land from Europe despite, ironically, Europe having recently undergone calendar reform to fix the broken Julian calendar. Their calendar was advanced, in part, by their use of Venus to tell dates, thus avoiding Moon-Sun cycle problems. The Maya also used a system of counting days in a huge cycle. It is well named as the Long Count. The fixed beginning date for the Long Count is August 11, 3114 BCE. Astronomers use a similar device, the Julian date, whose start date is even earlier, January 1, 4713 BCE. The Long Count start is thousands of years before the Mayan civilization existed and was likely picked by them because that date is where their numerical calendar cycles — consisting of cycles of 360 days, ~19.7 and 394.3 years, roughly all based on cycles of 20 — were all set to zero. In our year of 2012 – on December 21 – the Maya Long Count will reset like an odometer at 99,999 miles, beginning the next b'ak'tun of 394 years. Some have seen doom in that fact, but there are those who will find doom in any fact, no matter how innocuous. (See also Kristine Larsen's article on page 10 for other useful resources to use against 2012 arguments.)



Problems with the Maya for the AIC

Firstly, the Maya were not unified politically and there were many differences between the various city-states. One of these differences is in the use of the Long Count. Some city states (like Coba) use many more placeholders in their Long Count; for the Coba Maya, the odometer won't reset until 4.1×10^{28} years from now. Another problem is that there is no evidence that the ancient Maya saw any catastrophic significance of their Long Count calendar resetting. In fact, their calendar rituals indicate it would've been a cause for celebration.

Sadly, the Maya culture is but a shadow of what it once was. There are still Maya, and the AIC is all about harnessing their "ancient wisdom." This only happens, of course, when it supports the AIC's main premise: that we face a major shift on 12/21/12.

Alignments

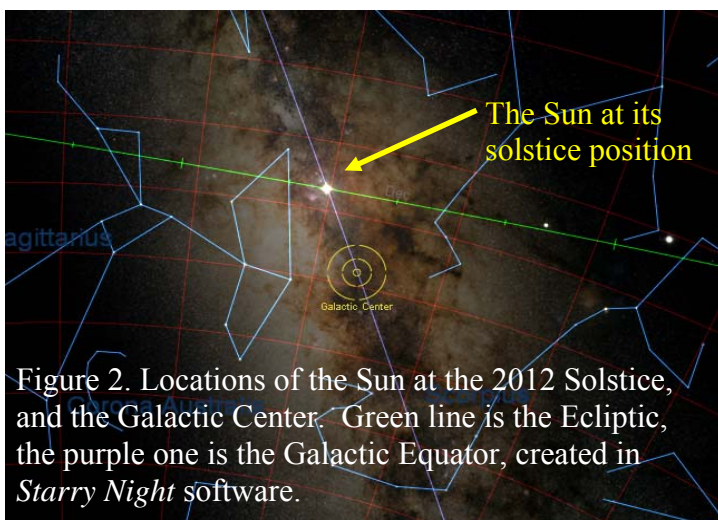


Figure 2. Locations of the Sun at the 2012 Solstice, and the Galactic Center. Green line is the Ecliptic, the purple one is the Galactic Equator, created in *Starry Night* software.

Celestial alignments are hard for AIC'ers to resist. Often, however, the people shilling these alignments rarely bother to do their homework. The next two sections examine alignments that are connected with 2012.

Galactic Alignment

In December, the Sun reaches its most southerly point on the Ecliptic. A few days earlier it also reaches its closest approach to the direction of the center of our Galaxy, which is near the border between the constellations of Scorpius and Sagittarius (See Figure 2). This happens every year; it will happen as usual in December 2012.

Due to precession, the 25,800 year wobbling of the earth's axis, the exact point of the winter solstice moves over time. Some have claimed that that point will be closest to the Galactic Center in 2012. This is simply and obviously not so.

A common problem involving the galactic lineup is agreement over what *is* lining up. Some say the Sun will line up with the Galactic **Equator**. This will happen in December 2012, but it happens every year – **twice**. The Sun crosses the Galactic Equator in June as well as December. This doesn't seem so significant.

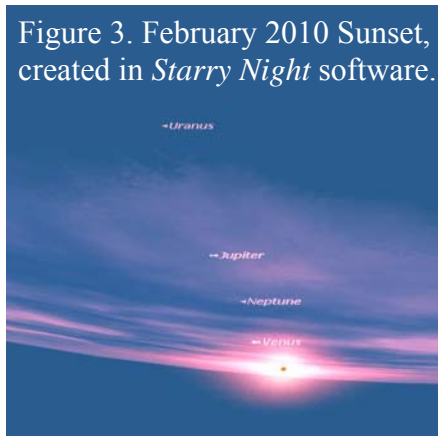
Others claim that the Sun will line up with the Galactic **Center** in December 2012. This is just wrong. The Sun doesn't pass over the Galactic Center because the ecliptic passes about six degrees north of it and that isn't even on the solstice but a few days before. Even if that alignment would be significant, that happens yearly, too. So what?

The Earth and Sun move through the galaxy and it seems reasonable that there will be times when things might line up somewhere in some way. Fair enough. But any changes of this type would take place over millions of years and be imperceptible over human lifetimes.

Planet Alignments

Planet alignments are a pillar of predictions made by the AIC. They are common enough that if any date is chosen, an alignment will be nearby in time. 2012 is no exception, as there will be a "lineup" of planets in December of that year. This lineup will even involve five planets. But they will be spread out over half the sky, and the most important planet of all, Jupiter, will not be involved. Figure 3 is an example of a Great Planet lineup. The three largest worlds, and Venus, the nearest one to us, are all close to-

Figure 3. February 2010 Sunset, created in *Starry Night* software.



gether in the sky! Doom, DOOM!! When will it happen? February 2010. Ooops...

Ironically, there is one very rare event that involves a lineup that will definitely happen in 2012: the transit of Venus. This truly amazing event will be visible to properly protected eyes without need of any telescope or binoculars and was also predicted centuries ago. It's a perfect teaching moment to deflect doom about 2012 whilst being able to have a good time looking at things in the sky – which is what it's all supposed to be about. The transit of Venus will be in June, however, so the AIC pretty much ignores it.

Other Dooms!

Polar Flips

Other types of doom are set on the idea that the Earth's poles will reset or flip, causing movie level destruction. There is a *grain* of truth, but finding it will require some digging.

Firstly, while the Earth's rotational pole wobbles (precesses), it will not flip, or shift, or reset, or stop. This is physically impossible without something to transfer the rotational angular momentum of Earth into something else. Spinning objects strongly resist having their axis of rotation shifted, as anyone riding a bicycle can confirm. Pole flips are an old idea starting out with the idea of ice buildup at the poles making the Earth unstable and flipping it. In the age of global warming, this seems even more absurd than the idea that ice can make the planet flip at all.



The magnetic field of Earth is a different thing altogether. It *does* flip and turn off temporarily, and it probably has affected the history of life over the last four billion years. Many 2012 AIC'ers see this shift happening then. The problem here is that this is also a slow process from a human point of view and picking one year especially makes no sense. Even if the magnetic field were decreasing, this isn't catastrophic. Life has survived all the past hundreds of times it has happened.

Rogue Planets

If alignments or pole shifts don't destroy Earth, perhaps a wandering planet will. Some argue that a planet named Nibiru is on course to violently interact with Earth or perhaps outright collide with it. When? May 2003. The world didn't end (or notice) and Nibiru is nowhere to be found. One disaster writer states it is already visible to the naked eye in the Southern Hemisphere, which would be news to astronomers and awfully hard to conceal from everyone else. If such a rogue planet were heading our way, by now it would be visible to millions of people and even USA Today couldn't ignore it. Such a planet has yet to be seen.

Massive Black Holes and Earth

One last idea is that the massive black hole at the center of our Galaxy will somehow do something that will kill us in 2012. The enormous distance, about 30,000 light years away, between here and there must be considered. The event would have had to happen 30,000 years ago. How would the Mayans, or any stone technology, hunter-gatherers, even know this? Our galactic black hole is also pretty quiet compared to those of more active galaxies. Simply put, it's too far away and too quiet to cause us any problems.

When your students bring up *The End of The World As We Know It*, or the movie, use it as a good teaching moment. Or at least a reason to throw a We Survived 2012 party...

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It's happened to most of us by now: a student makes an offhand comment about the Maya calendar predicting the end of the world on December 21, 2012 as if it were a foregone conclusion, or asking us how far away Planet X is, or how Earth's poles will shift, or where their family can move to be safe from the massive solar flares which will certainly fry us before Christmas on 2012. The viral internet marketing campaign for the disaster film *2012* fanned the flames of these fears, as have numerous 'documentaries' of dubious scientific quality on *The History Channel*, *SyFy* and other cable networks. (See Liam McDaid's article on page 7 which describes the 2012 history and arguments you can use against the 'chaos'.)

Google "2012" for help and your search will swiftly swallow one up in a morass of pseudo-science, misinformation, and just plain hysteria surrounding this topic. In order for us to answer our students' questions (and their parents' in some cases) truthfully and completely, we need to arm ourselves with the best and most complete information possible. Confronting pseudoscience head-on affords us a valuable opportunity to hone our students' critical thinking skills as well as communication skills, and demonstrates important connections between science and society. Here are websites which can help you on that path. Then turn to the end of the article for ways you can use these websites as bats and clubs on this pseudoscience piñata.



2012 Hoax <http://www.2012hoax.org>

The grand-daddy of 2012 debunking sites, this wiki was developed and maintained by amateur and professional astronomers and other concerned citizens. It features articles of varying length and detail about the facts, the fictions, and the personalities involved in the 2012 phenomenon. The site is constantly updated and expanded.

Starry Night Looks at Doomsday <http://www.starrynighteducation.com/sntimes/2008/06/#art1>

Geoff Gaherty, moderator of Yahoo's "Talking Telescope" group, has put together an easy-to-understand debunking of the so-called '2012 galactic alignment' using the desk-top planetarium program *Starry Night*.

The Truth About 2012 (The End is NOT near) <http://www.griffithobservatory.org/exhibits/special/2012.html>

E.C. Krupp, noted expert in archaeoastronomy and Director of Los Angeles's Griffith Observatory, has put together a selection of resources on 2012, including an historical overview of the 2012 phenomenon (originally published in the November 2009 edition of *Sky and Telescope*), a link to an hour-long public talk he gave on the topic, and a set of FAQs.

Foundation for the Advancement of Mesoamerican Studies (FAMSI) - It's Not the End of the World: What the Ancient Maya Tell Us About 2012 <http://www.famsi.org/research/vanstone/2012>

Professional art historian and Maya expert Mark Van Stone has crafted an exhaustive source of information on the Maya calendar and how it has been misused by the 2012 community. Resources include a detailed FAQ page, a lengthy set of links (including radio interviews), and graphics-heavy Power Point presentations about the specifics of Mayan time-keeping and astronomy.

2012 Doomsday Not Likely <http://news.discovery.com/earth/maya-doomsday-2012.html>

This article hosted on the Discovery Channel website is one of multiple versions of similar articles based on the work of AP writer Mark Stevenson. He interviewed living Mayans and archaeologists in creating this overview of widely-circulating erroneous ideas concerning Mayan beliefs about 2012. This article stresses that 2012 hysteria is a Western phenomenon and not a Mayan one.

The Planet X Saga <http://www.badastronomy.com/bad/misc/planetx/index.html>

Phil Plait, noted debunker of astronomical pseudosciences and misconceptions, invested serious effort in collecting information about the pseudoscientific claim that a mysterious object called Planet X (or Nibiru) is on a collision course with Earth. He then soundly and masterfully debunks said claim. Although this is not specifically a 2012 site, since Planet X/Nibiru is at the heart of many 2012 catastrophe scenarios, Plait's information is invaluable to those who seek the real story behind such claims.

Nibiru and Doomsday 2012: Questions and Answers <http://astrobiology.nasa.gov/ask-an-astrobiologist/intro/nibiru-and-doomsday-2012-questions-and-answers>

In response to a deluge of questions from the general public concerning 2012 in general and Planet X/Nibiru in particular, David Morrison, Senior Scientist of the NASA Astrobiology Institute, wrote this collection of twenty answers to commonly asked questions. Also includes short videos by Morrison and Neil deGrasse Tyson, Director of the Hayden Planetarium in New York City.

Astronomical Pseudo-Science: A Skeptic's Resource List <http://www.astrosociety.org/education/resources/pseudobib.html>

Central to the 2012 phenomenon is the chronic lack of debunking skills possessed by the general public. The 2012 hysteria has been so successful partially in response to its ability to bring together already-existing astronomical pseudosciences prevalent in the public consciousness. It is therefore important that in our efforts to debunk the various 2012 scenarios we do not lose sight of the larger picture of debunking pseudosciences in general. This website is an excellent (and often updated) list of resources for doing just that, compiled and maintained by Andrew Fraknoi of Foothill College for the Astronomical Society of the Pacific.

2012: Six End-of-the-World Myths Debunked <http://news.nationalgeographic.com/news/2009/11/091106-2012-end-of-world-myths.html>

Brian Handwerk constructed this summary of 2012 disaster scenarios for *National Geographic News* in association with the release of the 2012 film and National Geographic Channel's 2012: *Countdown to Armageddon* special. Although the individual articles are brief, they are richly linked to outside websites and other references on the *National Geographic* site.

365 Days of Astronomy podcasts <http://365daysofastronomy.org>

Originally created for the International Year of Astronomy in 2009, the *365 Days of Astronomy* podcast series features a variety of topics presented by professional and amateur astronomers. Three of the podcasts relate directly to the 2012 phenomenon: "Will the World End in 2012?" (April 27, 2009) by Columbia University's Cameron Hummels, a Ph.D. student in astronomy and the department's Director of Public Outreach, "Fighting the 2012 Hoax" (January 6, 2010) and "Arming Yourself for Battle" (January 18, 2010) by Bill Hudson of 2012hoax.org. Both the podcast audio file and text transcript are provided.

Ontario Consultants on Religious Tolerance http://www.religioustolerance.org/end_wrld.htm

The diligent student of such things as the End of The World should consult this site for lists of dates when we should have ended our world, reasons why they all fail, and more.

Cosmophobia. <http://www.astrosociety.org/2012/ab2009-32.pdf>

An abbreviated version of Morrison's article was published by the Astronomical Society of the Pacific. This version of Morrison's article may be more valuable for educators looking for a concise hand-out for classes. In addition, this version includes Morrison's views on what may be the ultimate hysteria – a widespread fear of the universe which he terms “cosmophobia.”

Ways to Use The Websites

In approaching this subject in the astronomy classroom, instructors may first wish to poll their students as to their personal beliefs/existing knowledge on the topic. Try a brief in-class writing assignment which the instructor should compile and share with the class. In this way students can keep their individual questions and misconceptions anonymous from their classmates and avoid peer pressure. Another good warmup is to discuss various superstitions concerning the natural world, many of which are culturally related, and some of which even persist to this day. These include wishing on a meteor, auroras as warring angels, and even the fear of Friday the 13th. **Morrison's “cosmophobia”** as an outcome of the 2012 phenomenon is an interesting one and may be a source of insightful class discussions and/or writing assignments, especially if students are challenged to consider their own superstitions.

Many of the videos and audio files on the websites are short enough to be used in the classroom as a springboard for class discussions (or a prompt for an in-class writing assignment) about the 2012 phenomenon specifically and pseudoscience in general. Instructors can also assign individual videos/podcasts to students to view/listen to outside of class and have them either write a reflection or have them share their thoughts in class discussions. As a capstone experience, students (individually or in groups) can write their

own podcast script concerning a particular aspect of the 2012 phenomenon (or another pseudoscience), and more advanced students may even produce an actual podcast or YouTube video. The **365 Days of Astronomy** podcasts are also valuable for the reader responses posted after each podcasts; students can look for trends and seek out obvious lapses in critical thinking and understanding of science by members of the general public.

Instructors with access to the *Starry Night* desk-top planetarium program can use **Gaherty's** online article to demonstrate to students that there will not be an actual alignment with the galactic center in 2012. Gaherty explains step-by-step how to do the demonstration, so if computer facilities allow, the students may be able to do the demonstration for themselves. For those without the program, the visuals on the site provide clear evidence that there will be no galactic alignment in 2012. Some planetariums run this program as part of their visuals, so it is recommended that instructors check with local planetaria for the possibility of a presentation on 2012.

Stevenson's article can also be used as the prompt for a discussion about how majority Western cultures tend to view other cultures through their

own lens.

The **FAMSI website** contains myriad resources including an FAQ about the Maya calendar and several Power Point presentations which can either be shown in class or assigned to students for out-of-

The screenshot shows the top of the Astronomy Beat website. The header includes the title "ASTRONOMY BEAT" with a star icon, the issue information "Number 32 • September 21, 2009", and the website URL "www.astrosociety.org". Below this is the publisher information: "Publisher: Astronomical Society of the Pacific", "Editor: Andrew Fraknoi", and "Designer: Leslie Proudfitt". The main article title is "Doomsday 2012, the Planet Nibiru, and Cosmophobia" by David Morrison, a NASA Astrobiology Institute Senior Scientist. The article begins with an "Editor's Introduction" where Morrison describes his website "Ask an Astrobiologist" and discusses the 2012 doomsday myth. A small inset image shows a screenshot of the "Ask an Astrobiologist" website. The article continues with a section titled "1. What is the origin of the prediction that the world will end in December 2012?" which discusses the Sumerian myth of Nibiru. The footer of the page reads "Astronomy Beat No. 32 • September 21, 2009" and "Page 1".

class viewing. Teachers can have students practice using the Maya calendar to calculate specific dates (such as their birthday) and even design their own Maya Calendar wheel. A novel assessment is to have students create their own calendar system for another world (in our solar system, try Mars or Jupiter, or go completely extrasolar) in which the astronomical cycles have different lengths than ours (for example, if the moon had a different orbital period). Students can make presentations about it in concert with history classes, emphasizing the interdisciplinary nature of astronomy.

Phil Plait's website on Planet X/Nibiru is an excellent example of critical thinking which the students can be led through. The same website has excellent debunking of other astronomical pseudosciences such as the 'Moon hoax' (the denial that we landed on the moon). Students can learn the methodology of debunking from Plait's site, and then either debunk another astronomical pseudoscience in the form of a FAQ, report, oral presentation, or poster (such as those listed on the **Astronomical Society of the Pacific** website). They can even create their own pseudoscience. In the case of a created pseudoscience, the student or a classmate can then suggest a process for testing/debunking the claim. Both kinds of debunking assignments have been successfully used by this author for many years in non-science major courses. The sites listed above by **National Geographic** and **2012hoax.org** can also be useful as templates for successful debunking.



Whether you are teaching K-12 students, college undergraduates, or the general public all of us who teach need to do our part in replacing ignorance with information, and fear with wonder.

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(Continued from Page 6)
Following Eratosthenes' Footsteps

less day, using actual sunlight, with its half-degree spread (the angular diameter of the solar disk).

Another thing to try is to perform the experiment on the other three solstice and equinox date configurations—with the North Pole pointed away from the light source, or both poles pointing sideways (an equinox date). Be careful not to cause a great misconception here! Once you've set the North Pole pointing to one side of the room, move the globe around the light source keeping the North Pole pointing the same direction. Otherwise you can give the idea that the poles move and don't point towards the North Star all the time.

Author's Note: The upside-down Styrofoam cup with crosshairs is based on Robert Mitchell's in the AstroNotes column of *The Physics Teacher*, May 1991, p. 318, reprinted in Timothy Slater and Michael Zeilik's *Insights Into the Universe* book from the American Association of Physics Teachers. Thanks to Tom Calderwood for technical assistance and to Weston School students for doing the lab.

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