

MEGACATASTROPHES!

Nine Strange Ways the World Could End

DAVID DARLING & DIRK SCHULZE-MAKUCH



ONE WORLD

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INTRODUCTION

We live in a quiet backwater of an ordinary, middle-aged spiral galaxy, circling one of the more sedate kinds of stars, on the surface of a stunningly life-friendly planet. Nature has dealt us a very kind hand indeed. But that doesn't mean we're completely safe or that we can afford to be complacent.

Space rocks as big as houses zip by us, closer than the Moon, every few months or so; some the size of large mountains have smashed into the Earth in the past causing serious mayhem. Giant stars explode, supervolcanoes erupt, ice ages come and go, the very fabric of space and time might rip apart at any moment if some theories are to be believed. And if these potential natural disasters aren't enough, there are threats of our own making in the form of new technologies that could spin out of control. We might even fall victim to an alien attack – seriously – just like in the good old B-movies of the 1950s.

Not that there's any need to panic. Almost certainly the world won't end this week, or in our lifetime, or in our children's children's lifetimes. But it's possible, even if we manage to avoid

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pressing the nuclear button, that the human race, and even the Earth itself, could be wiped out in less time than it takes you to read these pages. Or the end might come more gradually but still uncomfortably fast, over the space of a few years or a few centuries. The destruction might involve more than just our planet, too. There are ways in which the entire universe, with its hundreds of billions of galaxies scattered across billions of light years, could slip swiftly into oblivion without warning – and with more than a little human help.

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Prophesying the end of the world has always been a popular pastime. At the time of writing, the more excitable Internet forums, the tabloid press, and late-night radio talk-shows are gripped by tales of a coming apocalypse. December 2012 is the fateful month, some say, when, according to an ancient calendar of the Mayans, everything is going to go horribly pear-shaped. But before blowing your life's savings on one last outrageous street party, it may be worthwhile reading the small print on this prediction.

The calendar in question is what's called the Mesoamerican Long Count calendar, which supposedly began 5,125 years ago. In 1966, the American archaeologist and anthropologist Michael D. Coe argued that the current, fourth age of the Long Count would come to an end on December 21, 2012, and that this date would have been highly portentous to the Mayans living centuries ago. "There is a suggestion," he wrote, "that Armageddon would overtake the degenerate peoples of the world and all creation on the final day ... [O]ur present universe [would] be annihilated when the Great Cycle of the Long Count reaches completion."

Although Coe remains a respected figure, most Mayan specialists today disagree with him on this particular issue. The

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consensus view among scholars is that, although the Mayans believed in world ages, they made no predictions about any catastrophe happening at the end of the present cycle. Nothing in their records suggests anything other than that they saw it as the prelude to yet another world age, which, in their minds, would have been a cause for celebration rather than fear.

Pseudoscientists and pseudohistorians, however, aren't prone to letting the opinions of experts get in the way of a good story. The 2012 Phenomenon is alive and kicking, and will doubtless remain so until December 22 when we wake up to find that the Earth hasn't been knocked off its axis, or suffered any other ill effects from obscure cosmic alignments, geomagnetic reversals, or close flybys of unknown planets. If past experience is anything to go by, explanations of how we survived will quickly emerge, and new doomsday forecasts will appear to replace the ones that didn't quite work out. And, as always, these revised dire warnings will find a ready and eager audience.

Apocalyptic predictions have been doing the rounds for thousands of years. An Assyrian clay tablet dating back to about 2800 BCE warned: "Our earth is degenerate in these latter days. There are signs that the world is speedily coming to an end." Doom-mongers throughout the ages have had a uniformly dismal success rate.

Often, as in the case of the 2012 prophesy, the date when everything will unravel is pinpointed with great precision – to the embarrassment of the author when the world continues on its merry way past the appointed time. Early in Rome's history, many Romans feared the city would be destroyed in the 120th year of its founding. There was a myth that a dozen eagles had revealed to Romulus a mystical number representing the lifetime of Rome, and it came to be supposed that each eagle represented ten years. Since the Roman calendar began in what is our 753 BCE, the date of destruction was put at 634 BCE.

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In more recent times, hardly a year has gone by without someone staking their (often dubious) reputation on a prediction that the Day of Judgment or the “Rapture” is nigh. The year 2010, for instance, was the last time anyone needed to print calendars according to the Hermetic Order of the Golden Dawn. In 2011 it was the turn of Harold Camping and his California-based Family Radio group to declare that May 21 would see the Second Coming of Christ. Camping’s followers emptied their bank accounts trying to spread the word and were less than pleased to find themselves still stuck on a very material world and totally broke. Meanwhile New Hampshire atheist Bart Centre made a killing by setting up Eternal Earth-Bound Pets and charging clients \$135 a time for insurance policies that guaranteed care for animals whose owners had ascended to a better place. British physicist Brian Cox tweeted: “I think we should all pretend the rapture is happening so that when Harold Camping gets left behind later today he’ll be livid.”

Astronomical events have long been favored as portents of doom. Comets especially have been singled out as celestial omens. The 1066 return of Halley’s Comet in the skies over Britain (recorded in the Bayeux Tapestry) certainly didn’t coincide with good luck for King Harold II of England, who took an arrow in the eye, but may have been viewed in a more kindly light by his adversary William of Normandy. The same object was still rattling people’s nerves several centuries later when the Italian scholar Platina wrote, “A hairy and fiery star having made its appearance for several days, the mathematicians declared that there would follow grievous pestilence, dearth, and some great calamity.”

The appearance of another comet – Kohoutek – stirred David Berg (a.k.a. Moses David) of the Children of God cult to red-ink January 1974 as the fateful month. Unfortunately for his credibility, Kohoutek failed to collide with the Earth, although

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that didn't stop him making further predictions about the Second Coming.

John Gribbin and co-author Stephen Plagemann would probably like to forget the year 1982, because it was then that, according to their book *The Jupiter Effect*, the planets would align in such a way that giant earthquakes, tsunami, and other unpleasantness would be visited upon us. In fact, nothing untoward happened – there was never any good astronomical reason it should – and a suitably chastened Gribbin went on to write many more popular science books (including the slightly less successful *The Jupiter Effect Reconsidered*), though none based on quite such sensational claims.

On July 19, 1993, Sister Marie Gabriel Paprocski announced her prophecy that a comet would collide with Jupiter on or before July 25, 1994, causing the “biggest cosmic explosion in the history of mankind” and bringing an end to the world. In fact, a comet *did* hit Jupiter on July 16, 1994; however, Sister Marie's prediction seems a little less startling in view of the fact that it came nearly two months after astronomer Brian Marsden reported that comet Shoemaker-Levy 9 was on track for an impact with the giant planet. And, of course, there's no way that a relatively little object breaking up in Jupiter's atmosphere could have any effect at all on us hundreds of millions of kilometers away.

Tragedy accompanied the claim by the San Diego-based Heaven's Gate cultists that a UFO trailing behind comet Hale-Bopp would save their souls from the imminent destruction of the world. This rumor started when amateur astronomer Chuck Shramek mistook a star for what he thought was a “Saturn-like object” following the comet; Internet gossip ballooned the story to ludicrous proportions. There was no UFO and Hale-Bopp never came close to colliding with Earth, but thirty-nine members of the cult committed suicide in the belief that their souls would be among the few to be rescued.

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It seems we never learn. The year 2011 saw more folk getting agitated about the imminent arrival of comet Elenin. Google “Elenin” and you’d be bombarded with ill-informed offerings about how Elenin would come close to or even ram into the Earth, bringing death and destruction on a biblical scale. In fact, Elenin was nothing special in astronomical terms – just another comet visiting the inner parts of the solar system from the depths of space. With a nucleus, or hard central part, only a few kilometers wide, it was actually on the small side as comets go. And astronomers knew well in advance that the closest it would come to us, on October 16, 2011, was thirty-five million kilometers, or about ninety times further away than the Moon. Shortly after its discovery, a few armchair theorists had mistaken the size of Elenin’s coma – the glowing, almost vacuum-thin shiny fuzz of vaporized particles around the nucleus – for the size of the nucleus itself. Some of these self-styled experts then caused a stir on the Internet by claiming that Elenin was as big as a planet and would cause chaos during its close passage of the Earth. As the world now knows, little comet Elenin broke apart and disappeared from view last year without unduly disrupting our affairs.

Nothing captures the imagination quite as much as the terrifying prospect of worlds in collision. The Russian-born American psychiatrist Immanuel Velikovsky achieved remarkable popular success with a series of books on this theme. Scouring ancient literary sources, including the Bible, for his data, Velikovsky pieced together a revisionist chronology of events involving close encounters between the Earth and other planets, notably Venus and Mars. His *Worlds in Collision* (1950) and *Ages in Chaos* (1952) were best-sellers in their day, and such was the intricacy of his claims that it took scientists the best part of thirty years to critique them fairly and in full. Although Velikovsky didn’t emerge from the analysis well, it’s generally recognized that he uncovered some

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interesting references in ancient texts to the possible effect of comets and meteorites.

Another author who claimed to have found evidence of past collisions, from Sumerian writings, was the Azeri-born American Zecharia Sitchin. Like the German writer Erich von Däniken (of *Chariots of the Gods* fame), Sitchin was a proponent of the ancient astronaut hypothesis, which maintains that extraterrestrials have influenced human history. His theory was that Sumerian culture wasn't home-grown, as previously assumed by every respectable archaeologist and historian, but was in fact seeded by the Anunnaki, a race of aliens from a world whose existence he announced in his book *The Twelfth Planet* (1976) – Nibiru. No amount of debunking of Sitchin's faux-erudite work by Sumerian scholars, who've pointed out multiple flaws in his translations and his selective reading of texts, diminished the popularity of this entertaining narrative. Sitchin's books have been translated into more than twenty-five languages and have sold millions of copies.

Myth builds upon myth, fed by an insatiable appetite for escapist re-tellings of science and history. We seem to love a good scary story, especially if someone who poses as an authority tells us it might be true.

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Many apocalyptic predictions come about because of a shaky understanding of astronomy or the laws of physics. But what does real science have to say about the prospect of megacatastrophes?

Firstly, again, there's no need to lose sleep over these things. To the best of our knowledge, Earth isn't due to be demolished to make way for some hyperspatial express route, as it was in *The Hitchhiker's Guide to the Galaxy*. Yet, there's no denying, it does occasionally come under fire from space. As recently as 1908 an extraterrestrial missile, probably a wayward chunk of a comet,

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vaporized explosively in the atmosphere above Siberia, flattening trees over an area of several hundred square kilometers. Reindeer were the main casualties on that occasion but if the intruder had come down over a major city it would have been a very different story. Asteroids *do* hit our planet. The most infamous of them smashed into what is now Mexico's Yucatan peninsula 65.5 million years ago and caused such environmental mayhem that it played a role (though perhaps not an exclusive one) in finishing off the dinosaurs, along with two-thirds of all other species living at the time. We'll be hit again in the future, inevitably, unless a planetary defense system is put in place. It's just a matter of when and how hard.

More devastating still could be a gamma-ray blast originating far outside the Solar System. Sometimes when big stars explode they give off, in their death throes, an almost unimaginably intense pulse of high-energy radiation that tears across space at the speed of light. No inhabited planet within several hundred light years of such a blast would escape unscathed. A nearby gamma-ray blast could rip away most of Earth's protective ozone shield leaving us at the mercy of DNA-busting solar ultraviolet.

Nothing so dramatic will happen to our own star. The Sun, by cosmic standards, is a respectable, well-behaved stellar citizen. Even so, it does have its moments of unpredictability and, over longer periods, its energy output changes with major consequences for life on Earth. The ins and outs of solar variability are something that we're only just beginning to get a handle on – and what we're learning is a little disturbing. At the very least, an up-tick in solar flares during the next solar cycle, which is just starting, could disrupt sat-nav devices which have become ubiquitous since the last cycle and which rely on being able to pick up incredibly weak satellite radio signals. These signals could be drowned out by an influx of solar radiation, making everything from car navigation to oil-tanker docking a hit-and-miss affair.

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Slightly more worryingly, automatic landing systems for aircraft and military missions could be compromised.

In one way or another, our increasing dependence on technology is a big risk factor for modern man. We're building vast instruments, such as the Large Hadron Collider (LHC) – all twenty-seven kilometers of it, buried up to 170 meters below the Franco-Swiss border – to explore realms of physics about which we have little understanding (indeed, that's the whole point). Will the LHC spawn little black holes that will gobble up the Earth? Almost certainly not, since such mini-holes are probably being created all the time by cosmic-ray collisions in the atmosphere with no obvious ill effect. Will it bring to light the much-vaunted Higgs boson? Well, hopefully so, because if it does we'll know we're on the right track with our most promising ideas about the make-up of the subatomic particle zoo. On the other hand, a couple of reputable physicists have already suggested that the universe abhors Higgs bosons so much that it's trying to tell us so through various early problems that the LHC has experienced. In other words, effects are rippling back through time that prevent the Higgs from being created in the first place. Although slightly tongue-in-cheek, their suggestion does highlight how little we know about science under extreme conditions.

That's the trouble with new science and technology: because it's new and we don't properly understand it, it can have unforeseen consequences. Nanotechnology is one of the upcoming developments that, some claim, might have very nasty side effects. Sophisticated, self-replicating machines the size of protein molecules might be a godsend to medical science (enabling miniature disease-zapping submarines to patrol the bloodstream and so forth) but a calamity for civilization as a whole if they go AWOL and start converting the environment into the dreaded "grey goo", like a Borg assimilation of nature at the microscopic level. As it is, some types of nanoparticles have

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already been earmarked as health hazards because of the way they enable toxic substances to build up in the bodies of lab animals and potentially to damage DNA.

These are just some of the scientifically credible but lesser-known threats that *Homo sapiens* faces at this interesting but risky phase in its history. We'll be looking at each of nine categories of danger, the level of hazard they pose to our planetary ecosystem and humans in particular, and what, if anything, we could do to mitigate them.

You might be wondering why we haven't mentioned more obvious problems on the horizon. Two of the most immediate threats to our survival, on everyone's minds right now, are climate change and terrorism or other forms of global conflict. For the simple reason that these have been written about so much already we'll almost completely ignore them here. They're hugely important, of course, and rightly dominate much of our news. But our aim in this book is to take a rather more light-hearted look at other Doomsday scenarios. These are the lesser-known, and sometimes slightly eccentric, ways that our species might meet a sticky end.

MEET THE CATASTROPHOMETER

To get an idea of how likely and threatening are each of the types of megacatastrophe we'll be talking about, the “Catastrophometer” appears at the end of each chapter. This will show a value from 0 (absolutely no need to worry) to 10 (be very, very afraid).

The Catastrophometer applies only to megacatastrophes that might happen over the next 100 years or so (although the book itself sometimes deals with larger timescales). Generally, the higher the reading the more likely is the event and the bigger its anticipated effect on the human population.

The scale is crude and you may think it odd that a “moderate” risk of 10 million people meeting a sticky end ranks higher than a “low” probability of a total wipe-out – but we wanted to keep it simple. Also, the values shown at the end of each chapter are just the authors’ personal opinions and not to be taken too seriously! But hopefully this little device will offer a rough guide to the threat level and, if nothing else, a topic for conversation.

MEET THE CATASTROPHOMETER

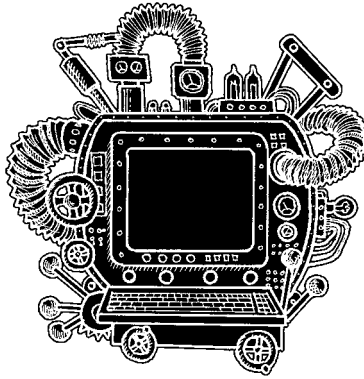


Figure 1 The Catastrophometer. Credit: Patrick Knowles.

The Catastrophometer scale is to be interpreted as follows:

Rating	Probability (of megacatastrophe)	Loss of human life
0	zero	0
1	low	10 million or more
2	low	1 billion or more
3	low	total extinction
4	moderate	10 million or more
5	moderate	1 billion or more
6	moderate	total extinction
7	high	10 million or more
8	high	1 billion or more
9	high	total extinction
10	certain	total extinction