



The Spinning Magnet: The Force That Created the Modern World--and Could Destroy It

Alanna Mitchell

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An engrossing history of the science of one of the four fundamental physical forces in the universe, electromagnetism, right up to the latest indications that the poles are soon to reverse and destroy the world's power grids and electronic communications

A cataclysmic planetary phenomenon is gathering force deep within the Earth. The magnetic North Pole will eventually trade places with the South Pole. Satellite evidence suggests to some scientists that the move has already begun, but most still think it won't happen for many decades. All agree that it has happened many times before and will happen again. But this time it will be different. It will be a very bad day for modern civilization.

Award-winning science journalist Alanna Mitchell tells in *The Spinning Magnet* the fascinating history of one of the four fundamental physical forces in the universe, electromagnetism. From investigations into magnetism in thirteenth-century feudal France and the realization six hundred years later in the Victorian era that electricity and magnetism were essentially the same, to the discovery that Earth was itself a magnet, spinning in space with two poles and that those poles aperiodically reverse, this is a utterly engrossing narrative history of ideas and science that readers of Stephen Greenblatt and Sam Kean will love.

The recent finding that Earth's magnetic force field is decaying ten times faster than previously thought, portending an imminent pole reversal, ultimately gives this story a spine-tingling urgency. When the poles switch, a process that takes many years, Earth is unprotected from solar radiation storms that would, among other things, wipe out all electromagnetic technology. No satellites, no Internet, no smartphones--maybe no power grid at all. Such potentially cataclysmic solar storms are not unusual. The last one occurred in 2012, and we avoided returning to the Dark Ages only because the part of the sun that erupted happened to be facing away from Earth. One leading US researcher is already drawing maps of the parts of the planet that would likely become uninhabitable.

The Spinning Magnet: The Force That Created the Modern World--and Could Destroy It Details

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From Reader Review The Spinning Magnet: The Force That Created the Modern World--and Could Destroy It for online ebook

Peter McLoughlin says

The book is a bit deceptive. You think you are getting a history of dynamos and electrification but instead, you get the history of the study of earth's changing magnetic fields. I was mildly disappointed. The story didn't keep my interest either. The author should have been more forthright and the story could have been better told.

David Wineberg says

The Ultimate Lose-Lose Proposition

With all the talk of climate change, the sixth extinction, the collision of galaxies and the death of the sun, Alanna Mitchell adds another – the fading of our magnetic field. We are protected from the sun's ferocity by a magnetic field that comes from the core of the planet. The sun can blow it back, but it can't blow it away. Worryingly, all is not well with that shield.

The Spinning Magnet is almost entirely history. Mitchell looks at the long list of milestones as we discovered and tried to understand electricity and magnetism. There are as many wrong turns as right ones, but today we have a good idea of what came before (though no feel for what comes next). The most important discovery was that electricity and magnetism are both manifestations of the same force. We ignore one for the other at our peril. By 1838 we knew the magnetic field came from the center of the Earth. We've spent the following 200 years taking measurements everywhere, all the time, to figure out the patterns, the intensity, the movements and the implications. But that's also how we know it is fading.

The magnetic north and south poles used to reverse fairly regularly, and they leave traces when they do. There hasn't been one since we came along, so we don't know what to expect. But reversing the poles and the field will almost certainly wreak havoc like we've never seen. For one thing, we now run on electricity. When extraordinary solar flares penetrated the field in the mid 1800s, batteries powering the telegraph network all over the western world caught fire, seemingly spontaneously. Disconnecting them did not shut the system down, however. It ran on "celestial power". Today, everything is electric. But in addition, everything runs on magnetic media. All the software, hard drives and memory banks in the world might be wiped if the magnetic field behaves badly. It could be like Puerto Rico after Hurricane Maria, but with no possibility of aid, as nothing would work anywhere. And that doesn't count what it might do living beings. Birds for example, can actually see the magnetic field, and use it to navigate thousands of miles twice a year. Many insects use it too. We have no idea how they will handle a reversal. If the field doesn't reverse but fades away, the sun will be free to fry the Earth into another Mercury, and continually bombard it with killer radiation (which is why "escaping" to Mars is no solution. Its magnetic field is long gone). It gives one pause.

Mitchell's style is fast and spare. Her book is very easy to read. The sentences are short, direct and declarative. The chapters are short and concise. They are discrete entities, each having its own tight purpose. She avoids the worst complexities. It is page 96 before Mitchell uses the word quantum. And it only appears once more later. That's pretty remarkable for a book on atomic structures and processes.

The irony is that our discovery of electricity, magnetism and how to employ them has allowed us to understand that life as we know it could end with the change or demise of the magnetic field and all the wonderful ways we have deployed electricity and magnetism.

David Wineberg

Mike Maurer says

I came across this book at my library. It looked interesting. Spinning magnets and all. It is a very high level history and explanation of the magnetic field that surrounds the Earth. Plus a bit of what is currently happening both below our feet and above our heads.

The history was interesting. A lot of supposedly smart people dragging their feet on exploring this neat science. I have seen it a lot in science, where the old guard of recently disproved notions cling on to their beliefs no matter what the evidence. That isn't science, but human nature. The same type of scientists who scoffed at a solid & liquid cores are the same that thought the continents don't move. Plate tectonics is only in the last 40-50 years. Much our understanding of magnetic fields is a bit more than 100 years old.

If you really want to freak yourself out, read the sections about what will happen when the poles reverse. Or simply weaken. Then add in a bad solar storm. Think Victorian or steampunk.

But the reversing poles are part of the history of the world. I wanted more stories or information about this type of event. Plus more insight into what we know about the moving poles. Do we know why they move, how deep is the chunk of material is, etc? This is a very lightweight book, targeted at those curious about the science, but may not have any science or engineering background.

David says

An unusual topic, well presented. It's split between a historically themed introduction to geomagnetism and a slightly -- but only slightly -- sensationalised treatment of the risks from unpredictable future shifts in the Earth's magnetic fields. She admits upfront to her lack of relevant background, which worried me, but she has done exceptionally well in educating herself on the topic and on the broad range of scientific concepts that underly her story. Her limitations show through only very rarely, either in outright mistakes or in lightly digested reports from experts.

Bradley says

Maybe this one was just up my alley in all the right ways or maybe the author is pretty spot-on with her mix of science history, humanization of the players, and just the right dose of scientific explanation for laymen.

Maybe it was both.

Regardless, I seriously enjoyed this non-fiction all about magnetism. It shouldn't come as all that much surprise that it has serious biological roots and it's all about physics and chemistry, but the author balances everything in such a way that it's always interesting. I didn't realize that magnetism was under controversy back in the days of Galileo. The way that it all ties seamlessly into geology should also be obvious, but I never felt uncomfortable in the writing. Indeed, I was pretty much uniformly fascinated.

The big zinger about the poles reversing and the effects on modern society aren't sensationalized, either. There's a big "I Don't Know" in there, but so much of the evidence points to a protracted (say a few thousand years) time of less magnetic shielding as the poles do their thing. The fact they will flip is not in doubt. The fact that we might be undergoing a radical influx of harmful radiation because the Earth isn't going to be blocking solar storms is probably the scariest thing I can imagine.

That's even worse than losing all our electronics. I mean, that's bad enough and I'll have to go buy a bedpan and a shotgun to defend myself in my new dystopian nightmare, but we're talking about a mass-extinction event. Well, assuming we or the animals don't start breeding for rad-tolerant biologies or take rad-x.

Can you imagine a bunch of teens running around with early onset dementia?

Oh, wait, yeah. I've read quite a few YA novels.

Really fascinating non-fiction, here! It's right up there with some of the very best non-technical popular science books I've read! (That's saying a bit. I like good science books. :)

Thanks to Netgalley for the ARC!

Steven says

I really enjoyed this accessibly written history of how we have come to understand the Earth's magnetic field. I learned so many new things about the earth and magnets. Geophysics is cool!

I think it is really hard to transport myself into the mindset of others prior to some big scientific discovery. The author does a good job at this. For example, when she described how Henry Gellibrand proved that the north pole wobbled about, I found myself staring at the floor of my house in awe. What wondrous things are going on down there? I have several other moments like these.

Kevin says

I had higher hopes for *The Spinning Magnet: The Force that Created the Modern World and Could Destroy It*. I was looking for more "This is what's going to happen! Look at how unprepared we are! This is how it is going to change the world! Everyone run for your lives... wait... WE HAVE NOWHERE TO RUN!!!" (There was a chapter along these lines this near the end.) What Alanna Mitchell gives you is a history of magnetism: its discovery, the expansion of our knowledge, and application to earth sciences. None of this is

bad – but as fairly baseline physics guy, I sometimes had trouble grasping the actual science of magnetism that was expansively detailed throughout. I wish there was more story here from the author’s perspective: why has a Latin scholar decided to write this book? What is her journey? She takes us through her conversations and lets us meet the people she met, but it isn’t the most exciting sub-narrative within the larger nonfiction work.

Good for physics enthusiasts who speak the language! And who don’t mind reading the word “magnet” over so many times... but not so good for someone like me who was looking for more “maybes” and speculation. Where are the madcap prophesies!? Not here, you apocalypse-seekers.

PS - I am curious as to why this cover with sans serif font was used as opposed to the other, which fit in better with the subtitle font INSIDE the book. It seems there was a disconnect there and don't understand the change. Perhaps the publisher could elucidate... why two covers?

Jim says

<https://undark.org/article/books-alan...>

Shirley Turner says

Well researched and riveting

The subject was explored in depth, from both historic and scientific angles. Complex topics were well explained in terms that were very accessible. The first-person view of travels, locations, and interviews with experts made for an easy and enjoyable read. And, a little scary to imagine what this world will go through when the poles switch.

Peter Tillman says

Science (AAAS) review: <http://blogs.sciencemag.org/books/201...>

"This field protects the environment from the harsh conditions of space, yet its strength has been declining since Carl Friedrich Gauss first devised a method to measure the absolute intensity in the 1830s.

Fluctuations in the rate of decline are small compared with the average trend, suggesting that the dipole might vanish in less than 2000 years. ..."

Samuel McCord says

Very interesting with lots of background history and personalization. I started getting impatient though and

skimming to sections with current information on the theme. In the end, I would have preferred to read a 50-page report with concise information. Glad I found it though.

Steve Stanton says

Just when you thought there was something trustworthy left in this old world, it turns out the compass points have gone awry. That's right: the Earth's inner anatomy has gone fundamentally askew as storms gyre in the molten core, threatening the powerful magnetic field that protects life on the surface. In this new science book, Canadian author Alanna Mitchell takes the reader on an engaging pilgrimage around the world to visit with scientific leaders and sites of historical interest, leading us step by step into this emerging area of study. The north-south polarity of our planet has reversed several times over ancient millennia, leaving a historical record on the Atlantic seabed that looks like zebra skin on the magnetic map. According to Mitchell's detailed research, the north magnetic pole has been "galloping" across the Arctic in recent years, a strange magnetic anomaly has been growing in the southern hemisphere, and the protective magnetic shield over the Earth has decreased by 10% in the past 200 years—but no cause for alarm just yet, because no one actually knows what's going on! The stakes are high in the race to figure this out, because our "spinning magnet" is the only thing holding our atmosphere together under a cruel sky. The hostile universe around us is chock-full of lethal ionizing radiation, and our own sun regularly spits out dangerous plasma and harmful particles from solar storms. With our modern reliance on electricity to maintain our digital society, we are sitting ducks for electromagnetic devastation.

Bandit says

I did this to my stubbornly nonscientific brain on purpose. Learn, brain, learn. Then again it's entirely possible I overestimated my interest in magnetism. Either way, this was a somewhat challenging read. And I admit to not reading nonfiction as much as I'd like, so I try for at least one a month. Lately, the selections seem to be positively apocalyptic, there are so many things out there that can destroy the world as we know it. Now there are deadly solar flares and magnetic reversals to add to that list. Although with modern politics being what they are who knows if anyone would ever live long enough to find out. Anyway...this book was pretty thorough, the author really did her research, so you can't help but learn things...from basic chemistry to something more complex, like the difference between ferromagnetism and ferrimagnetism, which is complicated and probably fairly irrelevant to life outside of specific fields of study. I seem to enjoy the historical aspects here more so than the actual scientific ones, so maybe I'm not exactly the target audience, but I can't help noticing how (relatively) recently some of these discoveries have been made and yet now there's nothing but certainty as to the general outline of the world's makeup. Who's to say another Einstein won't come along and change our understanding of it all? This, to me, is an exceptionally frustrating part of learning, especially science, this is why I no longer read/study so much about astronomy, too many unknowns still and too much certainty about the few things we do know. Almost like a strange arrogance born out of ignorance. Wow, this review I just one digression after another. Sorry. Back to the book...where chapter after chapter the author traverses continents (physically) and ages (metaphorically) to explain how the modern understanding of one of the four fundamental forces of the universe came to be. Compounding discoveries century after century to get to where we are now, which is to say expecting another reversal, which will most likely affect magnetic field protecting the Earth, which will most likely have disastrous effects on all/most life, which is thus far without timeline of affective solutions. After all as my favorite quote of the book states...Science is provisional. It's amazing to see how far the general understanding of this

has come from Aristotle's primitive (to modern eyes) view, but who knows what the future holds, certainly bleak things it seems. The narrative was almost layman accessible with some minor exceptions. The edition I read was an ARC through Netgalley and it lacked any photos/art and also proper formatting. In fact, it was formatted in such a manner that made it difficult to read and enjoy. No idea why publishers think that's a good way to offer books, it was literally covered in random numbers interspersed throughout the text, weird level of almost but not quite right like an underbaked cookie. But this shouldn't be a thing with the proper book, when it is published. So, there you go brain, you can continue proudly consider yourself an autodidact, this was work.

Ben Babcock says

One of my most favourite episodes of the new *Cosmos* (because, honestly, they are all so good) is Episode 10: "The Electric Boy", which focuses on the life and discoveries of Michael Faraday. In particular, the episode emphasizes how the invention of the dynamo and the electric motor spurred on a whole new technological revolution. The electric motor is just ubiquitous now, even more so than smarter digital electronics, and we take it for granted as such a basic piece of technological craft. Yet it is in fact a marvel of science and technology. With its somewhat sensationalist title, *The Spinning Magnet: The Force That Created the Modern World—and Could Destroy It* captures some of that same sense of wonder. In addition to Faraday, science journalist Alanna Mitchell takes us on a tour through history, introducing us to the people who marvelled at, experimented on, and made discoveries about electromagnetism. Thanks to Dutton and NetGalley for the e-ARC.

As the title implies, the book focuses heavily on magnetism as it relates to our physical planet. There was quite a bit more geology and geophysics in here than one might initially expect (not that that's a bad thing). Mitchell always links each point back to the central topic: our Earth is one, giant magnet, and the strength of the magnetic field plays an important role in protecting us from solar and cosmic radiation. Historically, understanding the way the magnetic field works—how it is laid out, and how it is changing—has been important for navigation and theoretical science. Now, though, as our technology base and even things like our power grids become increasingly dependent upon electronics, understanding the Earth's magnetic field is increasingly a matter of survival.

Reading this gave me a serious hankering to read more of Dava Sobel, and it isn't just because Mitchell briefly relates John Harrison's development of the marine chronometer. Like Sobel, Mitchell has the talent for breaking down complicated scientific concepts and putting them into a socio-historical context. I do so love when scientists can cross the line into writing popular science books, but even when they do, their closeness to the topic colours the way they explain it. Science communicators have such an important niche in our society: they understand the science enough to represent it truthfully, but because they haven't devoted a lifetime to researching it actively, they have enough distance to interpret rather than explain. Mitchell comfortably covers topics like vectors, electron valences, and wave-particle duality, in a way that isn't going to make your head spin like the very electrons she's talking about.

One important feature of *The Spinning Magnet*: it doggedly rejects the Great Man approach to telling stories about scientific discovery. Oh, it spotlights certain individuals in order to point out their contributions. Bernard Brunhes figures prominently, given that he is the originator of the idea of geomagnetic reversals. Some of the more usual suspects—Galvani, Volta, Franklin, Faraday—show up as well. Yet at every step of the way, Mitchell reminds us that **science is ultimately, and has always been, a collaborative effort**. This was true in the past, when each person stood on the shoulders of the giants who came before. It is true now,

when scientists meet regularly in conferences to discuss all the things they have discovered that make their pet theories untrue. Although I feel like I could have done without a lot of the modern-day descriptions of where and how Mitchell met with the various people she interviewed that begin most of the chapters, I will give her credit for showing us how most contemporary scientists operate within this very interconnected community.

It was also delightful to spend some more time thinking about geology and geophysics. Much like Simon Winchester's *The Map That Changed the World*, *The Spinning Magnet* is a potent reminder of how much we can learn about the history of our planet and our universe just by examining the rocks beneath our feet. There are so many *stories* these stones can tell us; I am constantly surprised and stunned by how much scientists can uncover by devising new and intricate ways to interrogate and interview these otherwise silent artifacts. I've always stereotypically seen myself as a "space" person; I like outer space and the impersonality of physics involving inhospitable regions of the cosmos. So it's nice to have a reminder that our own planet has secrets of the universe to unlock as well, and that we have a lot to learn from it.

In the final chapters of the book, Mitchell turns to that sensationalist question implicit in the title: could a geomagnetic reversal be in the cards for our lifetimes, and if so, does that mean The End? Fortunately, she doesn't buy into the hype. She pursues the question with the proper amount of skepticism. She points out the real dangers, such as the damage done by more intense solar storms back in the 1990s and early 2000s. She mentions the need for us to be prepared, to consider how better to shield our technology, to take this seriously—which, indeed, it seems like many countries are. Yet she is careful not to hype up the alarmist angle.

Even though this book, really, just confirms my long-stated belief that the Sun has it out for us all!

Goodreads tells me the hardcover version of this book clocks in at 300 pages. It's always hard to tell in ebook form (this is the first book I read, by the way, on my brand new Kindle Paperwhite, huzzah for eInk!), but *The Spinning Magnet* felt very long to me. Maybe it's simply because it has so many—thirty!—chapters, even if the chapters themselves aren't as long. Mitchell certainly tries to be comprehensive. Yet I almost found myself wishing for ... I don't know ... something more, some kind of story or theme to tie together everything that she shows us, beyond her quest to learn more about the obscure Brunhes or, of course, this spectre of geomagnetic reversal.

This is a satisfying read and one I'd happily recommend to anyone interested in the topic. It's edifying without being confusing or patronizing, and there is so much to learn in here. Sometimes it goes off on a tangent or I got a little bored (and that isn't necessarily Mitchell's fault). Overall, though, *The Spinning Magnet* is a great example of what I like to see in my popular stories of science, history, and how they come together.

Geoff Graham says

This is an well written book on an interesting and intriguing subject. However, to make a full book the author has padded it with her personal experiences and irrelevant material. For example, she tells us about Alexander Volta and the discovery of the voltaic pile which has only a tenuous connection to the subject.

In summary this book is a good read if somewhat tedious at times.
