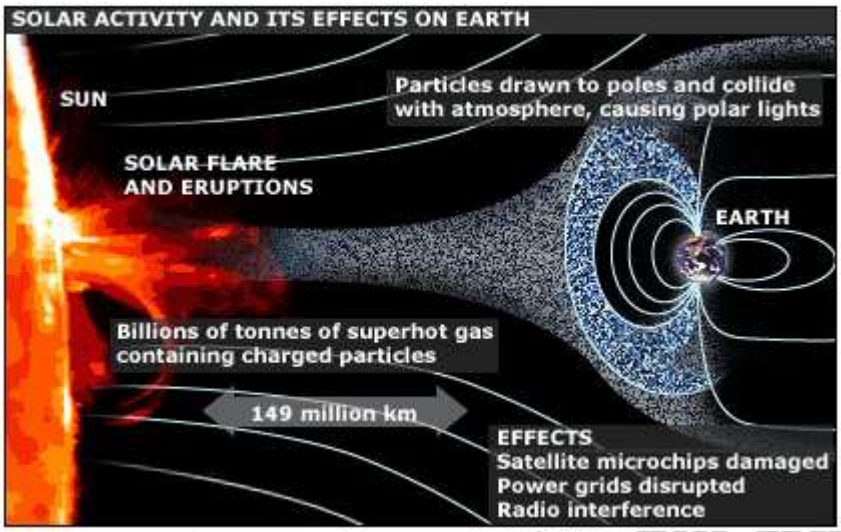
CME? EMP? Faraday Cage? – Oh My!

Version 2 includes Electromagnetic Spectrum Frequency & Radiation Charts

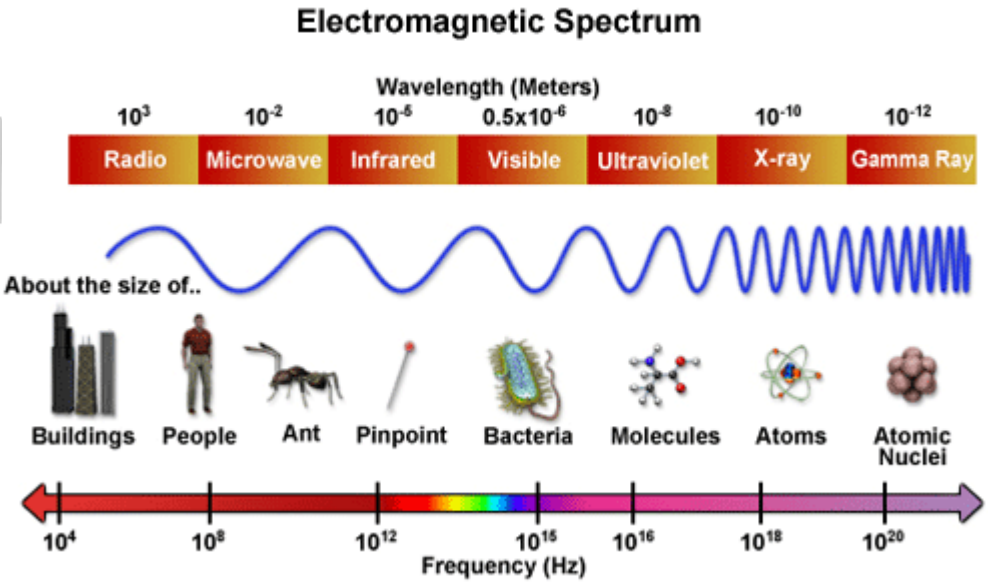
Holy cow! What does all this mean?

Well let's start with some explanations and definitions …

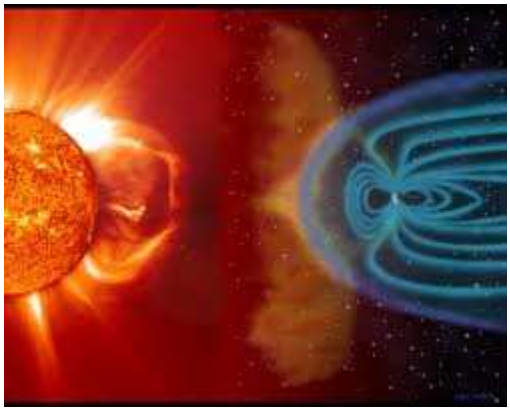
Solar Flares, Storms and CME or Coronal Mass Ejection:



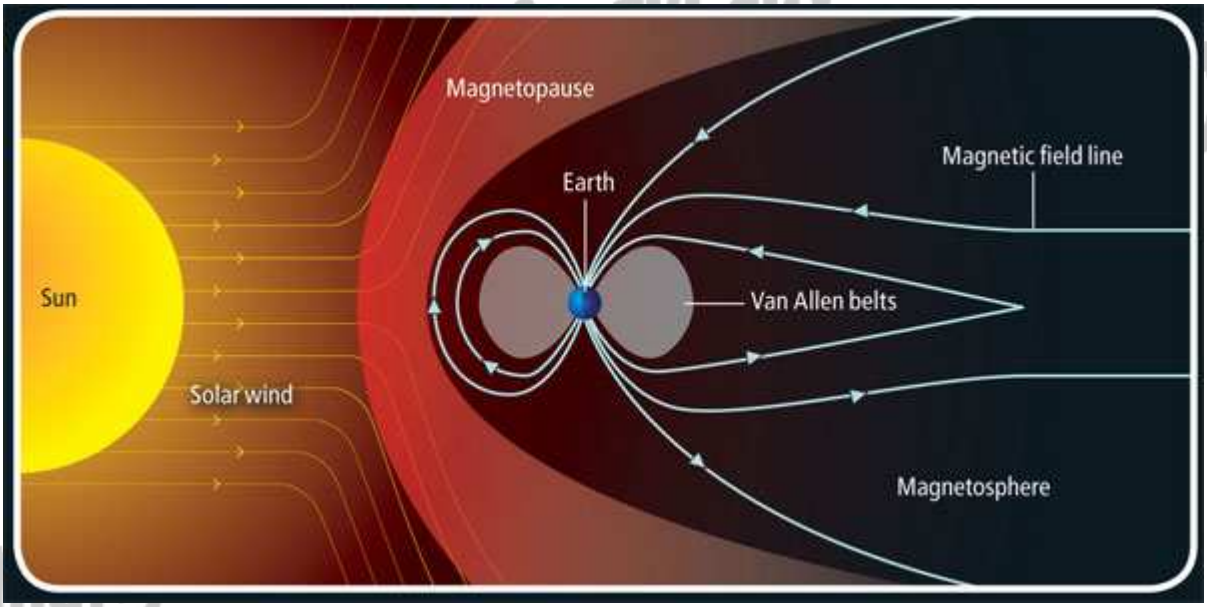
A **solar flare** isn't just an explosion of hot gases. It pushes out waves of light all across the spectrum. That includes light we can't see -- including radiation in the form of X-rays and gamma rays. These rays can be dangerous to humans. Fortunately, the Earth's atmosphere absorbs most of these high-energy rays.



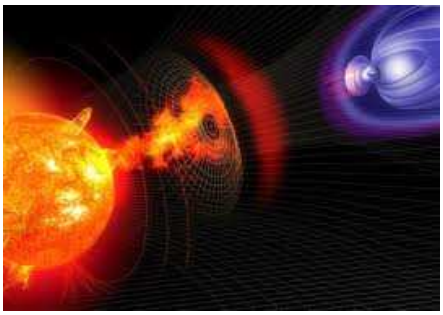
That's not to say everyone is in the clear after a solar flare. Humans in space or at high altitudes -- on board an airplane, for example -- could risk exposure to intense radiation. Short-term damage could include skin irritation. Long-term consequences might include an increased risk of developing skin cancer. But it's likely that any affected human would eventually recover from the exposure.



Electronics are also vulnerable to these rays. If high-energy rays were to hit a satellite, they could strip electrons from the metal components, ionizing them. As electrons break free, they could short out the electronics within a satellite. They could also create a magnetic field that would damage the satellite's systems. Some satellites have shielding to protect them from these rays, but many are still vulnerable.



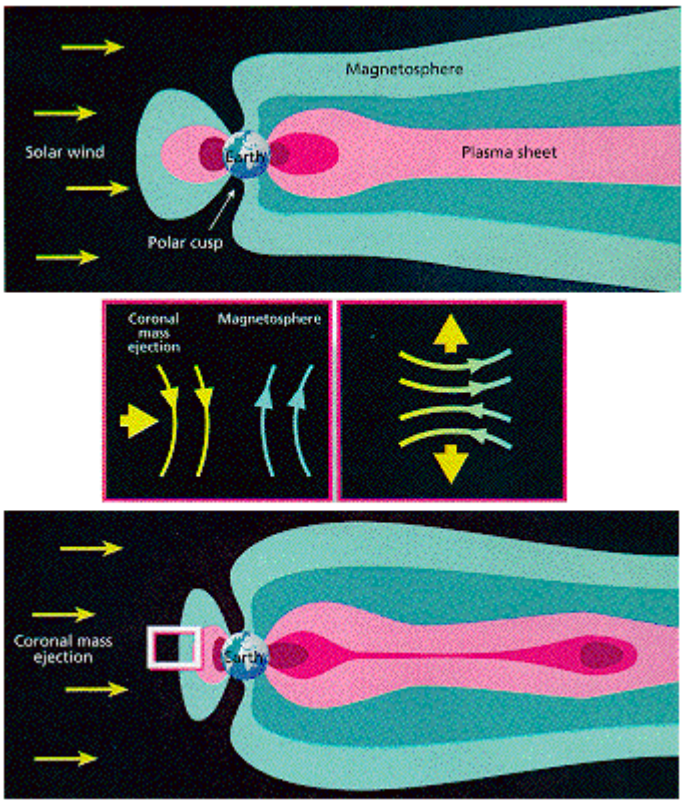
Because our atmosphere absorbs most of these dangerous rays, terrestrial systems are fairly safe from **solar flares**. But another solar event called a **coronal mass ejection (CME)** can cause serious problems for electrical systems here on Earth.



A coronal mass ejection (CME) is a massive burst of solar wind and magnetic fields rising above the solar corona or being released into space.

During a CME, the fluctuations of the sun's magnetic fields cause a large portion of the surface of the sun to expand rapidly, ejecting billions of tons of particles out into space. Sometimes CMEs accompany solar flares -- but not all solar flares produce CMEs and not all CMEs accompany solar flares.

> Most ejections originate from active regions on Sun's surface, such as groupings of sunspots associated with frequent flares. Near solar maxima the Sun produces about three CMEs every day, whereas near solar minima there is about one CME every five days.



Sun Flare on 6 June 2000 (3 Sivan 5760) According to Space Science News, from tony5m17h.net

Unlike a solar flare, a CME doesn't produce intense light. But it does produce a *magnetic shockwave* that extends billions of miles out into space. *IF Earth is in the path of that shockwave, our planet's magnetic field WILL react to the event*.

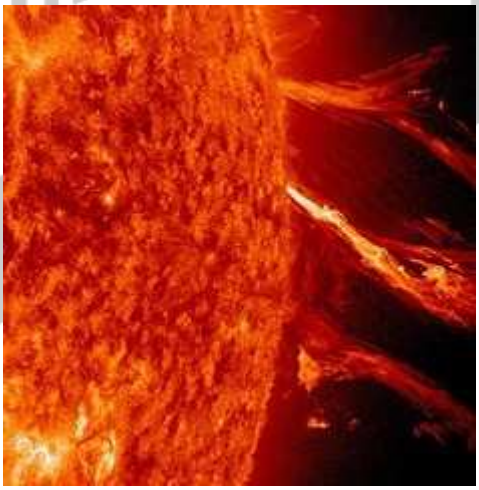
> It's similar to what happens if you put a weak magnet next to a strong one. The weak magnet's field will align itself to the strong magnet's field. A magnetic shockwave from the sun could cause the alignment of the Earth's magnetic field to shift unpredictably.
>
> **Natural Light Show:** The northern and southern lights are observable examples of how a CME can affect the Earth. The colorful lights result from subatomic particles moving at incredible speed, which causes gases like oxygen and nitrogen to ionize. As the atoms in the gases recombine with electrons they emit light. This mainly happens where the Earth's magnetic field lines converge at the planet's magnetic poles.

While a solar flare alone might not be enough to cause problems on Earth's surface, a powerful CME is another story. **In fact, massive CMEs have affected the Earth in the past.** But we weren't as advanced in electronics and electricity, nor did we depend upon them as heavily the last time a CME

really smacked us around. *The magnetic forces of a powerful CME would induce electricity in any large conductor and or conductive material.* That includes power transformers and the power grid itself.

Pretty lights aren't the only consequence from a CME. The magnetic fluctuations can cause compasses to fail. And since magnetic fields can induce electricity, any conductor could become an inductor. A powerful CME could induce electricity in large, powerful conductors and its massive frequencies and wave lengths could overload electrical systems and cause massive damage.

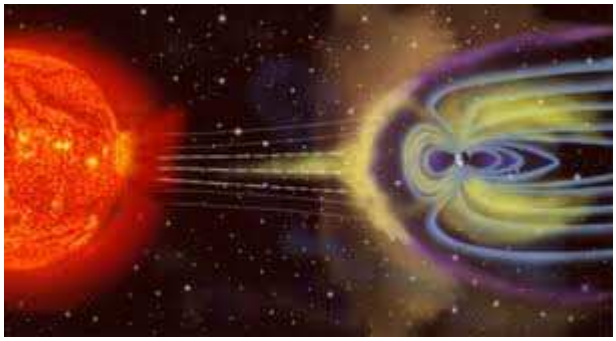
That's not the end of the bad news. The power grid in North America operates at near capacity. *It wouldn't be able to handle the increased electrical load from a solar super storm.* Power lines could sag and even snap as a result, especially in the older components of the grid. Massive power outages could affect much of the continent. The magnetic fluctuations would interfere with radio signals and communication and satellite systems would collapse as well.



It could take weeks or months to repair the damage. During that time, people would have no way to find out what was going on. Emergency services would face serious challenges. While the magnetic fields would probably not short out individual electronics devices like cell phones or computers as severally, communications systems could fail regionally. In other words, some small devices may still work but would lack the services they require to be useful.

It's possible that a CME could even affect your computer and cause glitches or short out circuits. In most cases, a simple reboot would solve the problem. But with the loss of the power grid, you'd be limited by your battery's charge. Once that ran out, you'd be stuck.

Even in these worst-case scenarios, the super storms don't wipe out *all* electrical systems across the planet. Some regions would remain relatively unaffected. *It would require a solar event of the 1859 type or greater magnitude, to wipe out the electrical systems across the entire planet*. But even a modest CME could demonstrate how vulnerable we are to the sun's magnetic temper tantrums.



There have been several large Solar Flare/CME events in recorded history:

The **solar storm of 1859**, also known as the **1859 Solar Super storm**, or the **Carrington Event**, was a powerful solar storm in 1859 during solar cycle 10. It produced the largest known solar flare, which was observed and recorded by Richard C. Carrington.

From August 28, 1859, until September 2, numerous sunspots and solar flares were observed on the sun. Just before noon on September 1, the British astronomer Richard Carrington observed the largest flare, which caused a major coronal mass ejection (CME) to travel directly toward Earth, taking 17 hours. Such a journey normally takes three to four days. This second CME moved so quickly because the first one had cleared the way of the ambient solar wind plasma.

On September 1, 1859, Carrington and Richard Hodgson, another English amateur astronomer, independently made the first observations of a solar flare. Because of a simultaneous "crochet" observed in the Kew Observatory magnetometer record by Balfour Stewart and a geomagnetic storm observed the following day, Carrington suspected a solar-terrestrial connection. Worldwide reports on the effects of the geomagnetic storm of 1859 were compiled and published by Elias Loomis which support the observations of Carrington and Balfour Stewart.

On September 1–2, 1859, the largest recorded geomagnetic storm occurred. Aurora were seen around the world, even over the Caribbean; those over the Rocky Mountains were so bright that their glow awoke gold miners, who began preparing breakfast because they thought it was morning. People who happened to be awake in the northeastern US could read a newspaper by the aurora's light.

Telegraph systems all over Europe and North America failed, in some cases shocking telegraph operators. Telegraph pylons threw sparks and telegraph paper spontaneously caught fire. Some telegraph systems continued to send and receive messages despite having been disconnected from their power supplies.

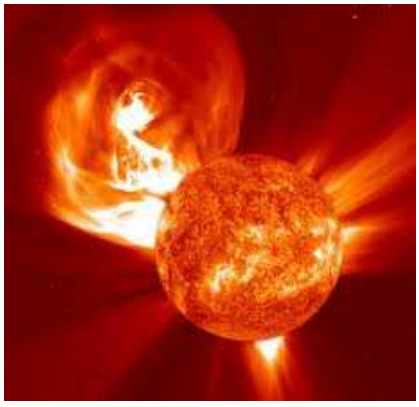
On September 3, 1859, the *Baltimore American and Commercial Advertiser* reported, "*Those who happened to be out late on Thursday night had an opportunity of witnessing another magnificent display of the auroral lights. The phenomenon was very similar to the display on Sunday night, though at times the light was, if possible, more brilliant, and the prismatic hues more varied and gorgeous. The light appeared to cover the whole firmament, apparently like a luminous cloud, through which the stars of the larger magnitude indistinctly shone. The light was greater than that of the moon at its full, but had an indescribable softness and delicacy that seemed to envelop everything upon which it rested. Between 12 and 1 o'clock, when the display was at its full brilliancy, the quiet streets of the city resting under this strange light, presented a beautiful as well as singular appearance*."

The **Aurora of November 17, 1882** was a geomagnetic storm and associated aurora event, widely reported in the media of the time. It occurred during an extended period of strong geomagnetic activity in solar cycle 12. The event is particularly remembered in connection with an unusual phenomenon, named an "auroral beam", which was observed from the Royal Observatory, Greenwich by astronomer Edward Walter Maunder.

> In the London Times, Nov. 20, 1882, the Editor says that he had received a great number of letters upon this phenomenon. He publishes two. One correspondent describes it as "well-defined and shaped like a fish … extraordinary and alarming." The other correspondent writes of it as "a most magnificent luminous mass, shaped somewhat like a torpedo."
>
> Although Fort suggested the event had supernatural overtones, scientific opinion was that the "beam" likely represented an extremely unusual auroral phenomenon. Maunder commented:
> *This "torpedo-shaped" beam of light was quite unlike any other celestial object that I have ever seen. The quality of its light, and its occurrence while a great magnetic storm and a bright aurora were in progress, seem to establish its auroral origin. But it differed very widely in appearance from any other aurora that I have ever seen.*
>
> The association of the November 1882 sunspot, or group of sunspots, with the strong auroral display, the collapse of the telegraph system, and variations in the magnetic readings taken at Greenwich was to prompt Maunder to pursue further research of the link between sunspots and magnetic phenomena.

The **May 1921 geomagnetic storm** was a significant event caused by an increase in solar radiation. It took place on 13 through 15 May. This event occurred before extensive interconnectivity of electrical systems and the general electrical dependency across infrastructures in the developed world, so the effect was restricted to certain sectors, even though resulting ground currents were up to an order of magnitude *greater than those of the March 1989 geomagnetic storm*, which blacked out large parts of north-eastern North America. At the time, scientists gave the size of the sun spot that began on May 10th that caused the storm as 94,000 by 21,000 miles in size.

> Northern lights appeared in much of the eastern United States, creating brightly lit heavens over the eastern United States. Telegraph service in the United States was slowed and then virtually eliminated around midnight of the 14th due to blown fuses, and damaged equipment. On the other hand, radio waves were strengthened during the storm, allowing for some strong intercontinental reception and electric lights do not seem to have been noticeably affected. Undersea cables also suffered from the storm. Damage to telegraph systems were also reported in Europe and the southern hemisphere



The **March 1989 geomagnetic storm** was a severe geomagnetic storm that caused the collapse of Hydro-Québec's electricity transmission system. It occurred during solar cycle 22. The geomagnetic storm causing this event was itself the result of a coronal mass ejection on March 9, 1989.

> A few days before, on March 6, a very large, X15-class, solar flare also occurred. Three and a half days later, at 2:44 am EST on March 13, a severe geomagnetic storm struck Earth. The storm began on Earth with extremely intense auroras at the poles. The aurora could be seen as far south as Texas. As this occurred during the Cold War, many worried that a nuclear first-strike might be in progress. Others considered the intense auroras to be associated with the Space Shuttle mission STS-29, which had been launched on March 13 at 9:57:00 AM. The burst caused short-wave radio interference, including the disruption of radio signals from Radio Free Europe into Russia. It was initially believed that the signals had been jammed by the Soviet government.
>
> As midnight came and went, a river of charged particles and electrons in the ionosphere flowed from west to east, inducing powerful electrical currents in the ground that surged into many natural nooks and crannies.
>
> Some satellites in polar orbits lost control for several hours. GOES weather satellite communications were interrupted causing weather images to be lost. NASA's TDRS-1 communication satellite recorded over 250 anomalies caused by the increased particles flowing into its sensitive electronics. The Space Shuttle Discovery was having its own problems: a sensor on one of the tanks supplying hydrogen to a fuel cell was showing unusually high pressure readings on March 13. The problem went away after the solar storm subsided.
>
> GOES-7 monitors the space weather conditions during the Great Geomagnetic storm of March 1989, the Moscow neutron monitor recorded the passage of a CME as a drop in levels known as a Forbush decrease.
>
> The variations in the earth's magnetic field also tripped circuit breakers on Hydro-Québec's power grid. The utility's very long transmission lines and the fact that most of Quebec sits on a large rock shield prevented current flowing through the earth, finding a less resistant path along the 735 kV power lines.
>
> The James Bay network went offline in less than 90 seconds, giving Quebec its second massive blackout in 11 months. The power failure lasted 9 hours and forced the company to implement various mitigation strategies, including raising the trip level, installing series compensation on ultra high voltage lines and upgrading various monitoring and operational procedures. Other utilities in North America, the UK, Northern Europe and elsewhere implemented programs to reduce the risks associated with geomagnetically induced currents.

April 6, 2000 Solar and Heliospheric Observatory (SOHO) recorded a powerful series of solar eruptions including a full-halo coronal mass ejection (CME)

In August 1989, another storm caused a halt of all trading on Toronto's stock market.
Since 1995, geomagnetic storms and solar flares have been monitored from the Solar and Heliospheric Observatory (SOHO) satellite, a joint project of NASA and the European Space Agency.

The **Bastille Day Flare** or **Bastille Day Event** was a powerful solar flare on July 14, 2000, occurring near the peak of the solar maximum in solar cycle 23. Active region 9077 produced an X5.7-class flare, which caused an S3 radiation storm on Earth fifteen minutes later as energetic protons bombarded the ionosphere.

> It was the biggest solar radiation event since 1989. The proton event was four times more intense than any previously recorded since the launches of SOHO in 1995 and ACE in 1997. The flare was followed by a full-halo coronal mass ejection and a geomagnetic super storm on July 15-16. The extreme level, G5, was peaked in late hours of July 15.
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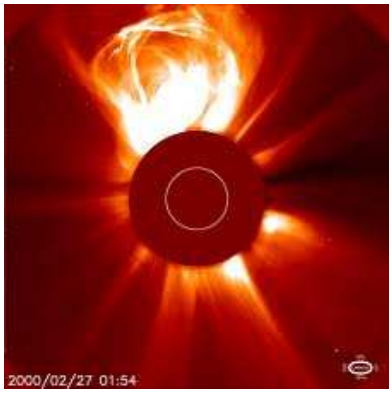
> The Bastille Day event was observed by Voyager I and Voyager II, thus it is the farthest out observed solar storm.



The '2003 Halloween solar storms' were so powerful that auroras were seen as far south as Texas and Florida. The weeks surrounding this 'All Hallow's Eve' mark a haunting milestone – the 5-year anniversary of some the most powerful solar storms ever recorded.

> Called the "Halloween Storms of 2003," these energetic storms began, surprisingly, a full two to three years after solar maximum, when solar activity was on the decline. During this usually "quiet" time, when few sunspots are visible, an outbreak of 17 major flares erupted on the sun.
>
> The flares caused the sun's magnetic field lines to stretch then suddenly snap like a rubber band stretched beyond its limit. The result was coronal mass ejections, enormous explosions on the sun's surface that can blast billions of tons of electrified gas and subatomic particles into space at speeds up to 5 million miles per hour. This 'space weather' can and does affect Earth.
>
> Space weather from these enormous solar storms slammed into Earth's magnetic field from October 19 through November 7. "The effects of these storms were ghoulish enough that [aircraft controllers] had to re-route aircraft, it affected satellite systems and communications, and it also caused a power outage in Sweden for about an hour," said Dr. Holly Gilbert, a solar scientist at NASA's Goddard Space Flight Center in Greenbelt, Md.
>
> During the height of the solar activity, more than half of the deep space and near-Earth space science missions experienced the effects of the Halloween storms of 2003. The Solar and Heliospheric Observatory (SOHO) satellite, a collaboration between NASA and the European Space Agency (ESA), failed temporarily. NASA's Advanced Composition Explorer (ACE) satellite experienced damage, and instruments aboard many spacecraft had to be shut down temporarily.
>
> Another effect of these storms was an increase in the colorful dancing lights seen at Earth's north and south poles, called aurora. "The auroras are normally limited to the higher latitudes, and these storms were so powerful they created aurora that could be seen as far south as Florida," said Gilbert.

Scary solar storms like the Halloween storms of 2003 are the exception, rather than the rule.

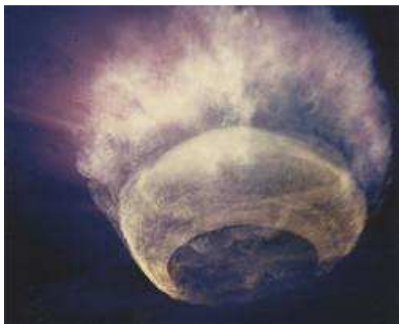
On 1 August 2010, during solar cycle 24, scientists at the Harvard-Smithsonian Center for Astrophysics (CfA) observed a series of four large CMEs emanating from the Earth-facing hemisphere. The initial CME was generated by an eruption on August 1 associated with sunspot 1092, a sunspot which was large enough to be seen without the aid of a solar telescope. The event produced significant aurora on August 4.

On February 14, 2011 the sun erupted with the largest solar flare seen in four years—big enough to interfere with radio communications and GPS signals for airplanes on long-distance flights. As solar storms go, the Valentine's Day flare was actually modest. But the burst of activity is only the start of the upcoming solar maximum, due to peak in the next couple of years.

On 31 August 2012 a CME did connect with Earth's magnetic environment, or magnetosphere, with a glancing blow causing aurora to appear on the night of Monday, September 3. Geomagnetic storming reached the G2 (Kp=6) level.

ElectroMagnetic Pulse or EMP:

This is humankind's way to mimic nature or a CME and of course it is considered a weapon of mass destruction or WMD. An **electromagnetic pulse** (commonly abbreviated **EMP**) is a burst of electromagnetic radiation. The abrupt pulse of electromagnetic radiation usually results from certain types of high-energy explosions, especially a nuclear explosion, or from a suddenly fluctuating magnetic field.



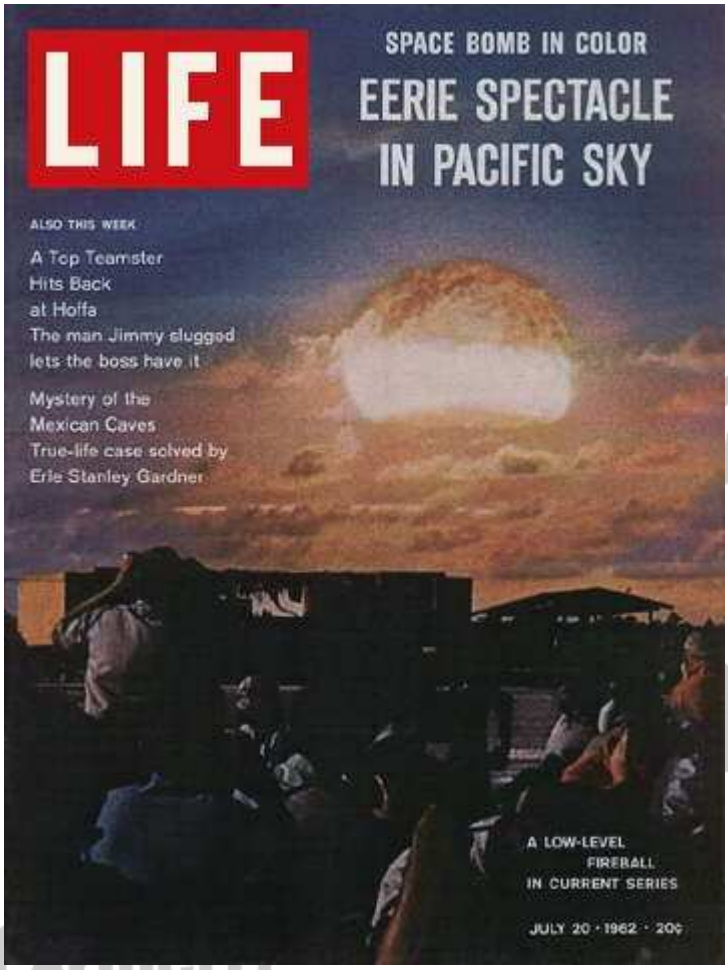
The resulting rapidly changing electric fields and magnetic fields may couple with electrical/electronic systems to produce damaging current and voltage surges.

In military terminology, a nuclear warhead detonated hundreds of kilometers above the Earth's surface is known as a high-altitude electromagnetic pulse (**HEMP**) device.

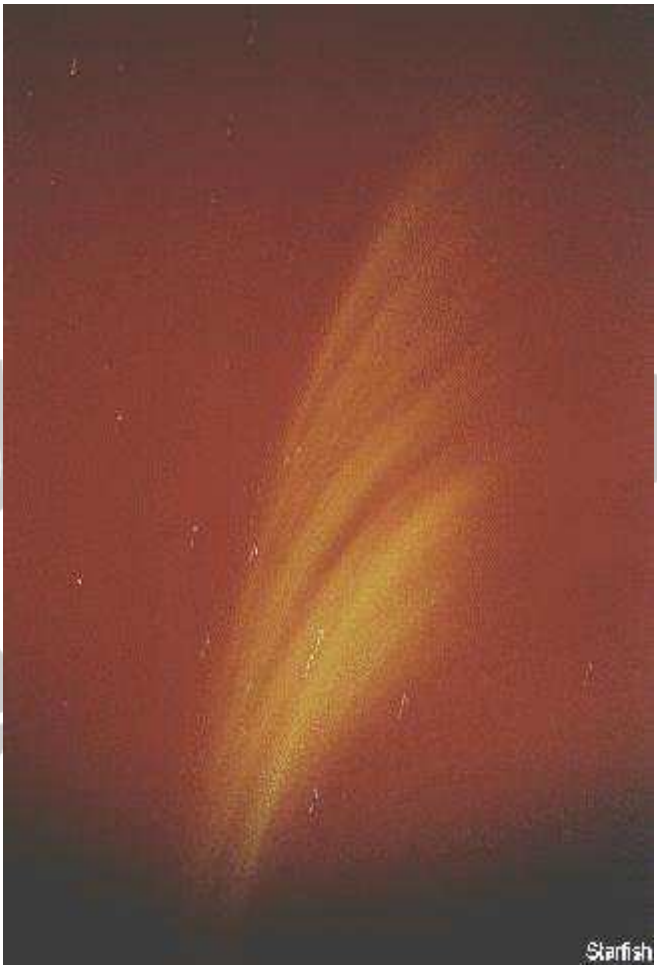
Effects of a HEMP device depend on a very large number of factors, including the altitude of the detonation, energy yield, gamma ray output, interactions with the Earth's magnetic field, and electromagnetic shielding of targets.

Life Magazine Jul 1962 EMP airburst or HEMP

Shot as seen from Johnston, Island

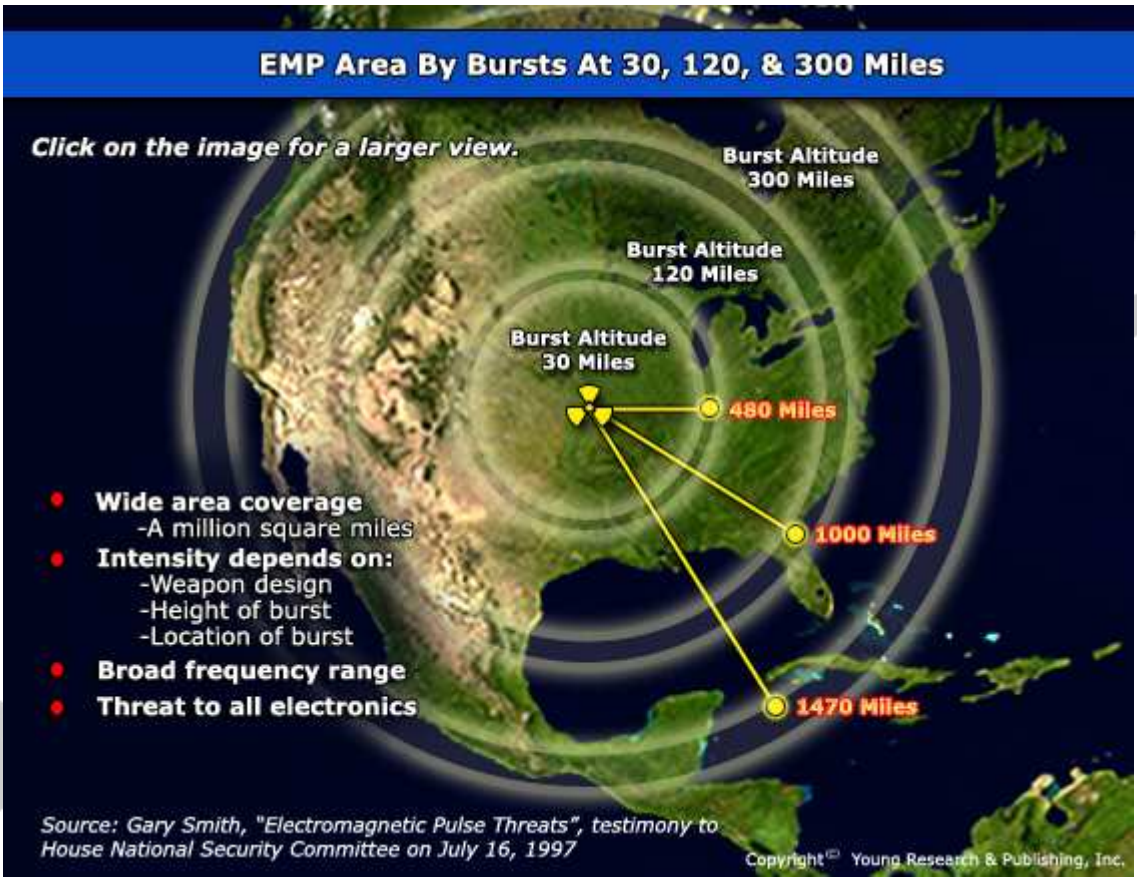


EMP induced Aurora over Hawaii



It is *possible* that either a CME or an EMP can strike and play havoc with our '*Techno Bubble*', this society that we have built around electricity and all of its various digital components. **IF one of these events should happen:**

- ALL non-protected electronics will be affected by an EMP or Carrington sized CME. It doesn't make any difference whether or not your electronics are plugged in, how long of an antenna you've got on something, what voltage it is, or whether or not they operate with batteries.
- Batteries will be affected, usually in the form of "shorting", even in the package on the store shelf.
- Electronic phone systems will also be damaged - landline, cell, cordless or satellite
- Surge protectors are useless in the event of an EMP or Carrington CME type exposure.
- Computers *anywhere*, including motherboards in a warehouse or the little chip in your vehicle will be damaged.
- Anything that conducts electricity will, even if it is just a nail.
- Gamma radiation is common and expected with these events and we humans don't deal with it well.
- Electrical shorts are known to cause fires, with no phone service, these fires can become major firestorms – urban, suburban or rural.



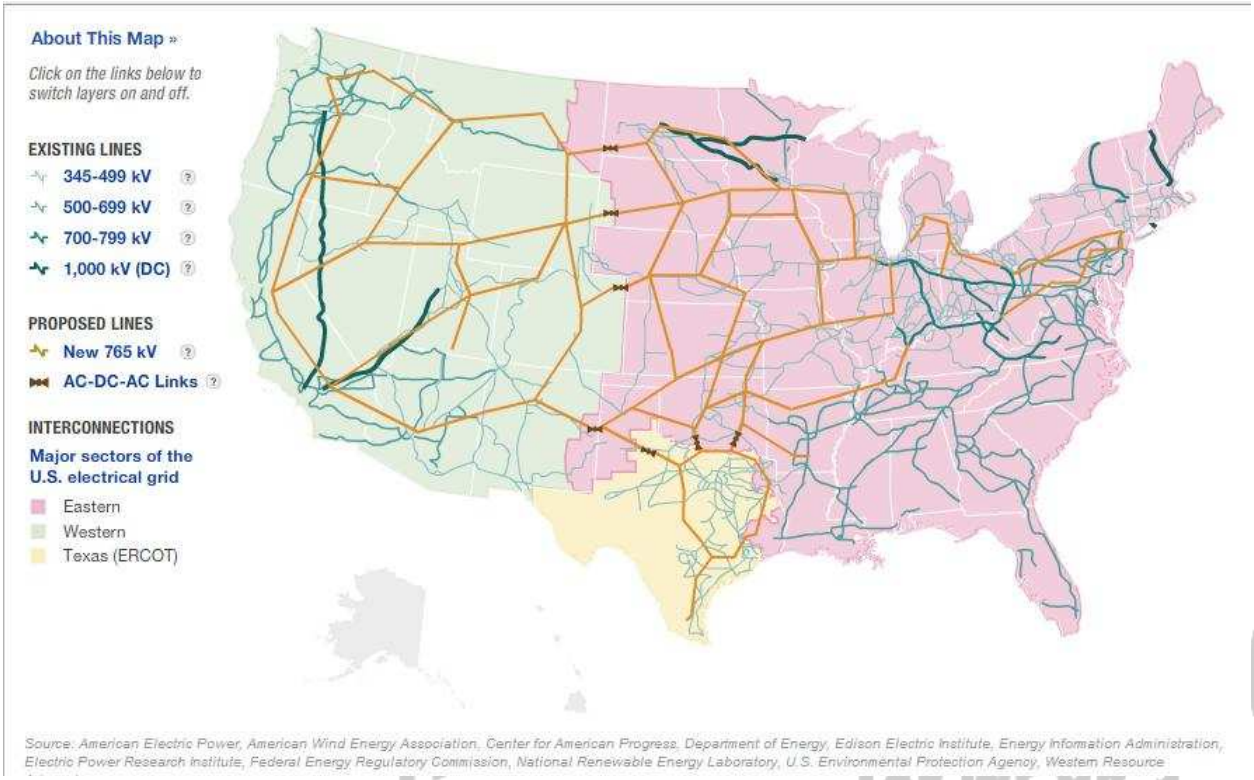
Thankfully a CME of the magnitude of the Carrington Event in 1859 (aimed at the Earth) only happens about once every 500 years, according to historical records in glacial ice cores.

> Ice cores contain thin nitrate-rich layers that can be analyzed to reconstruct a history of past events before reliable observations; the data from Greenland ice cores was gathered by Kenneth G. McCracken and others. These show evidence that events measured by high-energy proton radiation, not geomagnetic effect—occur approximately once per 500 years, with events at least one-fifth as large occurring several times per century. Less severe storms have occurred in 1921 and 1960, when widespread radio disruption was reported.

HEMP over NE USA

Not so thankfully, we humans are very unpredictable. All it takes to trigger an EMP attack is for one wacko, one unbalanced or arrogant government, to get a hold of the technology and have the stupidity to actually send and detonate one of these things somewhere.

The "experts" say the chance of an electromagnetic event (human or natural) **is slim.** Yet governments, utilities and IT technology corporations, as well as, industry heavily laced with technology to produce their product or service, seem to believe the chance of such an event is high enough to create and implement '*protection*' tools and protocols for at least parts of our '*techno bubble*'. If these entities haven't actually implemented these tools yet, they are least in the project planning phase.



The US Electric Grid by npr.org

The Worlds Electric Grid Reality Check

Don't get fooled by all the political mumbo-jumbo on how a '*Smart Grid*' will '*protect*' against an EMP or CME or 'fix' any existing grid problems.

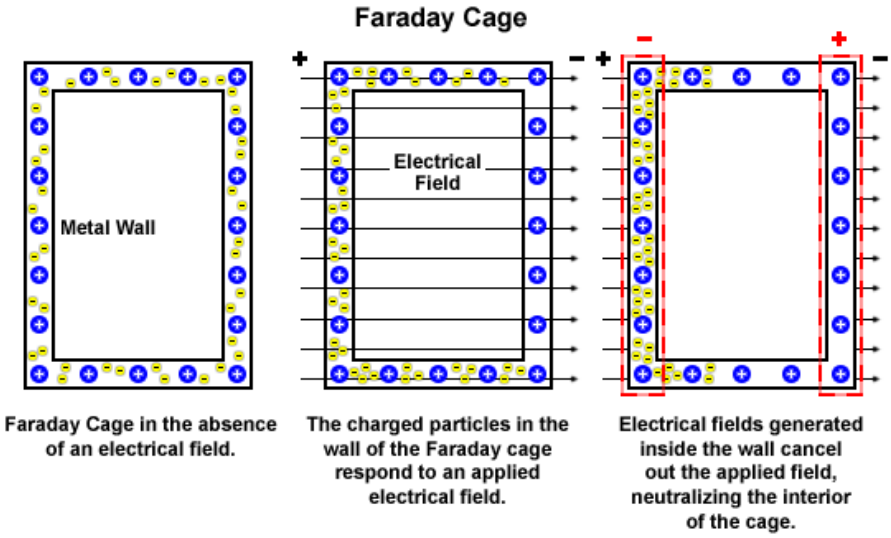
- Remember the Electric Grid is basically **a string of physical components** like transmission lines, poles, transformers, conductors and the like.
- A 'smart grid' is merely a **specialized computer program** that can process and react faster than us humans; however *it CANNOT fix or prevent any physical hardware problem*.
- A CME or EMP will cause such a surge in electromagnetic and ferromagnetic energy on the Earth that it creates a 'short' in the grid, enough to fry transformers, etc., *and* ***the grid will go down from hardware failure.***

What is this protection? A Faraday (Farady) Cage or Electromagnetic Shield

Michael Farady oil, by Thomas Phillips

In 1836, English scientist *Michael Faraday* conducted an experiment on electrostatic charges that resulted in the creation of the container that bears his name. He was not the first to experiment with this concept; his work was based on research performed by Benjamin Franklin nearly one hundred years earlier, in 1755.

A Faraday cage is an *enclosure* made of conductive material that blocks both static and non-static electrical fields and is grounded. The first such 'cage' was made of a fine ferromagnetic metal mesh or screen. This can protect devices from a weapons EMP strike, a solar CME event, or a lightning strike. The key here is *enclosure*, meaning all 6 sides of the 'box' or 'cage'.



Everyday Applications of the Faraday Shield Principle

- **Safety against lightening**: The cage protects the interior of the vehicle from the strong electric fields. Metal Cars and aircraft act as a type of Faraday shields to protect people when the vehicle is struck by lightning, *however it will NOT protect against the much higher electromagnetic frequencies of a CME or EMP.*
- **Protection for electronic goods**: Electronic equipment can be shielded and protected from *stray* electromagnetic fields (much smaller surges) by using coaxial cables that contain a conducting shell that acts as a Faraday shield. *This will NOT protect against a lightning strike, EMP or CME.*
- **Protective suits for linemen**: linemen often wear protective suits that act as Faraday shields while working with high voltage power lines. These suits protect them from getting electrocuted. *This will NOT protect someone from radiation or the much higher electromagnetic frequencies of an EMP or CME.*
- **MRI** (Magnetic resonance imaging) scan rooms are good examples of a Faraday Shield principle. External radio frequency signals are prevented from interfering with the data coming from the patient. *Most* of these machines are also in a room that prevents the various radio signals from

entering or leaving the room. The same can be said for X-ray rooms. No one has actually tested these rooms against the much higher electromagnetic frequencies associated with a CME or EMP.

- **Microwave**: the microwaves inside the oven are trapped and used for cooking. The metal shell of the microwave acts as a Faraday cage. The fine metal screen in the microwave's window completes the 360 degree surround.

Note: I question the lightening strike part as in the late 70's I saw an IBM System 68 mainframe that was struck by lightning thru a glass window and the metal outer shell of the mainframe CPU. It was a fried mess inside after the strike.

Basic Material for Conductors and Insulators

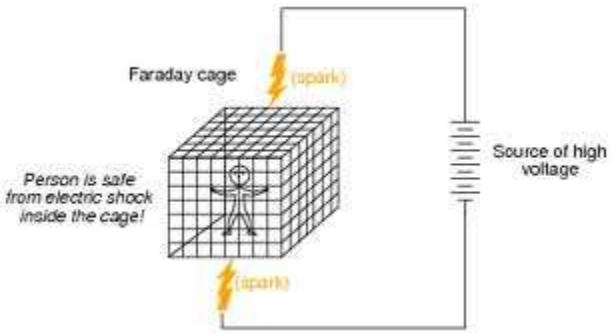
Conductors:	**Insulators:**
• silver	• glass
• copper	• rubber
• gold	• oil
• aluminum	• asphalt
• iron	• fiberglass
• steel	• porcelain
• brass	• ceramic
• bronze	• quartz
• mercury	• (dry) cotton
• graphite	• (dry) paper
• dirty water	• (dry) wood
• concrete	• plastic
	• air
	• diamond
	• pure water

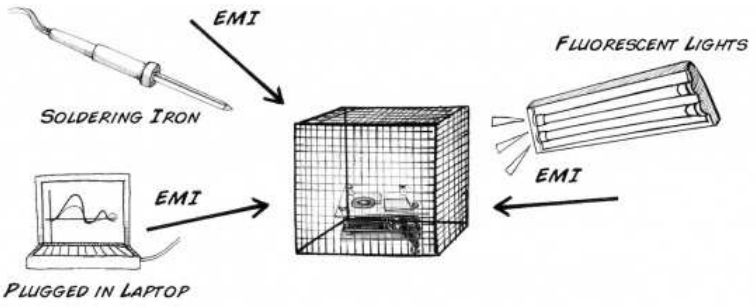
It must be understood that not all conductive materials have the same level of conductivity and not all insulators are equally resistant to electron motion. Electrical conductivity is analogous to the transparency of certain materials to light: materials that easily "conduct" light are called "transparent," while those that don't are called "opaque." However, not all transparent materials are equally conductive to light. Window glass is better than most plastics, and certainly better than "clear" fiberglass. So it is with electrical conductors, some being better than others.

For instance, silver is the best conductor in the "conductors" list, offering easier passage for electrons than any other material cited. Dirty water and concrete are also listed as conductors, but these materials are substantially less conductive than any metal.

It should also be understood that some materials experience changes in their electrical properties under different conditions. Glass, for instance, is a very good insulator at room temperature, but becomes a conductor when heated to a very high temperature.

- Gases such as air, normally insulating materials, also become conductive if heated to very high temperatures.
- Most metals become poorer conductors when heated, and better conductors when cooled.
- Many conductive materials become perfectly conductive (this is called *superconductivity*) at extremely low temperatures.





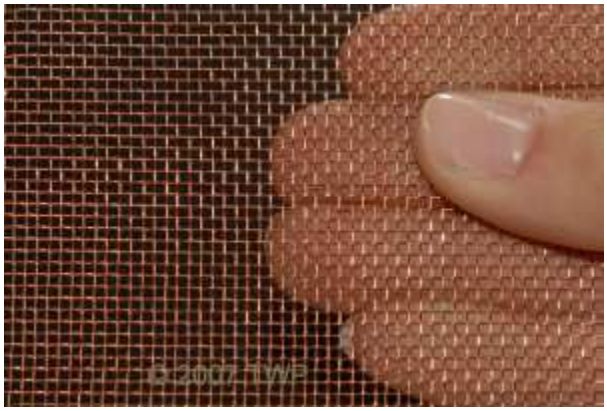
As you can see the **Faraday Shield Principle** has many applications in our modern world. However note that these applications ***may or may not protect*** a device or person from the *extraordinary ranges* of electromagnetic energy generated by a CME or EMP.

Faraday Shield Material:

A Faraday cage that uses only mesh or sheet metal can only shield against a magnetic frequency up to the RF range. Electronics nowadays are useful in the SHF, UHF and VHF range (such as your television). To efficiently protect your electronics from an EMP that is higher than an RF range (which most are), you need some steel, iron or thick copper.

Aluminum can work, however, remember that just as aluminum wire generated house fires when overloaded, so to can any Faraday Cage made of aluminum.

So of the top 6 conductive materials (stick to the good and cheap ones) **are:** copper, aluminum, iron, steel, brass or bronze.



Some Key Points:

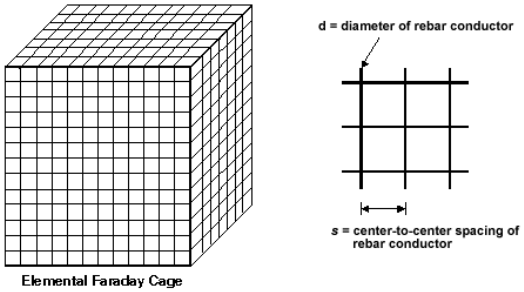
- Just because your car has rubber tires, it will NOT be impervious to the effects of an EMP of CME. A car is NOT a Faraday cage sufficient to withstand an EMP incident. It has some similar components, yes. Most cars made today consist of fiberglass and disjointed parts, not a **continuous** metal material. In addition to that, they are on tires. Tires on a car do NOT serve as grounding. IF you had an old fashioned car that was made of metal, that had its tires removed, that was also attached to an Iron or copper pole and that was ALSO on dirt—not gravel—then yes, you may have a car that doubles as a Faraday cage.
- Rubber containers are insufficient protection against an EMP or CME.
- Faraday cages DO need to be grounded. If it's NOT grounded, then the Faraday cage merely becomes a reflector or an amplifier.
- Faraday cages do NOT have to be solid, but they do have to be constructed continuously without gaps between the protective material. Thus the name "cage" instead of the oft misused term—"box." In fact, many of them that you can build yourself or will see on the internet will resemble a bird cage or a very *finely meshed* chicken coop wire.
- Contrary to what you may see on the internet, a sheet of foil on a box will not protect you. It's not thick enough to withstand the pulse. However, you CAN protect your foil insulated items if they are buried a couple of feet underground in every direction (up, down and sideways).
- Unless the material is also *ferromagnetic*, that magnetic fields are NOT blocked. Low-frequency radio waves are primarily magnetic waves (although with an electric field component), and may penetrate a Faraday cage because the varying magnetic field induces an electric field on the other side. Ferromagnetic materials are those substances, which when placed in magnetic field are strongly magnetized the direction of the magnetizing field.e.g.: - Nickel, Iron, cobalt, rare earth metals.
- *The cages must be grounded, continuously connecting, and the openings of them cannot be too large.* Chicken coop wire would work, but only if you double or even triple layered it as the opening are too large. For a reference of opening size, look at the front of your microwave door. It's a small mesh. Just a like a snake can slither its way through the right sized hole, so can an electronic wave.

A Faraday cage is NOT fool proof. The higher the frequency of the magnetic pulse, the faster and stronger it is. This is what causes the burn out.

What should you store in your Faraday cage?

Anything that you don't want to live without post-EMP and anything that you can charge in an alternate manner is a good candidate for residence within the container. Some items that you might want to prioritize for a place inside the cage are:

- Radios (shortwave, HAM or windup AM/FM/NWS)
- Walkie talkies that run on rechargeable batteries
- Thumb drives, USB drives, diskettes, cassettes and any magnetic 'tape' or 'disk' recording
- Digital camera and photo disks
- Batteries
- Flashlights
- Older Laptop and charger (for those important digital documents, etc)
- DVD player
- Extra hard drives
- USB drives
- Solar device chargers
- Invertors and charge controllers for solar power system
- Small pieces of medical equipment
- iPods
- A small generator



Why protect items that must be plugged in if the entire electrical grid is down?

- If the grid does come back up at some point, a person with devices that have been protected will be in the vast minority of people to possess a working unit. If the device has been unprotected, even with the return of electrical power at the flick of a switch, the item cannot be repaired and used in the future.
- If you have planned other sources of power (such as solar or wind power) then the items that you have protected can be used with those power sources. If this is the case, also be certain to protect the proper inverters or solar chargers to be used with the stored devices.
- If you have a ton of digital How-to documents that you didn't get a chance to hardcopy, then even though the internet is down you and still access and read those documents.
- If you have children that may seem lost without a TV or video game and you have alternative energy generation items that were protected along with the playing device, you can give 'entertainment' treats with your still working devices.

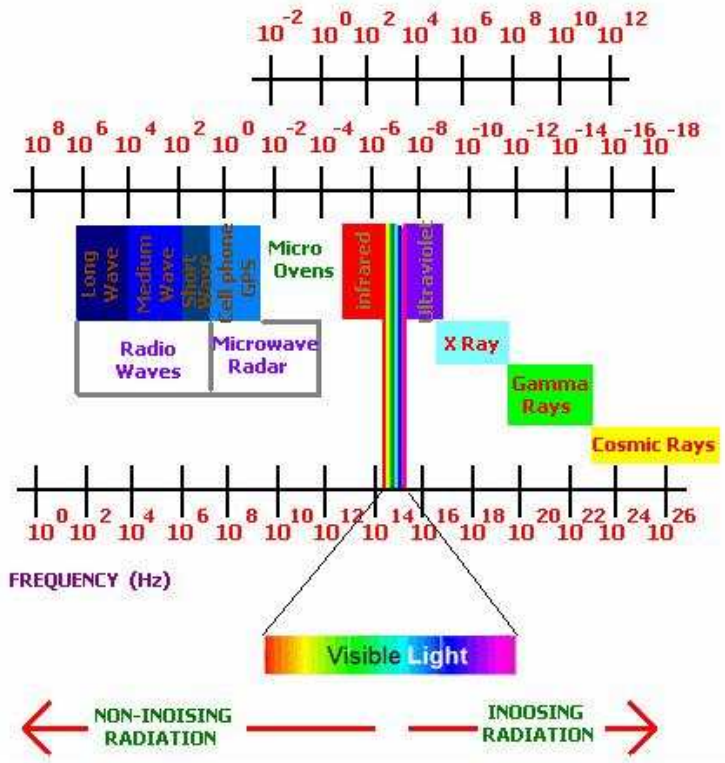
As Kellene Bishop of www.PreparednessPro says; "*Be selective in what you protect. It makes no sense to protect a cell phone, for example, as the cell towers will be useless. If it were me, I would protect radios, communication devices (such as a HAM radio), batteries and all of their respective tools, thumb drives loaded with all of my vital information, and a laptop. Keep in mind that a Faraday cage should be your LAST concern in terms of protecting every electronic that you enjoy presently. It's not like if you preserve your television you're going to have any "juice" to plug it into.*"

For a simple video on the **science of the workings of a Faraday cage**, check out this YouTube link http://youtu.be/t23iXhEiQUc. The science professor is EXCELLENT. Note though that he does say that a car is a Faraday cage, however, I want to reiterate that it is NOT sufficient to extinguish the effects of an EMP attack.

The PDF "**The Faraday Cage-What Is It? How Does It Work? An Introduction @** http://www.gamry.com/assets/Application-Notes/Faraday-Cage.pdf is a great little document.

For a good video on a **Faraday Cage experiment** (like the ones that *Mythbusters* on the Discovery Channel successfully did) can be found @ http://youtu.be/Z51WVaNdEvw (Need I say - DO NOT TRY THIS AT HOME?).

Two great articles on **How Faraday Cages Work** can be found @ http://science.howstuffworks.com/faraday-cage.htm and http://www.physics.gla.ac.uk/~kskeldon/PubSci/exhibits/E3/



Note: Faraday Shield or Cage protection is NOT protection from the possible radiation (gamma rays) **from CME's or EMP's; rather this protection is from the electromagnetic effects of these things on our technology. Hence, *you will still need some kind of radiation protection for you and yours.***


Creating a Faraday Cage

As just about always, there are tons of 'Faraday Cages' you can purchase, from cheap to expensive, including a suit jacket that blocks your Wi-Fi and cell iPhone transmissions. However, I prefer to **Keep It Simple and Cheap!**

Take advantage of some things you may already have in or around the house:

- An aluminum or galvanized garbage can with a lid
- A metal filing cabinet
- A metal tool box
- A microwave oven – unplug it before protecting anything in it
- A metal oven – be sure to disconnect any electrical plugs or trip the circuit breaker before storing anything in it.
- A clothes dryer (washers are not 'sealed' enough)
- Tin canisters (holiday popcorn cans) or ammo cans
- Metal lunch pail
- Metal locker, footlocker or steamer trunk
- Metal suitcase or briefcase
- Altoid tin for those smaller items
- Any safe large enough to hold your item
- Large stock pot (Be sure to clamp the lid down. Remember—continuous connection is key. (Since Faraday cages are not fool proof, depending on the strength of the pulse, I would recommend burying such containers 2 feet under the ground, storing survival electrical and battery items; Including the batteries).

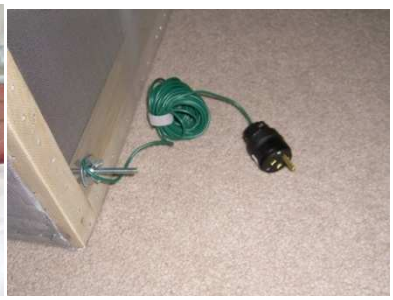
Tip: To secure a lid on a metal trash can or the like, purchase a roll or two of the metallic tape used to seal seams in heating/cooling duct work. Use this to seal the lids and cover hinges.

A common steel garden shed, grounded using 1/4" ground wire: The insulated ground wire does not touch the base/floor of the shed so things inside are safe.

Basically a Faraday Shield can be any conductive metal 'container' that has 360 coverage or encompasses all 6 sides of the enclosure, is substantial enough to take the projected electromagnetic energy and is large enough to hold your insulated electronic device in it.

Tip: If you think your Faraday shield may still be too weak, wrap it in heavy duty aluminum foil and burry the cage where it is surrounded by about two feet of good old dirt.

Important Things to remember besides having a conductive metal container:



- ***It is vital that none of your electronics directly contact the metal of the container.*** Insulate items by lining the container in a non-conductive material, like cardboard, foam, Styrofoam or wrapped in several layers of newspaper. You can also make cardboard sleeves for your devices.
- ***Technically any make-shift or purchased Faraday cages should be grounded in order to disperse the energy.*** The easiest way to do this is to have a wire lead from the metal skin of the

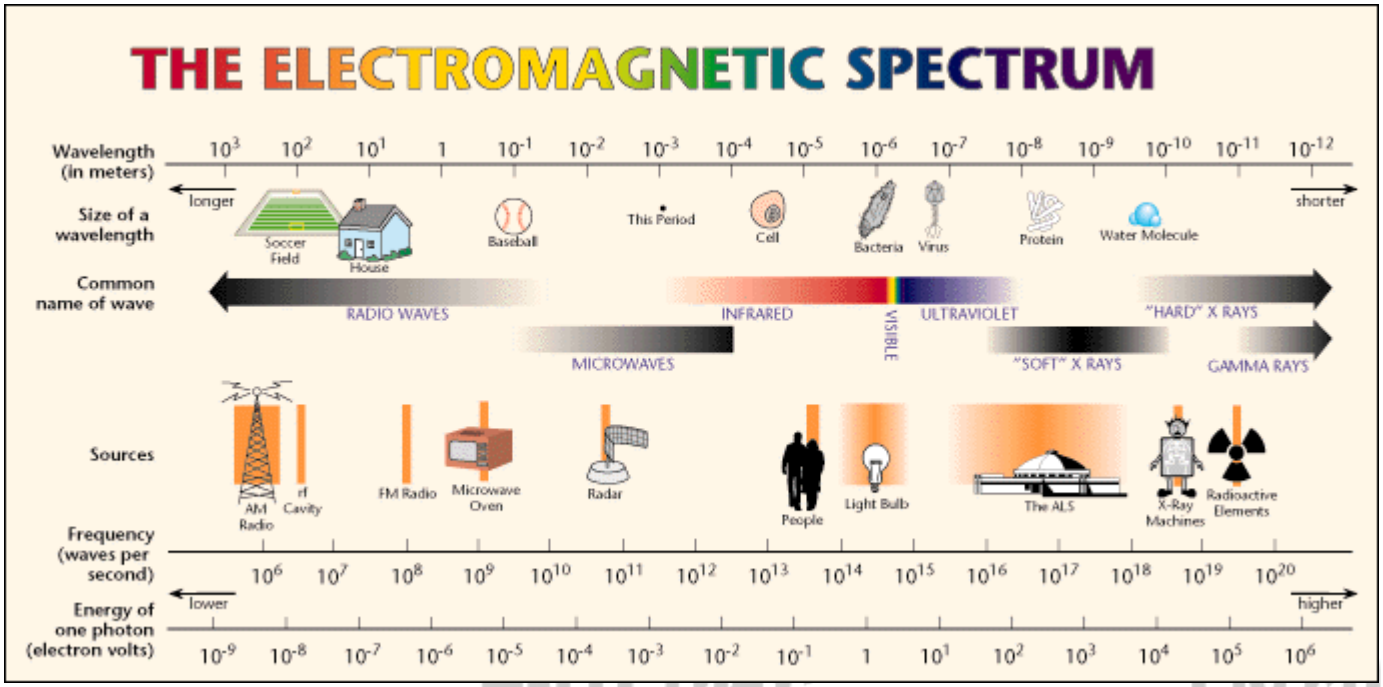
'cage' to the ground (good ol dirt) or the wire can go from the metal skin of the cage to a conductive metal pole that is stuck in the ground (like the old fashioned lightening rods).

So having say, a laptop, in a Faraday cage but still plugged into a power outlet or cable connected network will NOT work. Nor will sticking your emergency radio in your microwave, but not unplugging the microwave work.

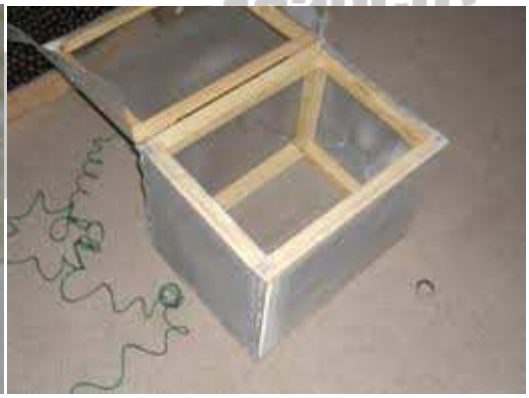
Remember these devices do not need to be in the 'cages' for long. To protect a device from the effects of a natural CME would be a few hours at most; for a human created EMP, a matter of a few minutes.

So how does one go about making one of these 'shields'?

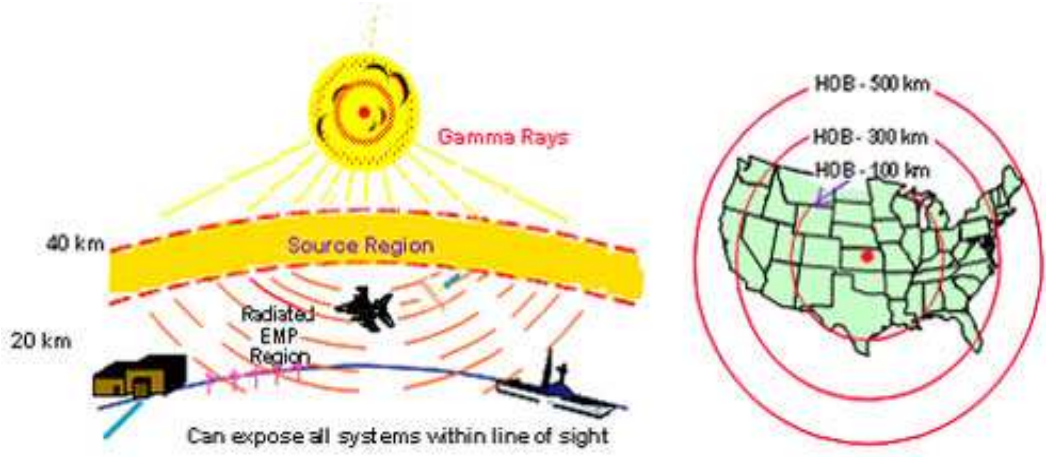
An easy way to make a Faraday cage would be to acquire some 2 x 4 brass mesh sheets (*Mythbusters* did this on the Discovery Channel). Make a box frame with the 2 x 4's and staple the brass mesh to the outside. Create a securely attached/connected access entry within the frame. Solder a ground wire to one of the corners and ground the cage. Scrap metal and mesh wires can easily be obtained in junk yards, on E-bay, the clay modeling section of a craft store, or at your local hardware or "farm and feed" store.



The important aspect of this to remember though is that mesh or sheet metal only shields magnetic fields if the frequency is up in the RF range. To properly stop the wave, you need some iron, steel, or some slabs of thick copper. Most electronics are useful in the VHF/UHF/SHF range today and will need more substantial protection.



I firmly believe in redundancy, and when it comes to protecting electronics, even more so. Considering this it would be wise to double or triple Faraday-ize your emergency and important electronic devices.



You do this by using the cheap cardboard box/aluminum foil cage type of Faraday shield for smaller electronic devices and then placing those inside a larger Faraday shield made of more substantial materials and containing more smaller pre-Faraday caged items; Lastly – burry it in the ground with at least two feet of dirt ALL around it. Triple Faraday protection!

Now of course you can't do that with items you use everyday like your laptop. That is why many sites suggested purchasing an old cheap laptop and backing up your extremely important digital information on it and then storing that laptop. As you accumulate more important digital doc's, save them to a CD or DVD that the older stored laptop can read and store these items in one of the cheaper Faraday cages.

> **Note:** Thumb drives, USB drives, diskettes, cassettes and any magnetic 'tape' or 'disk' recording medium will *most likely* be erased by a CME or EMP, so if these are important to you they need to be stored in some kind of Faraday cage. This is where the smaller items are used that can be opened easily like: Holiday metal popcorn tins, metal lunch boxes or even Altoid tins (thumb & USB drives fit perfectly after being wrapped in paper or thin foam padding) that can then be placed in say a metal file cabinet or even thrown into your unplugged dryer in a pinch.

Remember when you're browsing the internet - *Protecting against sparks is not the same as protecting against a strong magnetic pulse.*

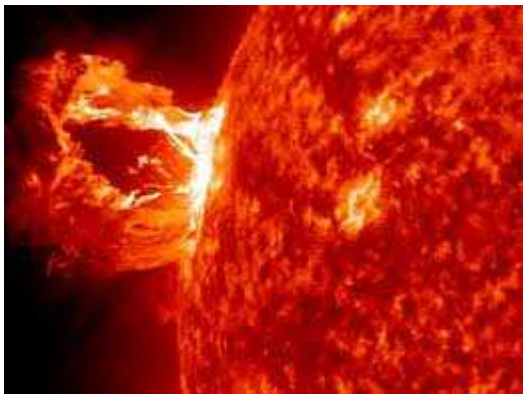
You can make your "cage" as small or as large as you'd like. It wouldn't be out of the question to continuously line a basement storage room or hole in the ground with copper mesh wire and a grounding rod.

Bottom line, with an appropriately constructed Faraday cage, you can likely protect that which is inside it from the electromagnetic attack of an EMP or CME incident, thus preserving the function of all that is contained therein (provided you have an alternate power source).

Some super cheap suggestions have already been made. However if you want to build one yourself there are a couple of excellent DIY How-To's on the internet that can be found at the sources listed below.

Faraday Cage Make it Yourself http://www.jeddaniels.com/2007/faraday-cage-part-1/
How to Build an Effective Faraday Cage
http://www.theinsidestraight.net/maxvenom/2009/12/15/how-to-build-an-effective-faraday-cage/
Skill of the Month: Make a Faraday cage http://thesurvivalmom.com/2012/10/09/skill-of-the-month-make-a-faraday-cage/
How to Build a Faraday Cage http://www.ehow.com/how_6618709_build-faraday-cage.html
Faraday Cages http://blog.totallyready.com/faraday-cages/05/11/
Make a Faraday Cage Wallet http://howto.wired.com/wiki/Make_a_Faraday_Cage_Wallet
Make a Mini Faraday Cage http://www.electronicsinfoline.com/New/Science/make-a-mini-faraday-cage.html
EMP - Practical Protection http://www.endtimesreport.com/EMP.html
Making Faraday Cages http://www.endtimesreport.com/faraday_cages.html
Disaster-Survival Resources is a great resource @ http://www.disaster-survival-resources.com/faraday-cage.html

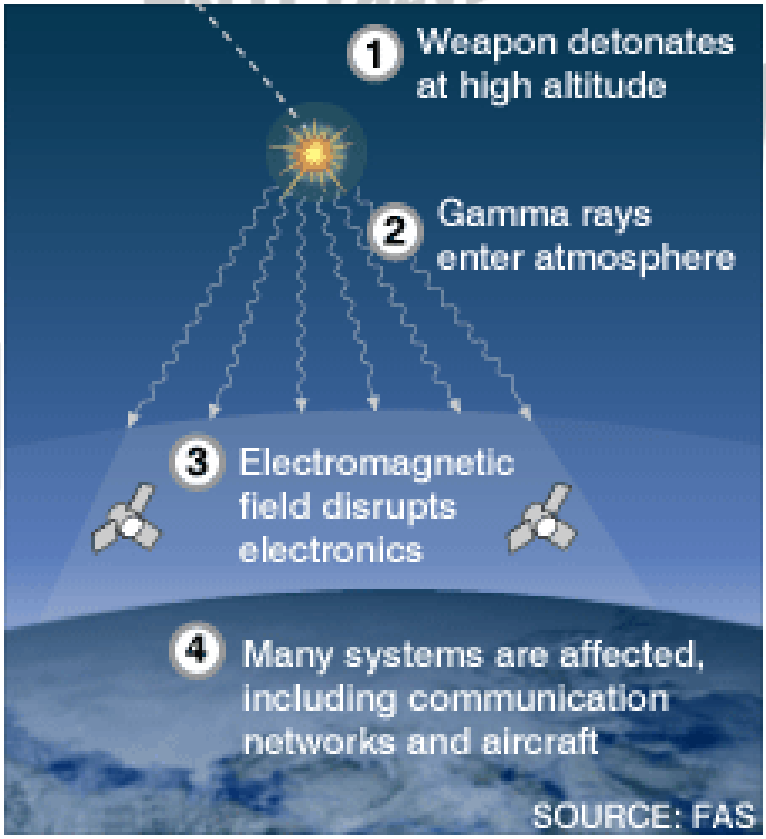
What are the odds of an Electromagnetic Event?



For a solar flare, storm or CME – it is not a question of IF; it's a question of WHEN. At least the massive events of this kind (that can cause us problems), with the Earth in their cross-hairs, only occur about every 500 years.

1962 - Christmas Island, Johnston Island, Central Pacific nuclearweaponarchive.org

For the human-created EMP type event, well as I have said – we humans are way too unpredictable. The 'experts' (mental, political, economic) on this type of thing seem to be torn 50-50 that it is WHEN and not IF – so your guess is as good as mine or theirs.



Let's face it folks we haven't had a Carrington sized CME event or an EMP attack since our world has become electronic (Thank you Lord!). ***No one really knows what will happen if one of these electromagnetic events should hit.*** Most of the information being related is based on educated guesses, that are themselves based on small scale experiments or logical 'assumptions' of the issues endured from past similar events (at least where CME's are concerned). ***Yet isn't it better to be safe than sorry?***

Be Prepared – Not Scared ;-}

TNT

If you would like some technical info on EMP's see:

Boeing's new missile takes down electronics without touching them 10/26/2012
http://www.nationalterroralert.com/2012/10/26/boeings-new-missile-takes-down-electronics-without-touching-them/ &
http://www.nbcnews.com/technology/futureoftech/boeings-new-missile-takes-down-electronics-without-touching-them-1C6663618

CHAMP - lights out 10/22/2012 http://www.boeing.com/Features/2012/10/bds_champ_10_22_12.html

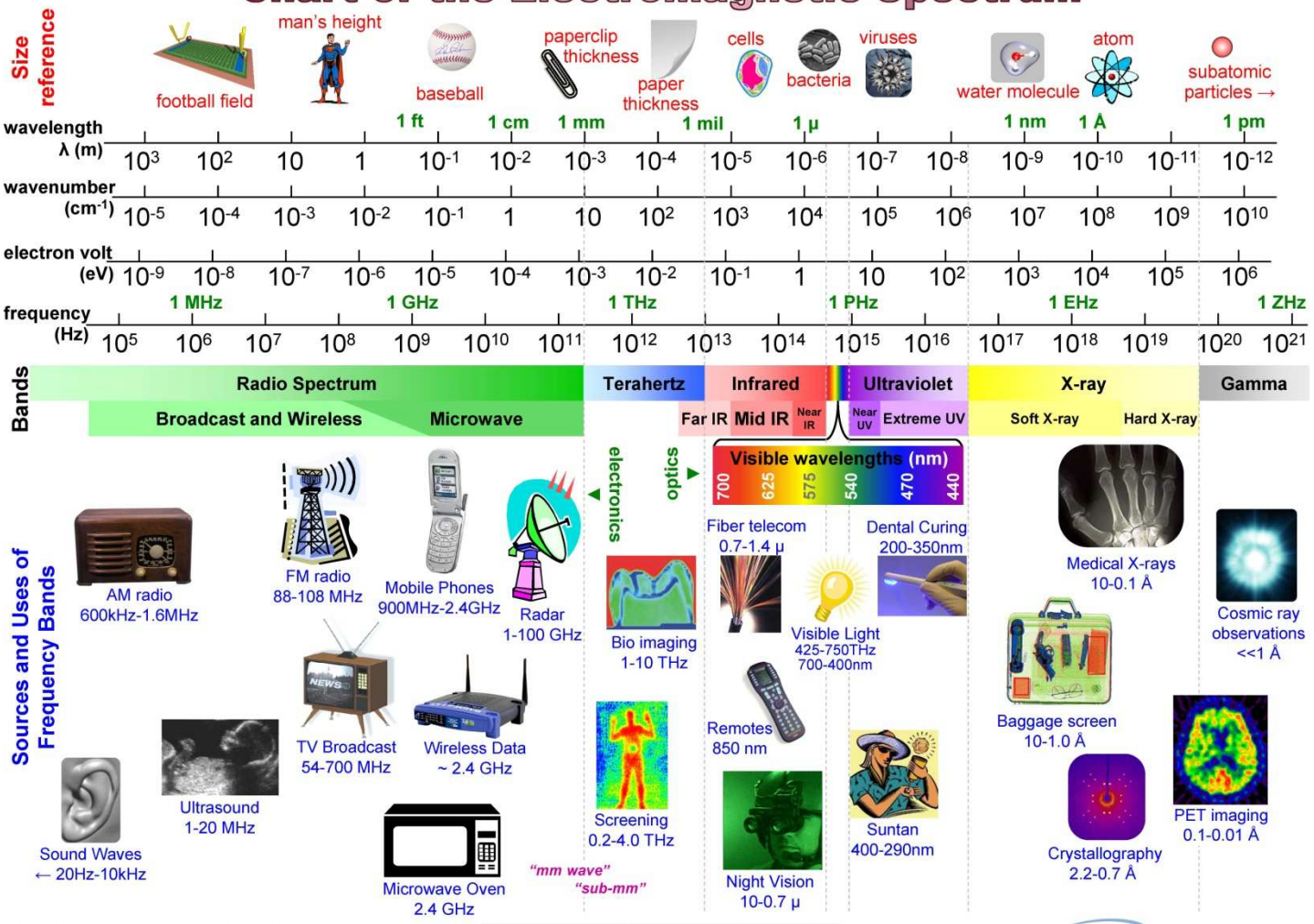
Lights out, Boeing creates the first working EMP bomb Dec 4 2012 http://www.nationalterroralert.com/2012/12/04/lights-out-boeing-creates-the-first-working-emp-bomb/ & http://vr-zone.com/articles/lights-out-boeing-creates-the-first-working-emp-bomb/18163.html with a Video @ http://youtu.be/yMOZvEnbPSU

Another video recently declassified by Boeing @
http://video.boeing.com/services/player/bcpid1173939806001?bckey=AQ~~,AAAAukPAlqE~,oAVq1qtdRjwBrIkHYj2MSytJiEK9s5fy&bctid=1913200772001

Boeing Non-kinetic Missile Records 1st Operational Test Flight Oct. 22, 2012
http://boeing.mediaroom.com/index.php?s=43&item=2454 and http://boeing.mediaroom.com/index.php?s=13&item=2093

Boeing CHAMP Missile Completes 1st Flight Test Sept. 22, 2011
http://boeing.mediaroom.com/index.php?s=43&item=1933

Chart of the Electromagnetic Spectrum



$\lambda = 3x10^8/freq = 1/(wn*100) = 1.24x10^{-6}/eV$

SURA Southeastern Universities Research Association ®

CLASS	FREQUENCY	WAVELENGTH	ENERGY
γ	300 EHz	1 pm	1.24 MeV
	30 EHz	10 pm	124 keV
HX	3 EHz	100 pm	12.4 keV
SX	300 PHz	1 nm	1.24 keV
	30 PHz	10 nm	124 eV
EUV	3 PHz	100 nm	12.4 eV
NUV	300 THz	1 μm	1.24 eV
NIR	30 THz	10 μm	124 meV
MIR	3 THz	100 μm	12.4 meV
FIR	300 GHz	1 mm	1.24 meV
EHF	30 GHz	1 cm	124 μeV
SHF	3 GHz	1 dm	12.4 μeV
UHF	300 MHz	1 m	1.24 μeV
VHF	30 MHz	1 dam	124 neV
HF	3 MHz	1 hm	12.4 neV
MF	300 kHz	1 km	1.24 neV
LF	30 kHz	10 km	124 peV
VLF	3 kHz	100 km	12.4 peV
VF	300 Hz	1 Mm	1.24 peV
ELF	30 Hz	10 Mm	124 feV

Source: http://en.wikipedia.org/wiki/Electromagnetic_spectrum

Legend:
γ = Gamma rays
HX = Hard X-rays
SX = Soft X-Rays
EUV = Extreme ultraviolet
NUV = Near ultraviolet
Visible light
NIR = Near infrared
MIR = Moderate infrared
FIR = Far infrared

Radio waves:
EHF = Extremely high frequency (Microwaves)
SHF = Super high frequency (Microwaves)
UHF = Ultrahigh frequency
VHF = Very high frequency
HF = High frequency
MF = Medium frequency
LF = Low frequency
VLF = Very low frequency
VF = Voice frequency
ELF = Extremely low frequency