

Catch the Wave – Fields, Forces, and Frequencies

Bob Dahse / GeoPathfinder.com

Definitions from Webster's Unabridged:

Field: A space within which a force is active

Force: The cause of motion, or of change or stoppage of motion, of a body

Frequency: The number of vibrations or cycles of a wave per unit of time, measured in Hertz, or cycles per second

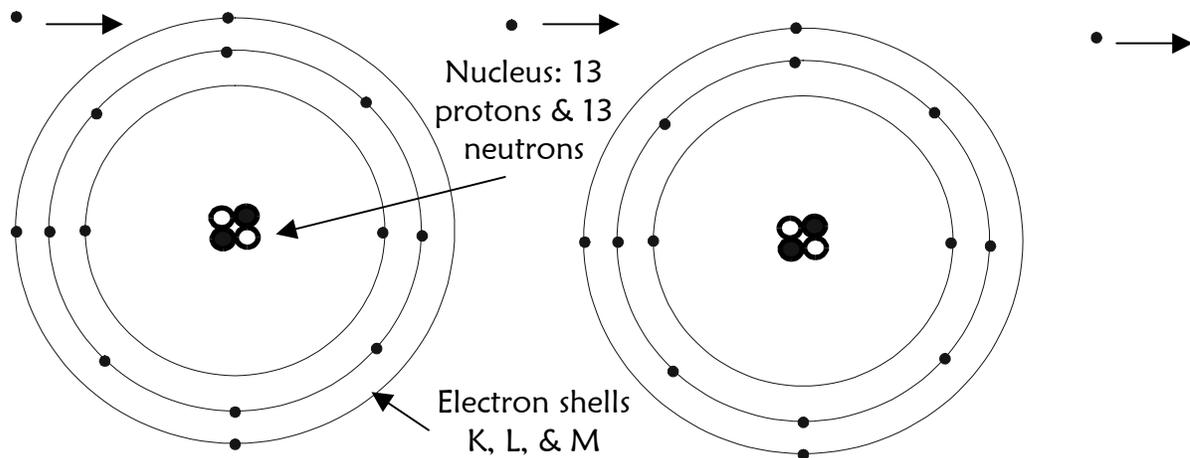
Wave: Any of a set of periodic, advancing impulses set up by a variation, pulsation or disturbance

Wavelength: The distance, measured in the direction of the progression of a wave, from any given point to the next point characterized by the same phase

Forces exist within **fields**, and if their intensity or size changes, they vibrate as **waves**, at specific **frequencies** and with a corresponding **wavelength**. Low frequencies have very long wavelengths and high frequencies have very short wavelengths.

To see where these forces and fields come from you need to picture an **atom**. The following is mostly a model used in the early 1900's. Atoms make up all the known **elements** that comprise all physical **atomic matter**. The core of an atom is the **nucleus**, made of **protons** (with a positive electrical charge) and, usually, **neutrons** (which have no electrical charge). Surrounding these are one or more **electrons** (which have a negative electrical charge) around the nucleus in orbits called **electron shells**.

Two atoms of aluminum showing orbital and traveling electrons



In reality particles of matter may not exist. Quantum Mechanics and Relativity have made this model obsolete in terms of predicting actual force and particle behavior. So what does exist? Just a poorly understood, non-uniform **space-time**, sizzling with a “quantum foam” of energy turning into particles and anti-particles, then back into energy. According to Milo Wolff in his book, “Exploring the Unknown Universe”, across this backdrop are tiny areas of space where inward- and outward-moving spherical waves form what we think of as particles. They are actually just standing waves, or “space resonances”, passing energy, such as electricity, between themselves. The energy transfer medium of electrical energy is called the photon, a “particle” with no mass (figure that out!). Since mass, energy and frequency are equivalent, electrons appear to

surround a nucleus only because the nucleus has lots of energy, hence a higher frequency and smaller wavelength. Electrons have far less energy so their wavelength is larger, making them appear to be bigger and in orbit around a tiny nucleus. They actually occupy the same space, which is possible because they are just different frequencies of waves. Looks can be deceiving!

Remember $E=Mc^2$? Matter and energy are just two states of existence, like water and steam. And just as steam violently expands to about 1700 times the volume of water when it forms, a tiny amount of matter would equate to an enormous amount of energy. All atoms can be described in terms of particles (matter) or waves (energy). If we discuss fields, that's wave energy. Flows of "current" either happen to particles or to energy passing between standing waves.

Atoms come in many apparent sizes, depending on the element, and can share electrons from their outer electron shells (chemical bonds) or they can flow from one atom of an element to another (that's electricity). Atomic theory began with the Greek philosopher Leucippus in 455 BC. "Elektron" is Greek for "amber" (you'll see why shortly).

Physical forces in order of strength, starting with the strongest:

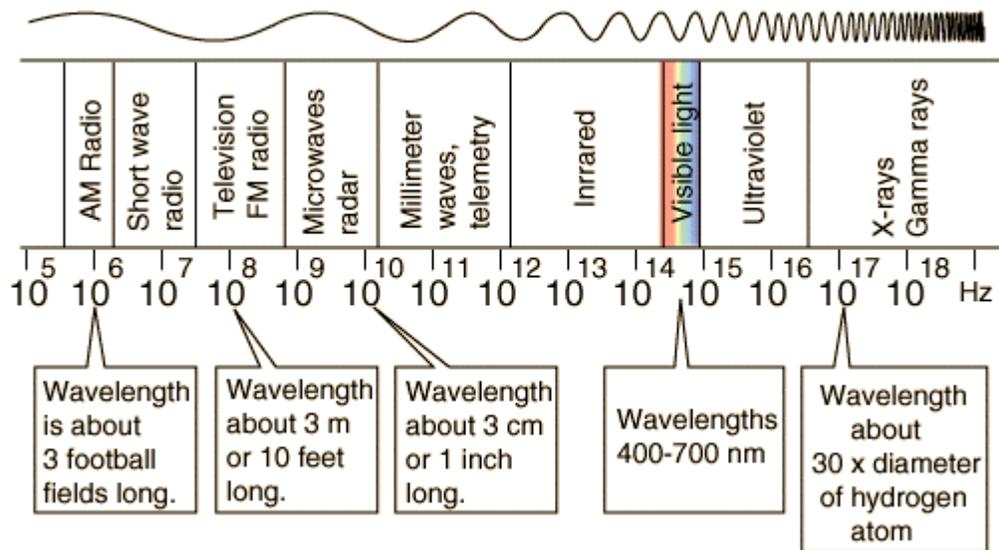
- **The Strong Nuclear Force:** holds protons together in the nucleus while the Electromagnetic Force (see below) tries to make them fly apart. 100 times the strength of the Electromagnetic Force. Its source is unknown.
- **The Weak Nuclear Force:** holds neutrons in the nucleus, even though they aren't attracted to protons by electrical charge, and controls alpha radiation.
- **The Electromagnetic Force:** made up of the **electric force** with a positive or negative charge, and the **magnetic force** with a north or south polarity. Similar charges and polarities repel each other, while opposite charges and polarities attract each other. A changing electric force generates a magnetic force. A changing magnetic force generates an electric force. Since perfectly stable fields are uncommon, we almost always lump them together into electromagnetic forces. Its source is unknown.
- **The Gravitational Force:** This makes all matter attract other matter. It's the only force that's constant for all types of matter and its source is unknown.
- **The Telluric Forces:** A general category for forces specific to a planet. These include some very strong electromagnetic forces caused by the Earth's magnetic field spinning in the "solar wind" of charged atomic particles, waves of energy caused by a thousand flashes of lightning per second, and more subtle forces radiating upward from the Earth's core and down into it (Earth Energies).

The current consensus among physicists is that **atomic matter and its associated energy makes up only 4% of all the matter and energy in the universe**. 23% is "dark matter" which can't be seen and has very weak interactions with atomic matter. 73% is "dark energy" which works against gravity to make the universe constantly expand. So 96% of what's out there is relatively unknown, despite our scientific pride! In reality even this model is mostly speculation based on scant evidence with huge margins for error. In a relativistic universe every measuring tool is in flux!

The lowest frequency is zero **Hertz** (cycles per second), or **DC** (direct current), characterized by a static electrical charge (static electricity) or a fixed magnetic field (as you'd find in a bar magnet). A static charge has no movement of electrons, just a local surplus or lack of electrons. The pressure generated by this creates an **electric field** measured in **Volts/Meter**. These fields were first described by William Gilbert; court Physician to Queen Elizabeth I. He wrote that a "humour" (charge) removed from rubbed amber could attract feathers because of a powerful "effluvium" (field) floating around it. When electrons in a wire are "piled up" or depleted to produce a voltage, the electrons emanate an energy wave that we detect as the electric field. It forms a radial pattern around the wire, which is why we say it radiates.

Each atom of every element has a characteristic opposition to the movement of its outer electrons. When this **resistance** (measured in **Ohms**) is overcome by enough **pressure** (measured in **Volts**) the moving mass, or energy, of electrons is measured in **Coulombs**, or more familiarly, **Amps** (Amperes, or Coulombs per second). Electrons have "spin", and when energy moves between them their spins align generating a **magnetic field**, measured in **Gauss, Teslas**, etc. The magnetic field around a wire looks like your curled fingers around your thumb (representing the wire) when you give the "thumbs up" sign.

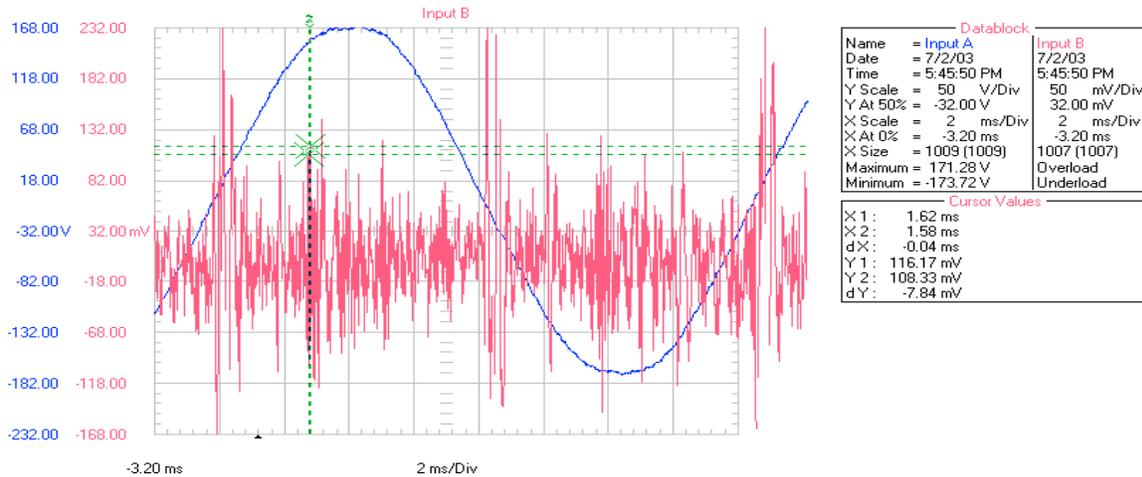
Any disturbance (starting, stopping, rhythmically changing, etc.) of a magnetic or electric field creates either a **pulsed DC** field (unchanging charge or polarity) or an **AC field** (an alternating current, where charge or polarity reverses periodically). These fields will have a frequency matching their rate of change and wavelengths found by dividing the speed of light by the frequencies. **The Electromagnetic Spectrum looks like this:**



Ionization is the process of stripping electrons from an atom or jamming additional electrons onto it. Ion = "traveler" in Greek. Frequencies from visible light and lower are called **non-ionizing** since they can't do this. But from ultraviolet light and up, ionization will occur, causing damage to DNA and other injurious chemical alterations.

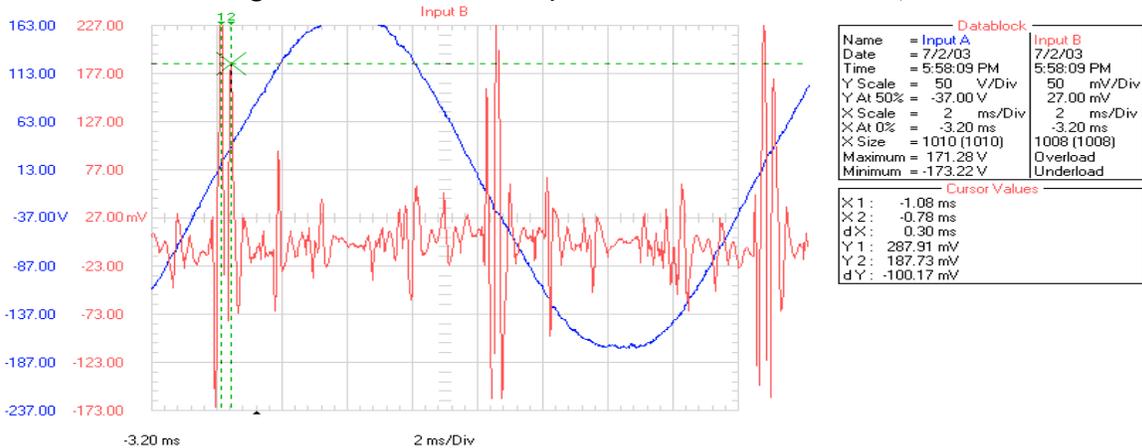
The lowest frequencies, from zero to around 35 Hertz are naturally occurring. They are associated with telluric forces. Powerline frequencies of 50 to 60 Hertz are

characteristic of human-made “grid” power, with a pressure ranging from 120 volts in homes to 1 million+ volts in power transmission lines. Harmonics of 50 or 60 Hertz (120, 180, 240, etc.), along with other **higher frequencies caused by switching power supplies, etc., also ride along the powerlines and in household wiring, seen here:** (note: the high frequency levels are actually 1000 times less intense than the sine wave)



THE WAVEFORM WAS COLLECTED IN ROOM 114 AT THE ELGIN/MILLVILLE MN HIGH SCHOOL. CHANNEL 1 WAS CONNECTED TO THE 120 VAC UTILITY SUPPLIED POWER RECEPTACLE. CHANNEL 2 WAS CONNECTED TO THE SAME POTENTIAL, EXCEPT THROUGH THE GRAHAM UBIQUITOUS FILTER. (REMOVES THE 60 HERTZ) THE AREA BETWEEN THE CURSORS REPRESENTS A FREQUENCY OF 25 KILO HERTZ. A TEACHER WHO PREVIOUSLY OCCUPIED THE ROOM DIED OF BRAIN TUMORS AND THE TEACHER IN THE ADJOINING ROOM DIED OF LUEKEMIA.

After filtration through some electrical “capacitors” (G-S Filters) they look like this:



THE WAVEFORM WAS COLLECTED IN ROOM 114 AT THE ELGIN/MILLVILLE MN HIGH SCHOOL. CHANNEL 1 WAS CONNECTD TO THE UTILITY SUPPLIED 120 VAC POWER WALL RECEPTACLE. CHANNEL 2 WAS CONNECTED TO THE SAME POTENTIAL, EXCEPT THROUGH THE GRAHAM UBIQUITOUS FILTER. 2 GRAHAM/STETZER SOLUTIONS FILTERS WERE PLUGGED IN AT THE TIME. THE FREQUENCY REPRESENTED BY THE AREA BETWEEN THE CURSORS WAS REDUCED FROM 25 KILO HERTZ TO 3.3 KILO HERTZ AND THE READINGS ON THE MICRO SURGE II METER WAS REDUCED FROM 455 TO 70.

But as frequencies rise, the amount of electric force radiating from a wire increases. This means that a cordless phone operating at 2.4 GHz (2.4 gigahertz, or 2,400,000,000 Hz) has **three times the radiating power** (because it's 3 times the frequency) as an 800 MHz (800 megahertz, or 800,000,000 Hz) phone if **both use the same amount of battery power**. And as voltage rises, the size of the electric field radiating outward increases. So living 100 feet from a 700,000-volt powerline gives you at least twice the electric field exposure as living 100 feet from a 350,000-volt line.

Magnetic fields from a current-carrying wire have varying intensities based on your distance from them. Halving your distance from the magnetic field gives you 2 to 9 times the exposure to magnetic fields (depending on field shape). Doubling your distance gives you one-half to one-ninth the exposure. They can only be contained using expensive magnetically permeable metal sheets. Electric fields from a wire also follow this trend, in a narrower range, but are easy to reflect or absorb using screening or solid sheets of an electrical conductor. But they exist even when no electrons are actually flowing (the *pressure of voltage alone* is enough to cause electric fields).

The ways that various radiated frequencies interact with us:

Frequency Coupling: The human body, along with other physical objects, resonates best with frequencies having wavelengths twice their size (half-wave resonance). In other words, an antenna or human that is 4.5 feet tall would resonate with the uppermost FM radio frequency of 108 MHz.

Thermal Exposure: In 1966, ANSI set a standard for “occupational exposure” to microwaves at 10 mW/cm². This standard was adopted from typical military radar exposure in the 1950’s, and is the exposure level required to actually heat cellular tissues (microwave ovens). This standard persists despite research indicating its recklessness.

Resonance Coupling: (cyclotron resonance): The Earth’s DC magnetic field interacts with vibrating (AC) electric fields at element-specific frequencies that cause changes in atomic spin. This resonance can make an element or molecule in an organism more or less available. It can affect cellular nutrient transfers, fetal development, parental gene mutation, and other forms of DNA damage, even at extremely low exposures.

Polarization Coupling: This refers to the physical orientation of the transmitting antenna and the object interacting with the electric field that’s broadcast. If an antenna is vertical and you stand upright, with your height equal to half of the transmitted wavelength, you get maximum, whole body resonance with the signal. If you lie down, your resonance drops because, even though your height is the same, you no longer line up with the orientation of the wavelength.

So in conclusion, how does all this stuff work, from basic physics to your life?

Always go back to theory! It all starts with **ionization**. If an atom gets piled up with extra electrons it becomes negatively ionized (a negative **charge**). If an atom gets robbed of electrons it becomes positively ionized (positively charged). This happens when you shuffle your wool socks across the carpeting on a dry winter’s day. Your socks grab electrons from the carpeting, and the **dry air acts as an insulator**, keeping the electrons from jumping immediately back or away. **Electric field pressure, or voltage**, that the electrons emit builds up around your body but gets **strongest at points that stick out** (like a pointy lightning rod on a building). Then you reach for a doorknob and the electric field built up around your fingers intensifies as it reaches out for the doorknob (with its own positive or neutral ionization) and forces the electrons to jump the gap to the knob, even before you touch it.

Electrons, like all atomic matter, seem to have a dual nature. They sometimes seem to act like particles (matter) but they are probably just standing waves, or

resonances, of energy. An excess of electrons creates the pressure of ionization that we call an electric field, which can be radiated into space or conducted through wire as voltage pressure. The spins of aligned electrons create a magnetic field, which can be radiated into space as a wave or conducted through a wire as coulombs, or amps.

Electrons, in their guise as particles, spin at a fixed frequency depending on their energy state (which shell they're in) and in various orientations. But lock them into a perfectly regular crystal of iron, nickel, or cobalt, and they can be made to all spin together in the same orientation. That's a common magnet, with a DC, or static magnetic field. This is the electron's particle nature displaying its wave nature. But if you put a piece of iron near an electric field (the wave nature of the electrons) the electrons in an iron crystal will line up. That's how you magnetize a magnet in the first place! This is what is happening when your iron-framed bed, with iron-alloy box spring, is shoved up against a wall with AC outlets on it, even with no power being used. You end up sleeping in an alternating 60 Hz (plus higher, more radiant, more energetic frequencies) electromagnetic field. For deep sleep your brainwaves want to cycle down to 1 – 3 Hz. Guess what happens instead? Sleeping well?

So what happens when you suddenly push and pull energy through a wire using the wave nature of the electron, an electric field? All of the electrons get lined up in the same directional flow. Sound familiar? The aligned spins produce a magnetic field when energy is flowing, and some device is consuming electrical power. So the electron's wave nature (electric field and voltage) can display its particle nature (magnetic field and amp flow). If you move a magnetic field, change its polarity, change its intensity, start it, or stop it, you can create an electric field in any conductor near it. That's what any electric generator does, from a gas-powered home model to a huge hydroelectric turbine. And as noted earlier, if you move or change an electric field you can create a magnetic field.

When we start to wiggle fields back and forth we create a pulsing (periodic bursts) or alternating field (AC). The field's rate of wiggle is its frequency. The formula, $F=ma$ tells us that the radiated Force of that field is equal to the **Mass** (or **Energy**, remember $E=Mc^2$, that energy and mass are interchangeable?) times **Acceleration** (change in speed). Using the particle model, electrons in an alternating electric field are constantly changing speed as they move from some atoms and back to them again, causing positive and negative ionizations (a sine wave, square wave, etc.). Electron spins and ionizations are constantly changing orientation, direction, and speed in an alternating electric/magnetic field. And a periodic (like pulsing DC) or transient (strobe light, spark, etc.) electric field does the same, but with just a change in electron charge intensity instead of charge polarity.

So what happens when we **double the frequency** of an electric/magnetic field? That's right, using $F=ma$, it **doubles the radiated force** and increases the size of the field. All radio, TV, cell phone, cordless phone and wireless devices depend on very high frequency electric fields to transmit a usable signal over a long distance. So we can't compare 2 watts of power conducting through a wire at 60 Hz with 2 watts radiating out of a cell phone antenna at 800,000,000 Hz. That's just communication company obfuscation to make you feel safe about a technology that zaps you with microwaves. High frequencies are very useful but why do you suppose they are called "radio" waves?

It's because they radiate outward, radially, as a form of radiation. And we all know how great radiation is, right?

So you folks with the fancy-sounding gadgets that shield you from cell phone emissions might want to rethink your civic pride. Any thing that shields you from radio waves either reflects it away from you, uses "stealth technology" to slightly lower the frequency or generate an opposing phase, or "grounds" it into the earth. Grounding requires a ground wire and a ground rod. And I don't see any of you using this ground wire on your wireless phones! This means you're simply doubling the radiated field intensity toward the person on the backside of your phone. Still proud about how clever and safe you are? Are you really so important that you need that thing on all the time, blasting out a periodic search signal to the nearest tower, or taking your call in a crowded room instead of stepping outside, reducing our exposure? Note: **I don't discuss "safe levels" of microwaves.** The more research you read, the more you'll see that **they may not exist.**

And you techy geeks who love the convenience of wireless Bluetooth, wireless networks, and WiFi; are you happier knowing that your constant, low-level microwave emissions create a chronic source of stress for everyone in the neighborhood, even those who are hypersensitive to radio waves? Are you a smoker too? If you really were all that smart you'd be lobbying against "electro-smog" instead of rolling around in it, and encouraging the communications giants by lapping up their latest fads. Use your head, dude! If it's not junk, why do they push it so hard? Judging by recent research on low-grade, continuous transmissions of 2.4 GHz, a world without wi-fi "dead zones" may become a world without successful reproduction in just a few generations.

The same rap goes to all the environmental do-gooders who install photovoltaic systems, wind turbines, and micro-hydro to save the planet, then sell their excess power to the grid instead of dealing with inconvenient battery storage. How clever you are as you save all that money on heavy, bulky, sometimes maintenance-prone, and possibly messy recyclable batteries. And you get money from the utility company as you **blast yourselves and your grid-connected neighbors** down the road with the high-frequency "switching transients" your inverter creates as it tries to mimic a utility-pure sine wave by chopping and reassembling other waveforms.

The electric utilities argue that they produce pure, safe power. *That's* what they do the epidemiological tests on and that's *why* they tell you it's safe. The huge voltages (electric fields) and power levels (magnetic fields) they distribute on powerlines are certainly not safe if you are near them 24/7, or ever come in direct contact with them via wiring or underground "stray voltage". And the higher frequency electric fields radiating from them aren't safe, but *they* aren't producing those! **We are!** Every computer's "switching power supply", every light dimmer switch, every inverter and DC voltage converter, every motor, relay, wall switch; in short, **any thing that changes, starts, or stops the sine wave makes it more dangerous and sends that signal down the powerlines to your neighbors and through your entire house.**

Until manufacturers add the circuitry needed to filter unwanted frequencies from their own devices we're all stuck with radiated "electrical soup". **Cheap, safe, or convenient; pick two!** Don't expect WalMart prices on clean-running electrical gadgets.

And don't expect safety from something cheap and convenient. Graham-Stetzer capacitive filters can reduce the amount of junk you produce and send down the lines, and shielding all of your home wiring for electric and magnetic fields is another expensive possibility, but **the best solution is to avoid AC power whenever you can.** We use 12-volt DC power as much as possible, cutting our electric field exposure by a factor of 10, and avoiding induced magnetic fields produced by changing electric fields. When we want AC we turn on our sine-wave inverter (modified by the manufacturer's free-for-the-asking transient filter) use the AC device and turn it back off. Inverters with a "search mode" do the same, but still produce high frequency "trash" that radiates from your home wiring and AC device cords whenever power is flowing. Shielding and grounding all AC wiring certainly is highly recommended, especially in bedrooms and other areas where you spend lots of time. But shielding the bed from in-wall wiring with simple aluminum or steel window screen is a far cheaper option, even if you add a ground wire to increase the effectiveness. Or just turn off the circuit breaker that leads to your bedroom at night. It's inconvenient, but cheap and safe.

Modern physics tells us that even a butterfly's fluttering wings have an effect, globe-wide. If you understand the alternating electric fields shaking off those wings you now know why that's true. Electric fields never die, they just get weaker. So I hope that our electro-techno arrogance, even with good intentions, doesn't either kill us or weaken us to the point of species collapse! **Use electricity responsibly:** don't use it when you don't need to, use smaller amounts of it, use DC power, keep the voltages low, keep AC frequencies as low as possible, keep your distance from it, reduce the time you spend with it, and don't turn it into the electromagnetic version of second-hand smoke.

Have a nice day, and please let others do the same!