

Hello! This is Brant Meyers, author of [PEMF; The Fifth Element of Health](#), and I am super-excited about this video series because we are going to review Electrodynamics, or Electricity, Magnetism and Light, which really is the foundational physics that you need to understand PEMF therapy and most energy medicine devices.

Electricity and Magnetism are all around us. We have electric lights, and many electric appliances in our house. We have radios, stereos, speakers, CD-players. We have cell phones, iPads, laptop and desktop computers. We have WIFI, Bluetooth, smart TVs and smart meters. Light itself is an electromagnetic phenomenon as radio waves are, too. The colors of the rainbow in the blue sky are there because of electricity and magnetism.



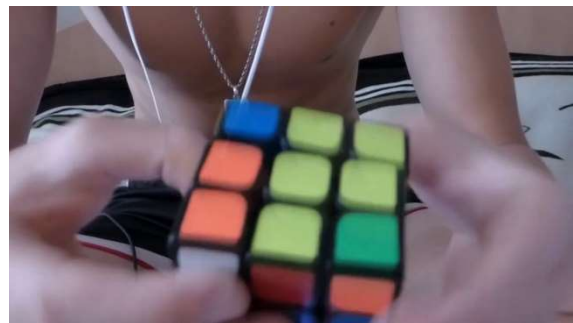
Cars, planes, trains run because of electricity and magnetism. Horses need electricity because muscle contractions require electricity. Lightning and the earth's Schumann resonance and magnetic fields of the earth are a result of electromagnetism. Energy medicine devices like PEMF therapy, lasers, LEDs, red light therapy, saunas, Rife machines, scanners, ionizers, TENS units, etc. all are based on electromagnetism.



Your nervous system is driven by electricity. Atoms, molecules, all cell reactions exist because of electricity and magnetism. You could not see without electricity. Your heart could not beat without electricity.

You could not even think without electricity, although some people even *with* electricity have a problem with that!

To understand the basic science of PEMF and expose the bad science that's running rampant in the PEMF community we need a solid understanding, for starters of classical electrodynamics; "classical" in the sense that we're not going to get into quantum mechanics – yet.



Understanding the electromagnetic force starts with understanding what force is. “Force” in its simplest definition is a push or a pull on an object. And this pushing or pulling can be both contact or on-contact, as we’ll see. Forces are important because they are responsible for changes



in motion. In fact, Isaac Newton describes this in his first law. The law of inertia states that:

*An object continues in a state of rest, or constant motion, unless it is acted on by an outside force.*

So, for example, your dog sleeping on the couch isn’t likely to move unless you apply a force by poking or pushing him, to use a humorous example.

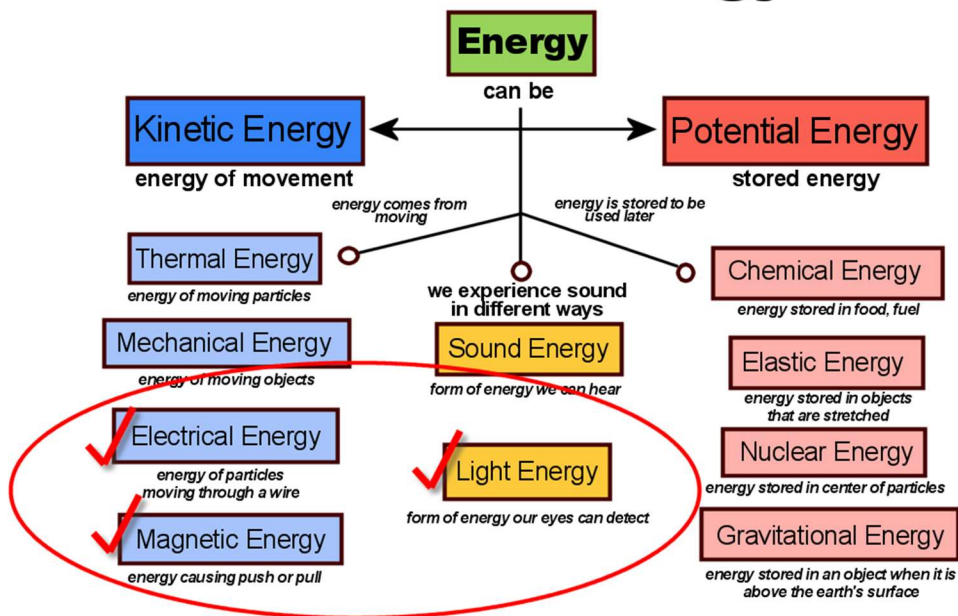
Forces can be a result of a direct contact—like you’re actually pushing or pulling something. It can be an applied spring, it can be friction, drag, tension – take a look at this image and you can see a few examples. Or, forces can also be non-contact, like gravity, and the electromagnetic force.



We're going to mainly be dealing with non-contact forces in this module, and we're going to put the electromagnetic force in terms of a field formalism, that is, a field is going to act as the force. You can think of force as an interaction, and there are four fundamental forces – or interactions – in nature. As we mentioned, the gravitational force, the electromagnetic force, and there are also the strong and weak forces. The strong force takes place within the nucleus of an atom and it works at only short distances, and the weak force is responsible for radioactive decay and making the sun shine. But in general, the two main forces we deal with on a day-to-day basis are the gravitational force and the electromagnetic force.

Where there is force, there is energy, and energy by its standard definition is the ability of a force to do work. There are different kinds of energy corresponding to the different forces.

## Forms of Energy

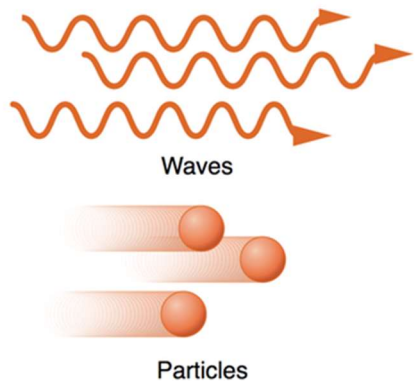


There are two main types of energy; kinetic energy which is energy of motion or movement, and potential energy which is energy that is stored. Energy comes in different forms as is shown in the chart above. Most energy medicine devices, as I've circled in the chart are electromagnetic in nature, so we're going to focus on those three main types of electromagnetic energy in this module; electrical energy, magnetic energy and light energy. Although all are connected within



one electromagnetic force, they all are different in their properties and healing power, as we'll see in this course.

## Particles and Waves



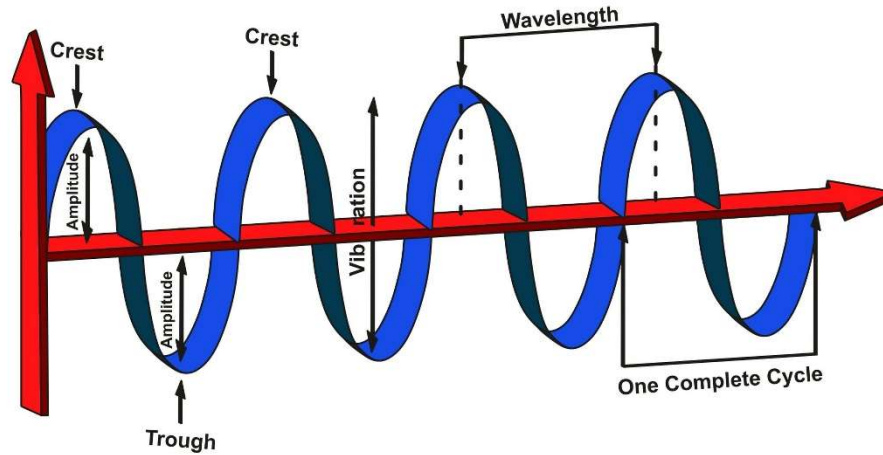
Classical—or Newtonian—physics divides the physical world into particles and waves. Particles transport energy and momentum with their mass and motion from one point to another in space. Waves transport energy from one place to another without mass. Waves use frequency, resonance and amplitude to transmit energy. This is the main form of energy transfer for PEMF devices and most energy medicine devices.

Because most energy medicine devices like PEMF use time-varying electric or magnetic fields or electromagnetic waves like radio, infrared, light, or UV – which are more wave-like than field-based – let's begin with a basic understanding of what waves are.

## Classical Wave Theory

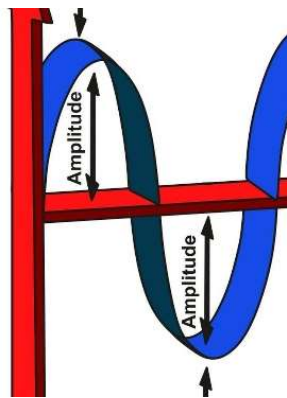
Classical wave theory is a good starting point for understanding energy medicine.

All life is oscillating or in vibration. Light is vibration, seeing, hearing, touching, smelling, tasting is all vibration. Oscillations – or vibrations – are more technically called “waves” in science. A “wave” is a generic term for a pattern that repeats itself over time. Sound waves, brain waves, water waves in a pond, ocean waves, light waves, magnetic waves are all repeating patterns.



One “cycle” of a wave is the portion of the wave that repeats itself. Let’s briefly define some wave characteristics, as this is really important to understanding PEMF therapy.

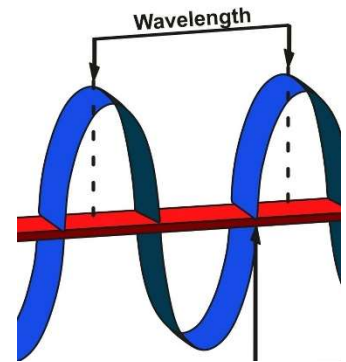
### Amplitude or Intensity



Amplitude or intensity is the maximum amount of the disturbance during the wave cycle. The Amplitude is the height of the wave. Classically, the amplitude relates to the energy in the wave, or the amplitude squared to be more technical. The greater the amplitude, the more energy the wave has. Loudness and brightness are two examples of amplitude. We’ll talk about amplitude or intensity with regard to PEMF devices and what is the best amplitude or intensity to work with. As we’ll see, it’s more of a lower intensity or lower amplitude. You can think of amplitude as a volume switch. You’re just turning up the volume or you’re turning it down.

### Wavelength or Frequency

The next two characteristics of a wave are wavelength and frequency, which are related. Wavelength is the distance between the two consecutive crests—or peaks—of a periodic wave, which is wave that repeats itself. The distance equal to the wavelength makes one cycle of change. So, wavelength is the length of the wave.



Frequency is the number of cycles per unit time of a wave that repeats itself at a given point.



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The frequency, which is measured in hertz (Hz) is named after the physicist Heinrich Hertz and equals the number of times the signal repeats itself in one second, that is, cycles per second. So, for example, our ears perceive high frequency as a high pitch or a high note.

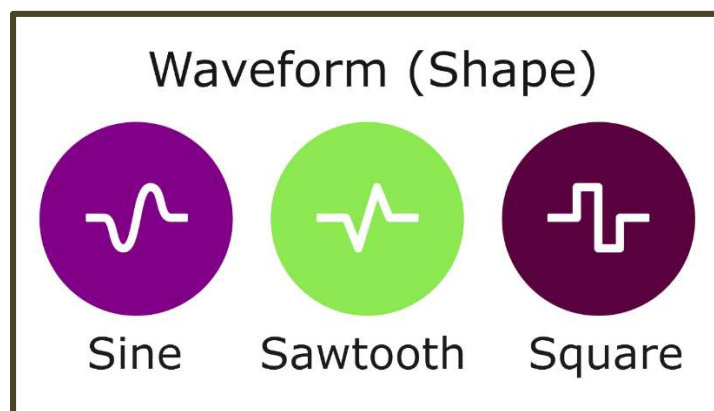
Our eyes can only see a very narrow bandwidth of frequencies of the electromagnetic spectrum from red to violet. But violet would be the higher frequency and red would be a lower frequency. So, this is the range of frequencies that our eyes perceive.

In my book and in many articles and videos I give a good case for that the ideal frequencies for a PEMF device should be zero to 50 Hz, because those are the frequencies the earth is giving us, those are the frequencies the cells primarily respond to, those are the frequencies that have been proven in research literature to work on healing and regeneration of different tissues, and interestingly, those are the frequencies that our brain operates at and even the frequencies that we radiate, according to squid magnetometers.



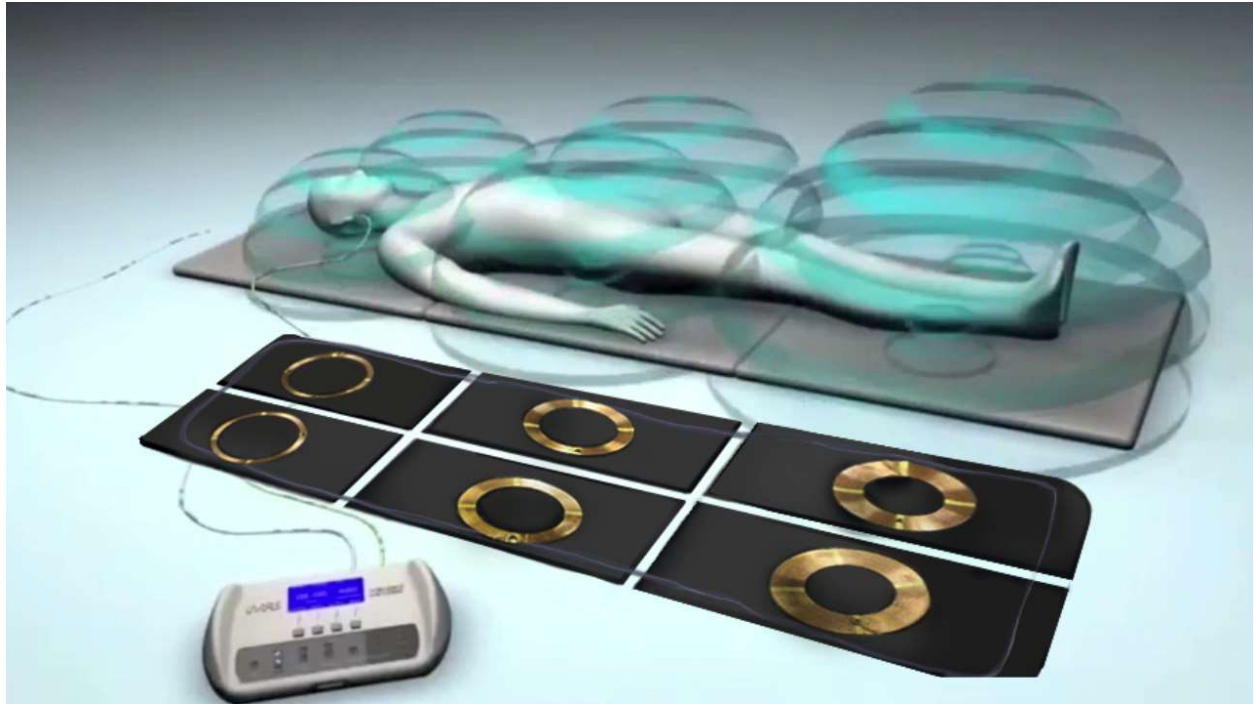
Frequency is very important because, to transmit energy from one point to another with waves you need to have the right frequency resonance.

Besides frequency and amplitude—or intensity—the waveform or shape of the wave is also very important. You want a rapid rise and fall, as we'll see, like a sawtooth or a square wave. The complexity of the pulse train is also very, very important. That's a little more complicated and we'll have a whole module where we'll look at that.





We'll come back to electromagnetic waves at the end of this video series and in other modules, but this serves as a simple introduction to the idea of the wave, which is the primary way most energy medicine devices transfer energy from one point to another.



Thanks for watching! In the next video we're going to look at what charge is—it's called, "electrostatics." We're going to look at:

- Coulomb's law and Gauss's law
- what electric fields are
- basic ideas of voltage and electrical potential
- and all o the basic ideas of electrostatics.

So, we'll see you in the next video.