



# Zero-Point Energy and Interstellar Travel

by Josh Williams

*“Ere many generations pass, our machinery will be driven by power obtainable at any point in the universe... it is a mere question of time when men will succeed in attaching their machinery to the very wheel work of nature.” –Nikola Tesla, 1892*

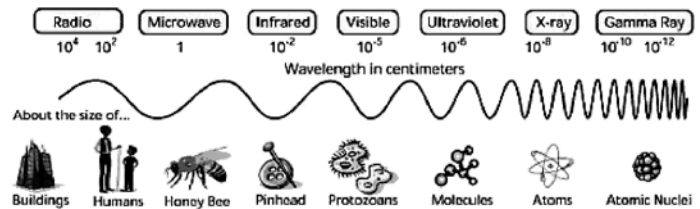
Some call it the ultimate free lunch. Others call it absolutely useless. But as our world civilization is quickly coming upon a terrifying energy crisis with little hope at the moment, radical new ideas of usable energy will be coming to the forefront and zero-point energy is one that is currently on its way.

## So, what the hell is it?

Zero-point energy is a type of energy that exists in molecules and atoms even at near absolute zero temperatures (-273°C or 0 K) in a vacuum. At even fractions of a Kelvin above absolute zero, helium still remains a liquid, and this is said to be attested to zero-point energy. Also at this unbearable temperature, atoms are said to undergo tiny atomic or sub-atomic fluctuations according to the Heisenberg uncertainty principle which states that the position of an atom and its momentum (and hence its velocity since momentum equals mass multiplied by velocity) can never be simultaneously accurately measured. Modern physics tells us that temperature is just a measure of the velocity of the atoms and molecules that make up an object, so if an object is cooled to absolute zero, the constituent particles logically would come to rest (having a velocity of zero) and the position would be measurable. But this contradicts the Heisenberg uncertainty principle. And so the particles have these fluctuations (or vibrations) via Heisenberg and are said to be caused by zero-point energy. In fact, this is the very idea from which zero-point energy gets its name, since the atoms are at absolute zero (or the zero point) and still contain some energy to undergo these fluctuations. So what follows from this is that since even at absolute zero, or very close to it, these atoms still vibrate: the motion from zero-point energy never disappears.

The actual (supposedly) usable energy

itself comes from the conversion of electromagnetic radiation energy into electrical energy, or more specifically, the conversion of an extremely high frequency bandwidth of the electromagnetic spectrum (beyond Gamma rays) now known as the zero-point spectrum.

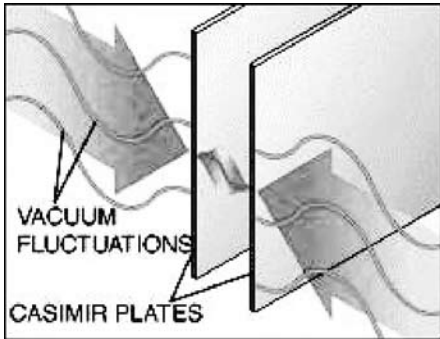


As you can see, the wavelengths from this part of the spectrum are incredibly small, literally atomic and sub-atomic in size. And since the wavelength is so small, it follows that the frequency is quite high. The importance of this is that the intensity of the energy derived for zero-point energy has been reported to be equal to the *cube* (the third power) of the frequency. So obviously, since we're already talking about some pretty high frequencies with this portion of the electromagnetic spectrum, we're talking about some *really* high energy intensities. In fact, Nobel Laureate Richard Feynman and one of Einstein's protégés, John Wheeler, calculated that there is more than enough energy in a cup of coffee to evaporate the worlds' oceans! Now some physicists say there's no limit to the intensity of the energy (and therefore the frequency), but a majority says that we're limited by what's known as the Planck frequency which is about 1043 hertz. Note that at our current level of technology, we're nowhere close to utilizing such high frequencies. To put the Planck frequency into perspective, gigahertz radio is about 1010 Hz, visible light is about 1014 Hz, and gamma rays stretch into 1020 Hz. So whether zero-point energy is capped or not, we still have quite a ways to go to reach the upper limits, and the cube of 1020 (=1060) Hz is still an astonishing intensity (even if we can't achieve the upper limit of 1043 Hz). And if the intensity of the energy is limited to precisely the Planck frequency, that still implies an energy density of 110 orders of magnitude greater than the radiant energy from the center of the sun.

The last point to be made about zero-point energy is that it's homogenous (uniform), isotropic (identical in all directions) and ubiquitous (exists *everywhere*).

**Well...that's all well and good, but where did this idea come from?**

Zero-point energy is born out of principles of quantum mechanics, which is the physics of sub-atomic phenomena. Quantum mechanics predicts the existence of "virtual particles" that pop in and out of existence for *very* short time spans. In 1948, Hendrik B. G. Casimir predicted and showed that the existence of these particles would produce a measurable attracting force that acts on two uncharged parallel plates (in a vacuum) separated by atomic distances.



The force produced by this phenomenon (now known as the Casimir effect) is proportional to the inverse of the fourth power of the distance between the plates ( $F=k/d^4$ ) where  $k= hc/480$  where  $h$  equals Planck's constant and  $c$  equals the speed of light. So as the plates are brought closer and closer together, the force created by the decreasing number of virtual particles between the plates is overpowered by the force created from the virtual particles outside of the plates and thus the plates are forced closer together. But even though this force was readily verified with non-conducting plates, there was still a need in the scientific community to verify this effect with conducting plates. Finally, in 1997, Dr. Lamoreaux of Los Alamos Labs performed the verifying experiment with two parallel gold-plated plates attached to a torsion pendulum with less than one micrometer (micron) between the plates. The results of his experiment matched the theory of quantum electrodynamics to within 5% (a result Dr. Lamoreaux was rather pleased with).

**Well, can I like, use this "zero-point energy" to power my toaster and stuff?**

Just not too long ago, zero-point energy was seemed to be rather elusive since the energy involved came from such a high frequency of the electromagnetic spectrum. By modern conventional methods, we were only able to efficiently convert or extract energy from lower frequencies.

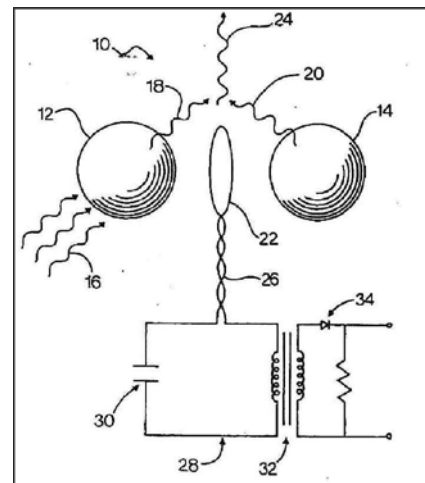
But now physicists are coming up with ways to harness an energy source that once seemed to be

out of reach. *Physical Review* has published numerous articles which state that it is theoretically possible to tap this energy source for power and propulsion.

Once a physicist for the Jet Propulsion Laboratory (JPL) Dr. Fabrizio Pinto, created Interstellar Technologies Corp. to develop near-term applications of zero-point energy. In fact, he was given a U.S. patent issued last December entitled "Method for Energy Extraction."

One method that zero-point energy can be extracted is magnetically, a feat which two Russian laboratories claimed to have managed. One of them reproduced and improved a magnetic device previously invented in England and was able to obtain an output of 7 kilowatts.

ZPower Corp. of Phoenix Arizona claims that the solution to tapping this energy source is to produce an antenna or receiver which will operate in these extremely high frequencies. Although not the same method proposed by ZPower Corp., Dr. Frank Mead, Director of the Air force Research Laboratory, patented for the first time in history on Dec. 31, 1996 an invention that would convert zero-point energy by this method. He designed spherical receivers that would collect zero-point radiation, but he had to design them so that they would work with the high frequencies that zero-point energy offers. The following diagram is a schematic of Dr. Mead's design.



Physicist Dr. Robert Forward proposed another method of extracting zero-point energy using the Casimir Effect, which when published in a journal was the first to demonstrate a Casimir Machine. The following is a diagram of his idea.

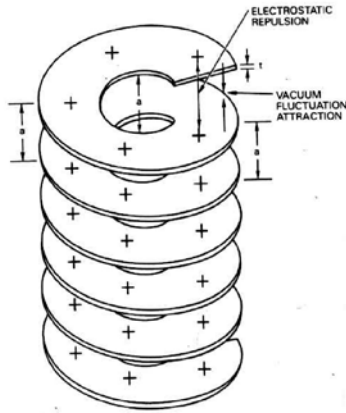


FIG. 1. Spiral design for a vacuum-fluctuation battery.

Dr. Forward describes this “parking ramp” style corkscrew or spring as a zero-point energy battery that will tap electrical energy from the vacuum and allow charge to be stored. The spring will tend to be compressed from the Casimir effect, but the like charges from the stored electrons will cause a repulsive force which will balance out the Casimir Effect. Therefore, during usage, it would be compressed since the electrons would be being used and extended when being charged.

**Will we be able to go to the stars with this stuff? That would be cooooll...**

At least two large aerospace companies and one U.S. Defense Dept. agency are “betting that ‘zero-point energy’ could be the next breakthrough in aerospace vehicle propulsion”. (Scott) If zero-point energy is the next big thing, then vehicles capable of some astonishing things are predicted to come about. For example, Mach 4 fighters (4 times the speed of sound), quiet 1,200-seat hypersonic airliners that fly at 100 mile altitudes as far as 12,000 miles in a mere 70 minutes, and 12.6 hour trips to the moon. In fact, according to William B. Scott, the author of “To the Stars”, an article in *Aviation Week & Space Technology* (3/1/04), “Spacecraft capable of interstellar travel will approach the speed of light...” A manned spacecraft to Mars powered by zero-point energy could theoretically make a trip within 7-40 days which is only dependent on the separation between Earth and Mars. But of course, researchers could be years or even decades away from the breakthroughs needed to build such a propulsion system.

So just how likely is a breakthrough in harnessing zero-point energy to usable magnitudes? This is the big question. Hal E. Puthoff, director of the Institute for advanced studies has said, “I’d say our confidence level [of a breakthrough] is 50% or better.

We have some ideas we’re exploring, but we’re not ready to talk about them.” (Goldes) Even if they’re not ready to talk, 50% still sounds semi-promising indeed. As for when any breakthroughs might be coming along? Puthoff says assuredly, “We’re definitely not stumbling around in the dark any more. It’s been shown that zero-point energy is real and has real consequences. It’s definitely a technology that’s not ready for prime time, but it’s definitely ready for serious scientific investigation.” (Scott) According to John E. Allen, a consultant to BAE Systems, a breakthrough could come about “within a decade or two.” (Scott) Who knows? Perhaps zero-point energy will take us to the stars sooner than some of us had anticipated. Perhaps mankind as we know it will find a way to attach its machinery to the “very wheelwork of nature” and soon explore bodies in the vast expanse of the universe.

#### SOURCES

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