

Dark energy: the force that will change our world

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Fourteen years ago, our understanding of the Universe's life was entirely different. Scientists believed that the Universe was born in the Big Bang, a massive explosion from which the Universe sprung, rapidly growing from a microscopic size to being light years across. The material formed stars, planets, and galaxies, and would either continue to expand forever, slowed by gravity, or, if the gravity is strong enough, would eventually cause the Universe to implode in on itself and possibly restart the process. That was fourteen years ago. Since then, scientists have discovered that the Universe has not only continued to expand, as the prediction had stated, but it has also that but the expansion is accelerating.

That meant that some form of energy, temporarily named dark energy, had to be driving the Universe apart, and the total amount of dark energy had to be greater than the total amount of every form of energy combined previously believed to exist in the Universe. Where is all of this energy coming from? This is still a heavily debated topic, but many scientists have proposed theories for its source. One of the most widely accepted theories for the origin of dark energy is vacuum energy. Vacuum energy is a form of energy that is always present in some amount in a vacuum, or a region completely devoid of all matter. The amount of energy in a vacuum varies based on conditions surrounding the vacuum, or areas where matter is present.

In the vacuum of space, the conditions on stars and planets influence the vacuum energy. Scientists have estimated, based on the approximate conditions on these stars and planets, that the total amount of vacuum energy in existence is enormous- more than would come from the entirety of

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matter in the Universe, if it were all converted to energy in the way that Einstein described, and the way that nuclear weapons utilize to produce massive explosions. But how could dark energy research affect your life? Imagine a world without the use of fossil fuels. Imagine being free of the worry of a tomorrow without energy. Imagine everybody living free of the ever-growing and increasingly threatening energy bills that everybody must pay. Imagine living without the omnipresent guilt residing in the back of your mind that comes from the knowledge that every day, you add to the destruction of habitats for animals.

This all may sound like something possible in the far future, or coming from science fiction, but it could be possible within your lifetime- thanks to the work of scientists from countless universities around the globe racing to complete an electricity generator that will not use any kind of fuel, and the only resources it will use are the materials used to build it. But how does this generator work? It relies on vacuum energy. Vacuum energy constantly generates particles- two at a time, one being normal matter, and the other is its equivalent in antimatter. These particles- known as virtual particles- only come into existence for a tiny fraction of a second. In fact, the time they exist for is too short for them to be detected directly, and scientists have instead relied on indirect methods to prove their existence. The generator relies on virtual particles to drive its turbine.

As two objects cannot occupy the same space at the same time, the virtual particles will push two charged metal plates in a vacuum away from each other. The generator uses this force by placing a charged metal disc on a stem that is allowed to rotate. Branching off of this stem are slanted metal

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plates that, when placed in a vacuum, are pushed away from the disc by virtual particles, spinning the stem, which turns a generator. Given the right conditions, this generator produces more power than it takes to keep the plate charged. This means that the excess power can be used for anything that electricity would normally be used for- powering appliances, computers, powering electric ovens, and so on. If we can create devices that run only on electricity, we will have no dependence on fossil fuels, and no air pollution from them.

Our environments would not be ravaged from the wild search for energy sources, and the world would be a better place to live in.