Space Harvesting of Antimatter Might Fuel Starships

Analysis by Ray Villard
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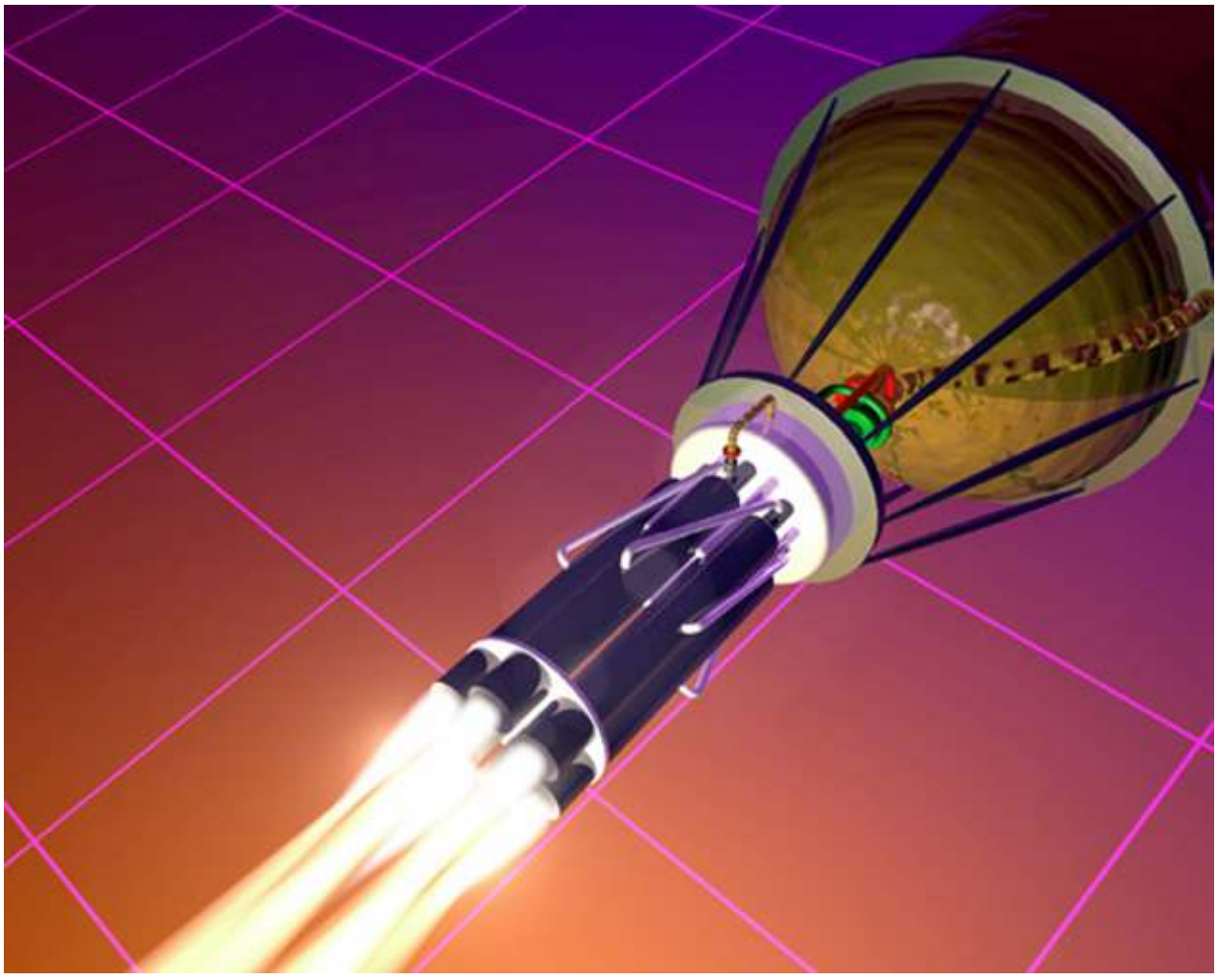


Over the coming decades there will be increasing discussion about sending robotic interstellar probes to nearby stars.

The discovery and cataloging of inhabited planets within just a few light-years of Earth will provide the motivation -- we'll want to see how Darwinian evolution has played out on other worlds.

WATCH VIDEO: Discovery News investigates how and why the Large Hadron Collider is smashing protons together at record energies.

WIDE ANGLE: Project Icarus: Reaching for Interstellar Space

Remote sensing from huge space telescopes may never definitively prove that life is elsewhere -- we'll want to see it squirming under a microscope or, better yet, walking on all six legs.

But how to get to the stars? Both scientists and science fiction writers have long favored matter-antimatter propulsion. In the Star Trek TV series, antimatter fuel is discussed as casually as buying a propane cylinder for the barbecue grill.

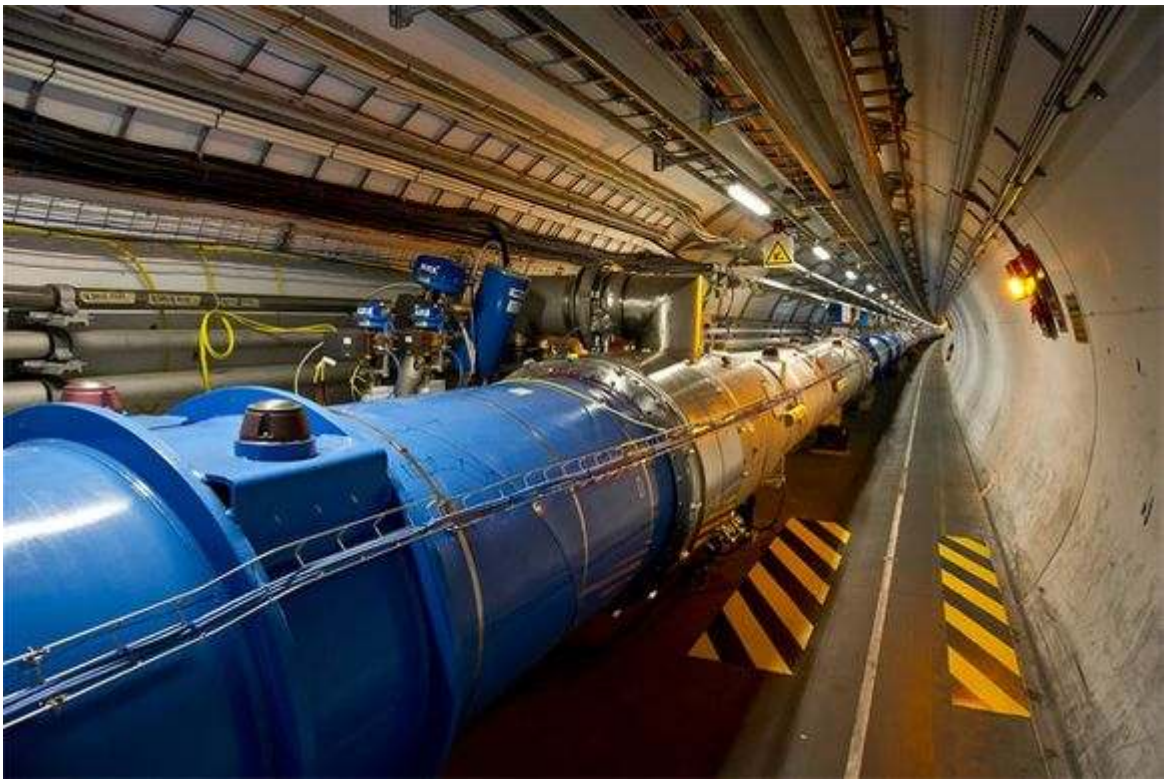
Antimatter is the mirror image of the electrical charges found in normal matter. It was abundant after the big bang. But when it came into contact with normal matter-- **poof!** The Ying-Yang forms of matter annihilated with each other in a powerful burst of gamma rays.

Fortunately for us, there was a very slight excess of normal matter in the early universe to make stars, planets, and people. This is call a *CP violation*: the breakdown of the predicted symmetry between the number of particle and antiparticles made in the Big Bang.

ANALYSIS: Antimatter Matters: Fermilab Glimpses 'The Toe of God'

The problem is that God doesn't make half the universe out of antimatter any more. And even if there were whole antimatter galaxies out there you'd want to stay far away from them.

But as a source of fuel antimatter can't be beat, as Jennifer Ouellette describes in her recent article.



In the 2009 film "Angels & Demons" antimatter extracted from the Large Hadron Collider is use to manufacture a terrorist bomb for leveling the Vatican. *Talk about overkill!*

In reality, some estimates suggest that it would take 1,000 years to make a microgram of antimatter with present-day accelerators. However, the intensity of beams of antiprotons in accelerators has increased about four orders of magnitude per decade. Coincidentally, the growth in production of liquid hydrogen, which propelled NASA's space shuttle, has likewise increased exponentially over the past few decades.

A stash of antihydrogen may grow exponentially such that a microgram of fuel might be produced by the middle of the 21st century say some experts.

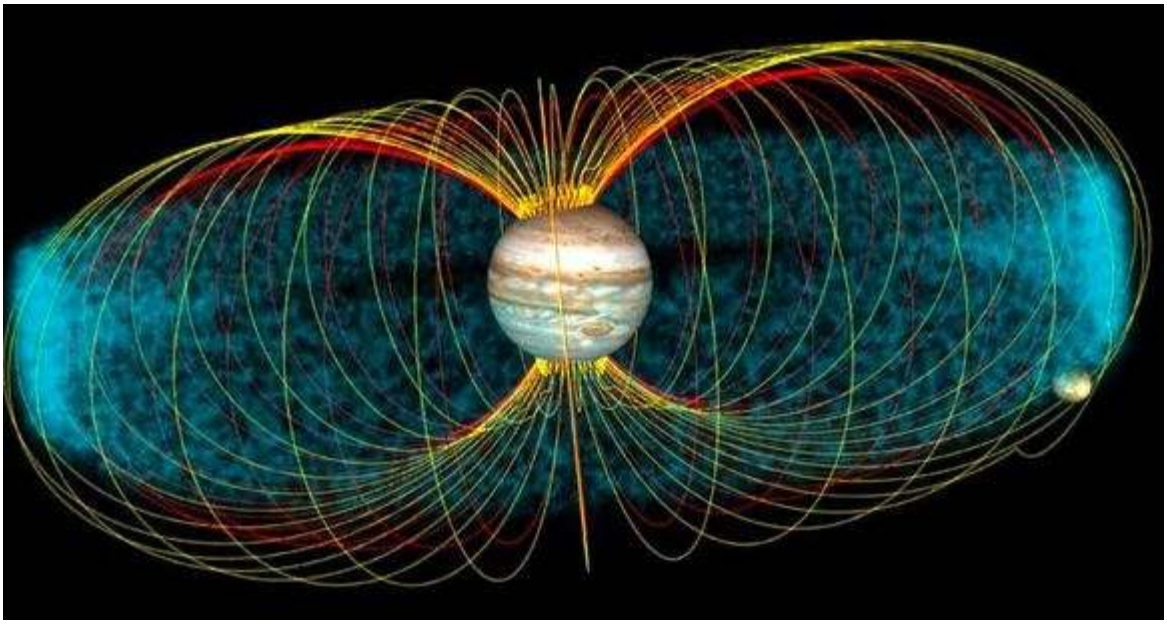
The trouble is that *a lot* more antimatter is needed for an interstellar mission. For a planet reconnaissance and landing mission, the starship will have to have enough fuel to decelerate into the target star system. A starship with a 100-ton payload designed for a cruising at 40 percent the speed of light would require the equivalent of 80 ocean supertankers full of antimatter fuel. If the cruise speed were limited to 25 percent the speed of light or less, fuel requirements would be dramatically lower.

Antimatter propelled starships can only become more than a sci-fi dream if it ever becomes feasible to accumulate antimatter in large quantities. And, once it's collected it has to be stored safely, shielded from contact with normal matter. In 2011, CERN's Antihydrogen Laser Physics Apparatus (ALPHA) trapped 309 atoms of antimatter for more than a quarter of an hour.

NEWS: Record Smashed: Antimatter Trapped for 16 Minutes

The upshot is: we'll likely have to turn to nature to make the antimatter for us.

Antiprotons have been discovered trapped by the Earth's magnetic field by the international PAMELA (Payload for Antimatter/Matter Exploration and Light-nuclei Astrophysics) satellite. The Alpha Magnetic Spectrometer recently installed on the International Space Station should also be able to detect, identify, and measure antiparticles in Earth orbit.



Theoretical studies suggest that the magnetospheres of much larger planets, like Jupiter, should have more antiprotons than Earth. "If feasible, harvesting antimatter in space would completely bypass the obstacle of low energy efficiency when an accelerator is used to produce antimatter," writes Ronan Keane (Western Reserve Academy) and Wei-Ming Zhang (Kent State University) in a recently published paper on antimatter engine design.

As far-fetched as all of this may sound, imagine trying to explain to Lord Kelvin or Thomas Edison the mastery we'd have over matter and energy at the start of the 21st century. Even Albert Einstein was quoted in 1932 as saying, "There is not the slightest indication that nuclear energy will be obtainable." Therefore, the seemingly impossible challenges of using anitimatter as the ultimate power source may be comparatively routine a century from now.

Antimatter harvesting fuel tankers may someday ply interplanetary space between Earth and Jupiter. Orbiting antimatter fuel depots may be built up as a resource for launching our first interstellar mission to rendezvous with "Earth II."

Image credits: NASA, CERN

Story taken from:

http://news.discovery.com/space/harvesting-antimatter-in-space-to-fuel-starships-120523.html#mkcpgn=rssnws1