



## The Warren Astronomical Society Paper

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## Astro Chatter

by Larry Kalinowski



NASA announced that it has found definite proof of the existence of dark matter. The picture shows a ring of dark material that surrounds the galaxy cluster ZwCl 0024+1652.

Closer study revealed a ripple in the dark matter, which distorts the background galaxies, much like the bottom of a pool is distorted

with wave action. It's five billion light years from Earth and 2.6 million light years in diameter.

The Hubble telescope was used for the discovery.



Twenty-eight more planets have been discovered outside our solar system, according to Jason Write of the University of California, Berkley. Some around brown dwarf stars, which were not considered to be planet harbingers in the past. The rest were around M type stars, about twice as large as are Sun.

The Earth seems to have "captured" a third asteroid that has a period similar to the Earth. It's called 2003 YN107. The orbit is so awkward that it may escape the Earth's influence in the next few years. So far its made four orbits around our planet, since its discovery. The object is believed to be an asteroid or a small portion of the Moon that blew away from its surface during a collision, long ago.

A Venus-Saturn conjunction will occur on June 30 – July 1, making interesting viewing, to say the least. Closest approach is actually on the 30th. The two will be 0.7 and 0.8 degrees apart on those two days. I'm bringing it up in this issue, just in case the July issue comes out later in the month.











## **The Ions of Dawn** **By Patrick L. Barry**

This summer, NASA will launch a probe bound for two unexplored worlds in our solar system's asteroid belt—giant asteroids Ceres and Vesta. The probe, called Dawn, will orbit first one body and then the other in a never-before-attempted maneuver.

It has never been attempted, in part, because this mission would be virtually impossible with conventional propulsion. “Even if we were just going to go to Vesta, we would need one of the largest rockets that the U.S. has to carry all that propellant,” says Marc Rayman, Project System Engineer for Dawn at JPL. Traveling to both worlds in one mission would require an even bigger rocket.

This is a trip that calls for the *unconventional*. “We’re using ion propulsion,” says Rayman.

The ion engines for the Dawn spacecraft proved themselves aboard an earlier, experimental mission known as Deep Space 1 (DS1). Because ion propulsion is a relatively new technology that’s very different from conventional rockets, it was a perfect candidate for DS1, a part of NASA's New Millennium Program, which flight-tests new technologies so that missions such as Dawn can use those technologies reliably.

“The fact that those same engines are now making the Dawn mission possible shows that New Millennium accomplished what it set out to,” Rayman says.

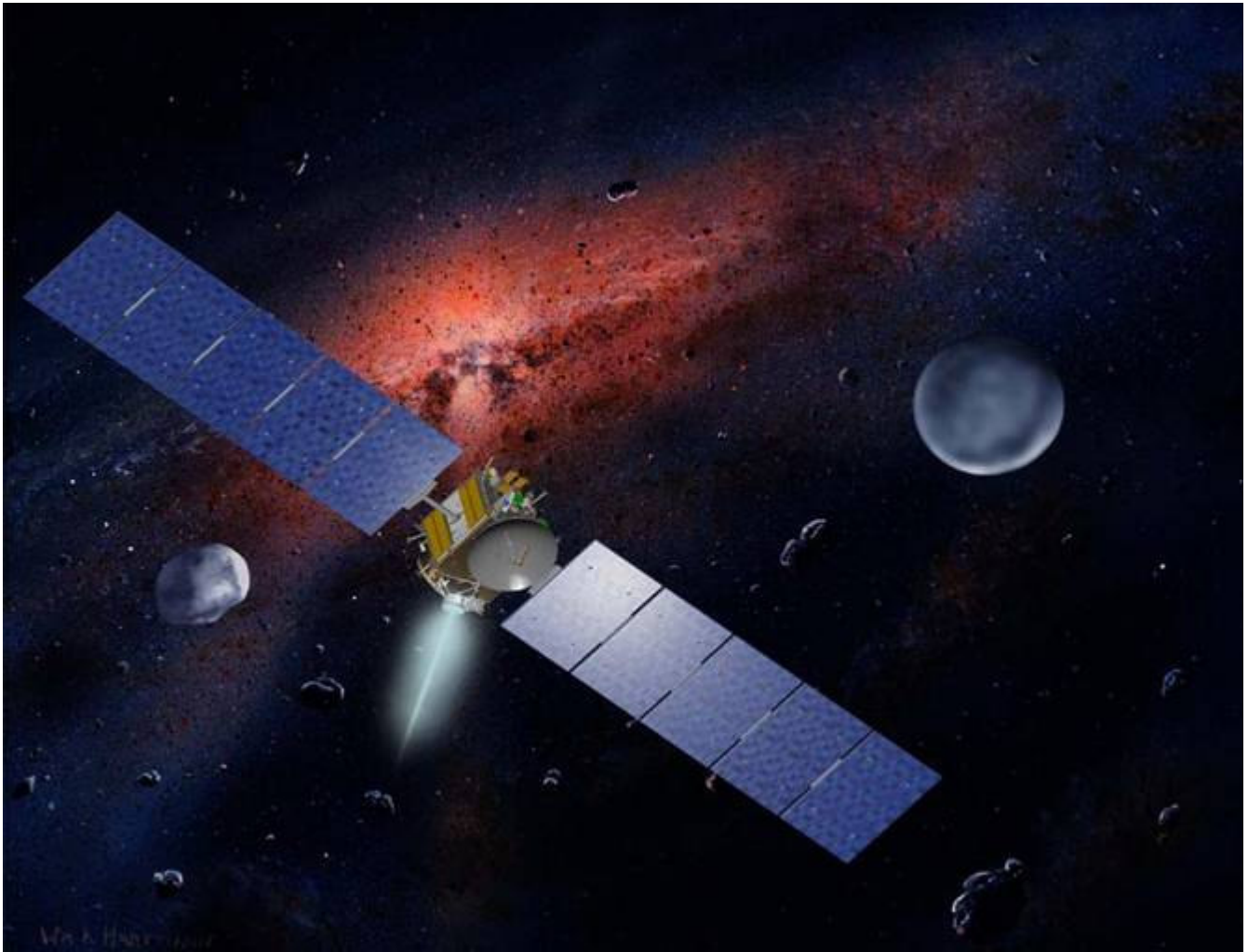
Ion engines work on a principle different from conventional rockets. A normal rocket engine burns a chemical fuel to produce thrust. An ion engine doesn't burn anything; a strong electric field in the engine propels charged atoms such as xenon to very high speed. The thrust produced is tiny—roughly equivalent to the weight of a piece of paper—but over time, it can generate as much speed as a conventional rocket while using only about 1/10 as much propellant.

And Dawn will need lots of propulsion. It must first climb into Vesta's orbit, which is tilted about 7 degrees from the plane of the solar system. After studying Vesta, it will have to escape its gravity and maneuver to insert itself in an orbit around Ceres—the first spacecraft to orbit two distant bodies. Dawn's up-close views of these worlds will help scientists understand the early solar system.

“They're remnants from the time the planets were being formed,” Rayman says. “They have preserved a record of the conditions at the dawn of the solar system.”

Find out about other New Millennium Program validated technologies and how they are being used in science missions at <http://nmp/TECHNOLOGY/infusion.html> . While you're there, you can also download “Professor Starr's Dream Trip,” a storybook for grown-ups about how ion propulsion enabled a scientist's dream of visiting the asteroids come true. A simpler children's version is available at <http://spaceplace.nasa.gov/en/kids/nmp/starr>.

*This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.*



*Artist's rendering of Dawn spacecraft, with asteroids. Largest are Vesta and Ceres. Credits: Dawn spacecraft—Orbital Sciences Corporation; background art—William K. Hartmann, courtesy UCLA.*



PRESENTS

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