

# 7 Cassini spies Titan's "Black Sea"

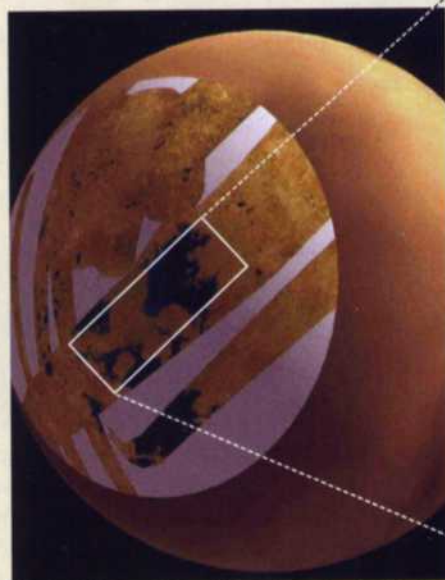
As NASA's Cassini spacecraft flew near the north pole of Saturn's largest moon February 22, its radar partially imaged a lake so big mission scientists are calling it a sea. What Cassini saw indicates this plus-sized pond takes up a greater percentage of Titan's real estate than the Black Sea does here on Earth.

The spacecraft, in orbit around Saturn since mid 2004, uses a radar beam to punch through Titan's smoggy atmosphere. The instrument has found numerous dark, smooth areas planetary scientists believe are lakes. "We've long hypothesized about oceans on Titan and now, with multiple

instruments, we have a first indication of seas that dwarf the lakes seen previously," says Jonathan Lunine, a planetary scientist at the University of Arizona, Tucson.

While Cassini researchers lack definitive proof the terrain contains liquid, they find themselves increasingly comfortable with this conclusion. The surface smoothness, shore-like contours, and other properties of these features make it difficult to call them anything but lakes.

So, what are they filled with? Titan's frigid atmosphere holds much methane and ethane. Scientists expect any surface fluids will be a cocktail of these two substances.



**EACH TIME** Cassini sweeps over Titan, the craft's radar reveals another strip of the smoggy moon's surface. NASA/JPL/USGS

# 6 Welcome to Milkomeda

An oft-cited tidbit of astronomical lore is the pending collision between the Andromeda Galaxy (M31) and the Milky Way. In May, T. J. Cox and Abraham Loeb at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, presented the most detailed analysis yet of the future cosmic crash and its aftermath. The study showed the collision will happen sooner than previously thought — and may include a surprising twist for the solar system.

The researchers developed new computer models of both galaxies — including the gas and dark matter between them — and then simulated the crash. The two great spirals approach and pass one another multiple times before finally merging, and each interaction creates long tidal tails of stars. The merged object, which Loeb dubbed Milkomeda, undergoes only a modest increase in star formation. By the time the merger is complete, both galaxies will have used up most of their available gas quiescently making stars.

The most surprising aspect, say the researchers, is that the merger will take place within 5 billion years — before the Sun will burn out. The first pass will occur only 2 billion years from now, at least a billion years earlier than previous estimates. Intergalactic material and the galaxies' dark-matter halos sap much of the galaxies' orbital energy, which results in an earlier collision.

Another surprise was the solar system's fate. The astronomers compute a 10-percent chance the collision will sweep the Sun, its planets safely in tow, into one of those tidal streamers during the



**AT THEIR FIRST ENCOUNTER** 2 billion years hence, Andromeda and the Milky Way may resemble NGC 2207 (left) and IC 2163. The interacting galaxies lie 114 million light-years away in Canis Major. NASA/HUBBLE HERITAGE (STSC)

galaxies' first encounter. The next time around, there's a 50-50 chance the solar system will be cast out.

One unexpected possibility: The Sun could switch galaxies and become bound to M31 before the merger. "In effect, Andromeda will capture the Sun, and future astronomers in the solar system might see the Milky Way as an external galaxy in the night sky," Loeb muses. An exciting outcome, certainly, but the astronomers emphasize it's also an unlikely one. They compute only a 2.7-percent chance M31 will steal the solar system.

"The motivation for the study came from work I did in 2001 about the observational implications of living in an accelerating universe," Loeb explains. In the future, all distant galaxies will accelerate away from us, eventually reach the speed of light relative to us, and then fade from our view. Andromeda is the only massive galaxy that will remain bound to the Milky Way. "If you want to do extragalactic astronomy," Loeb jokes, "you'd better do it now."