

Triton Fun Company

Science Newsletter June 2007

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Does Mercury still have a molten core ?

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Does the innermost planet in our Solar System still have a molten core? Being considerably smaller than Mars (and every other planet, given the recent and notorious loss of Pluto), Mercury's interior should have cooled off billions of years ago, leaving a planet that's solid all the way through.

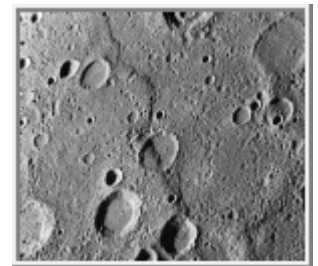
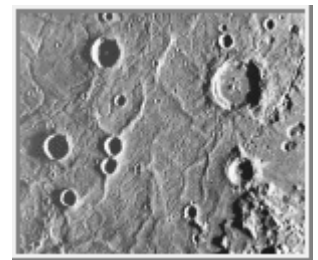
Yet, the Mariner 10 spacecraft, which visited Mercury in 1974, measured a magnetic field 1/100 the strength of Earth's. The laws of physics weigh in mightily on magnetic fields: They're generated by moving charges, and that means a liquid iron interior for a planet that really shouldn't have one. This has been a real scientific head-scratcher for decades, but planetary geologists have two possibilities that might just fly for the wing-shoed messenger of the gods:

(1) If Mercury's crust is permanently and strongly magnetized, it might be able to account for the relatively mild field strengths of Mercury. This, however, only works if the crust is much thicker on one side—the field of a uniform crust would simply cancel itself out, leaving us utterly demagnetized. Can New York pizza and Chicago pizza coexist on one small world?

(2) If the iron is mixed with substantial quantities of sulfur, it could have a much lower melting point, keeping it fluid even after four and a half billion years of cool-down time.

Enter Stan Peale of UC Santa Barbara and his colleagues from Cornell. They used extraordinarily precise radio signals to detect the motions of Mercury's surface features as they rock, or *librate*, back and forth during the course of Mercury's elliptical orbit. The effect is much greater than it should be for a solid planet, all of which has to be grabbed and twisted by the sun's gravity. A detached, molten core fits the observations much better—but these observations are not easy.

If Mercury has substantial amounts of sulfur—which has a low melting point, and would seem to have come from a *cooler* part of the Solar System—this would be the flip side of Comets Wild 2 and Temple 1, which seem to have gathered material from *hotter* parts of the Solar System. What does this tell us about the early history of the planets? Was it Celestial Bumper Cars? Or are we barking up the wrong pantheon?



Mercury's surface

Fascinating geology on Mercury: the smooth areas are cooled lavas and mare. Mariner 10 images: taken March 1974

NASA's Messenger Mission to the innermost planet is now only months away from its first encounter with Mercury! There's all the more reason now to be excited—and we already were—about what its wing-tipped instruments will tell us. See the Planetary Society website (and other sites listed below) for more information. (And the Dwarf Planetary Society for Pluto updates!).

We are always looking for **contributors** to the Science Newsletter. If you would like to write an article about a science subject you are excited about, or contribute a superfluous question, or if you would like to be on our **mailing list** for future newsletters, please e-mail us at:

science@tritonfun.com

More info on Mercury

From your Newsletter Editor

Photos: NASA/JPL/JHUAPL/CIW

Websites about the MESSENGER mission and the Mariner 10 mission to Mercury :

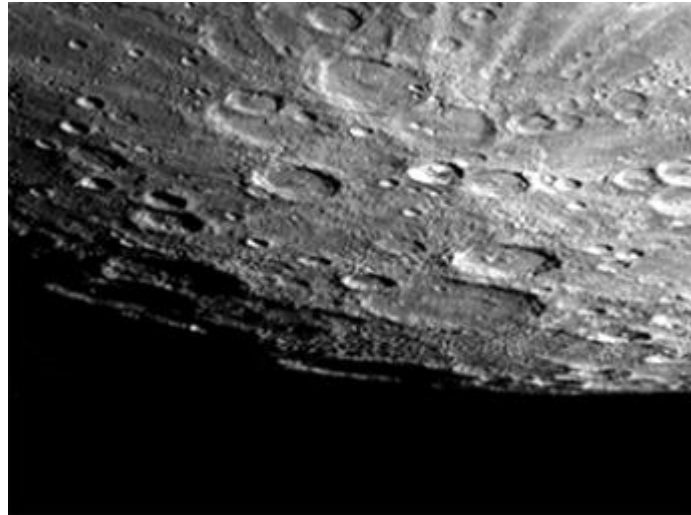
<http://messenger.jhuapl.edu/index.php>

<http://www.planetary.org/explore/topics/messenger/>

<http://www.ksc.nasa.gov/elnw/messenger/index.htm>

<http://nssdc.gsfc.nasa.gov/database/MasterCatalog?sc=1973-085A>

Mariner 10 was a NASA spacecraft that was the first and only mission to visit and study Mercury. Now, over 30 years later, the **Messenger mission** continues the exploration. **Messenger** flew by *Venus* and got a gravity assist on June 5, 2007 ! The first *Mercury* flyby by **Messenger** will be in January 2008. The actual primary mission when the spacecraft goes into Mercury orbit (and where most of the science will be done) will start in 2011. **Messenger** is run by the Johns Hopkins Applied Physics Laboratory.



Planet Mercury

The hellishly hot innermost planet of our solar system. Mercury was visited by the Mariner 10 spacecraft in 1974-1975. Celestial mechanics allowed spacecraft mission controllers to send the Mariner 10 spacecraft flying past Mercury 3 times (so it made 3 encounters: March 1974, September 1974, and March 1975). However, each time it flew by, it looked at the same hemisphere of Mercury. The Messenger mission will be able to view the other hemisphere which has never been seen by humanity. This is primary exploration and we will be exploring new terrain on this mysterious planet.

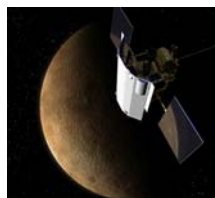
Mercury is very hot on the sun-facing side (800 F) and extremely cold (-300 F) on the side not facing the sun. Mercury turns on its axis only once every 59 days. This slow rotation allows the sun to heat it for a long time making the planet very hot.

Photo: Mariner 10 image of the south pole of Mercury taken in September 1974



Mercury's surface

Scarp and ridges and craters, oh my !



Messenger spacecraft orbits Mercury

Spacecraft will see sides of Mercury that have never been explored: new extraterrestrial landscapes

Mariner 10 First to Mercury



References:

Murray, B.C., Mercury, *Scientific American*, 233, 58 (1975)

Murray, B.C., Mariner-10 pictures of Mercury—overview, *J. Geophys. Res.* **80**, 2342 (1975)

Strom, R.G. et al. Preliminary imaging results from 2nd Mercury encounter, *J. Geophys. Res.* **80**, 2345 (1975)

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Magnetosphere hats

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** Send us your superfluous questions for a future issue ! They can be on any subject. The funnier, the better. M.D., our editor, appreciates the help and will send you a free Triton Fun coffee mug as compensation for your question. Or write an article for us and be read by professional and amateur astronomers and scientists in the U.S. and Canada ! **

Superfluous Questions:

1. When (and where) were shoelaces first invented ?
 - a) 1790 in England
 - b) 1820 in Boston
 - c) 1804 in France
 - d) 1850 in New York
2. What actor in the classic TV series "Suddenly Susan" also appeared in the classic film "Breaking Away" ?
 - a) Brooke Shields
 - b) Dennis Quaid
 - c) Barbara Barrie
 - d) Nestor Carbonell
3. What are neutralinos ?
 - a) Italian meatballs
 - b) displaced persons
 - c) battery dischargers
 - d) subatomic particles
4. What is a stannane ?
 - a) a bridge connector
 - b) an officer in the Greek Navy
 - c) a compound containing tin
 - d) a tool for fixing microscopes

—> ANSWERS in next months issue of the Science Newsletter ! <—

** ANSWERS to May's Superfluous Questions: 1. b) Berkeley 2. c) fluid-filled sacs 3. d) Lucius Snow 4. b) California