News archive

- 2010
  - January 2010
- 2009
- 2008
- 2007
- 2006
- 2005
- 2004
- 2003
- 2002
- 2001
- 2000
- 1999
- 1998
- 1997

Planetary physics shrunk into a lab as MIT pursues fusion

Jan 28, 2010 6 comments

Researchers in the US have simulated a magnetic field structure normally produced by the core of a planet, and they say that their design could lead to an efficient way of harnessing nuclear fusion for power generation. The experiment, based at the Massachusetts Institute of Technology (MIT), could also provide an opportunity for space physicists to model the dynamics of planetary magnetic fields and their interaction with charged particles from space.

Nuclear fusion is the powerhouse of stars resulting in the release of vast amounts of energy and the formation of heavier elements – the building blocks of the world we see around us. Some physicists believe that fusion could be harnessed as a source of energy here on Earth by combining deuterium and tritium at high temperatures to form helium-4 plus a neutron. The abundance of its raw materials, the absence of direct carbon dioxide emissions, and the minimal amount of harmful waste are among fusion's major selling points.

One of the most promising ways of reaching the appropriate temperature and pressure is to use magnetic fields to "confine" plasma – clouds of ionized gas. In the majority of these experiments, plasmas are confined inside large doughnut-shaped vessels called tokamaks. Physicists have so far failed, however, to get more energy out of a tokamak than the energy used to heat and confine the plasma.

Planetary inspiration

In this latest research, Michael Mauel of Columbia University, New York, and his colleagues explore an alternative design inspired by observations of planetary magnetic fields. They suspend a half-ton magnet using powerful electromagnetic fields, and use this to manipulate plasma at 10 million K trapped inside a steel ring structure in an experiment called the Levitated Dipole Experiment, or LDX. The results confirm the researcher's prediction that random turbulence inside the magnetic chamber increases the density of plasma – a crucial step towards fusion.

Related stories

- Protons bring fusion into view
- Europe moves forward with laser-fusion plans
- Fusion: the way ahead (in depth)
- Fusion: the final frontier for plasmas (in depth)

Related links

- Michael Mauel
- Levitated Dipole Experiment

Restricted links

- *Nature Physics*

"This experiment was inspired by space research that has occurred over the past 50 years," says Mauel. "Satellites have explored the magnetospheres of planets such as Earth's or Jupiter's and these space observations showed a dipole magnetic field could confine hot ionized matter at high pressure."

This experiment was inspired by space research that has occurred over the past 50 years

Michael Mauel, Columbia University

Mauel says that the LDX has distinct benefits over tokamak experiments because the dipole magnetic field is not "twisted or helical" and the plasma is able to circulate from the edge to the hot core without producing a drain on the plasma's energy. He says that confining fusion with dipole fields would be particularly suitable for so-called "second-generation" fusion fuel, which avoids the need to breed radioactive tritium from lithium, which is the fuel of choice for tokamaks.

Manuel believes that these results could also aid space science. "These results will be of interest to space physicists who study the dynamics of ionized bases confined to outer space by the dipole magnetic field of planets."

To develop their work, the researchers intend to create hotter plasmas to increase the rate of fusion. They also wish to improve the precision of temperature measurement in their experiment.

This research is published in *Nature Physics*.

About the author

James Dacey is a reporter for *physicsworld.com*

6 comments

Add your comments on this article

1 **John Duffield**
Jan 28, 2010 4:15 PM
United Kingdom

Excellent stuff. Good old MIT.

Reply to this comment · Offensive? Unsuitable? Notify Editor

2 **kasuha**
Jan 28, 2010 7:59 PM
Prague, Czech Republic

Correct name for the machine is tokamak, not tokomak. It's a russian abbreviation originally.

Reply to this comment · Offensive? Unsuitable? Notify Editor

3 **James Dacey**
Jan 29, 2010 11:14 AM
United Kingdom

Quote:

> *Originally posted by* ***kasuha***
> Correct name for the machine is tokamak, not tokomak. It's a russian abbreviation originally.

Thank you for pointing this out - the article has been updated. According to the Larouse Dictionary of Science and Technolgy, the term 'tokamak' is an acronym of the Russian words meaning toroidal magnetic chamber.

Reply to this comment · Offensive? Unsuitable? Notify Editor

4 **dsakarya**
Jan 29, 2010 4:12 AM
Dover, United States

Fusion has always been just....

"a few decades in the future", for the last haft century.

Reply to this comment · Offensive? Unsuitable? Notify Editor

5 **jimbo**
Jan 29, 2010 5:19 AM
eugene, United States

Dyskara is RightOn.
Believing that slow, inchworm-like progress will make it happen is to be blind to both history & the present reality of fusion research. From Project Sherwood in the 1950s, to Tokamaks in the 1980's, to the ITER & NIF today, the track record is abyssmal with regard to fusion's delivering energy to the electric power grid. This is more of the same BS hype that the president, congress, DOE, and national labs have inundated the public with for 50+ years !! Yet still the $$$ flow, promises are broken, hype extended ad nauseam, & Nothing is delivered. Oh, and did I mention: if this dipole idea has been known for 50 years, why have our prescient MIT fusion scientists, just Now gotten around to implementing it ?? Answer: desperation. It will make no difference in their zero-sum game.
Better to break lock with federal programs, and ask WHY have private industries not been empowered to make fusion happen ??
The great Robert Bussard came closest, but the NAVY pulled funding from his company, prior to his recent death. Many others are trying, but their funding is ~1% of federal programs.

If this busted, broken down jalopy continues to amble down the road, it will eventually run out of ideas, hype, & gas.

Reply to this comment | Offensive? Unsuitable? Notify Editor

6

MikeMcc
Jan 29, 2010 9:46 AM
Royston, United Kingdom

Quote:

> *Originally posted by* ***jimbo***
> Dyskara is RightOn.
> Believing that slow, inchworm-like progress will make it happen is to be blind to both history & the present reality of fusion research. From Project Sherwood in the 1950s, to Tokamaks in the 1980's, to the ITER & NIF today, the track record is abyssmal with regard to fusion's delivering energy to the electric power grid.
> This is more of the same BS hype that the president, congress, DOE, and national labs have inundated the public with for 50+ years !! Yet still the $$$ flow, promises are broken, hype extended ad nauseam, & Nothing is delivered. Oh, and did I mention: if this dipole idea has been known for 50 years, why have our prescient MIT fusion scientists, just Now gotten around to implementing it ?? Answer: desperation. It will make no difference in their zero-sum game.
> Better to break lock with federal programs, and ask WHY have private industries not been empowered to make fusion happen ??
> The great Robert Bussard came closest, but the NAVY pulled funding from his company, prior to his recent death. Many others are trying, but their funding is ~1% of federal programs.
> If this busted, broken down jalopy continues to amble down the road, it will eventually run out of ideas, hype, & gas.

Jimbo, you're actually wrong abot the polywell reactor research. The next tranche of funding is in for WB7 and WB8, the work continues and is looking promising. Your comparison of early Tokamaks and JET/ITER/DEMO is also ill-informed, they have made great strides in understanding the processes and refining the engineering concerned. ITER will be a net producer of energy.

Reply to this comment | Offensive? Unsuitable? Notify Editor