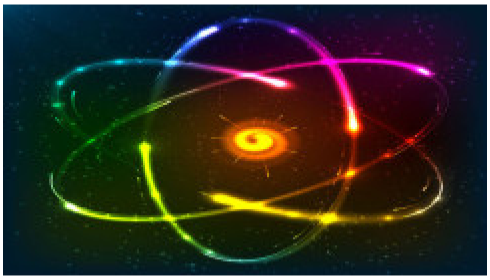
Fusion Research Breakthrough: Controlling Fusion Heat Bursts

By Raphael Rosen | *Science Daily



Researchers from General Atomics and the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) have made a major breakthrough in understanding how potentially damaging heat bursts inside a fusion reactor can be controlled. Scientists performed the experiments on the DIII-D National Fusion Facility, a tokamak operated by General Atomics in San Diego. The findings represent a key step in predicting how to control heat bursts in future fusion facilities including ITER, an international experiment under construction in France to demonstrate the feasibility of fusion energy. This work is supported by the DOE Office of Science (Fusion Energy Sciences).

The studies build upon previous work pioneered on DIII-D showing that these intense heat bursts – called "ELMs" for short – could be suppressed with tiny magnetic fields. These tiny fields cause the edge of the plasma to smoothly release heat, thereby avoiding the damaging heat bursts. But until now, scientists did not understand how these fields worked. "Many mysteries surrounded how the plasma distorts to suppress these heat bursts," said Carlos Paz-Soldan, a General Atomics scientist and lead author of the first of the two papers that report the seminal findings back-to-back in the same issue of

Physical Review Letters this week.

Paz-Soldan and a multi-institutional team of researchers found that tiny magnetic fields applied to the device can create two distinct kinds of response, rather than just one response as previously thought. The new response produces a ripple in the magnetic field near the plasma edge, allowing more heat to leak out at just the right rate to avert the intense heat bursts. Researchers applied the magnetic fields by running electrical current through coils around the plasma. Pickup coils then detected the plasma response, much as the microphone on a guitar picks up string vibrations.

The second result, led by PPPL scientist Raffi Nazikian, who heads the PPPL research team at DIII-D, identified the changes in the plasma that lead to the suppression of the large edge heat bursts or ELMs. The team found clear evidence that the plasma was deforming in just the way needed to allow the heat to slowly leak out. The measured magnetic distortions of the plasma edge indicated that the magnetic field was gently tearing in a narrow layer, a key prediction for how heat bursts can be prevented. “The configuration changes suddenly when the plasma is tapped in a certain way,” Nazikian said, “and it is this response that suppresses the ELMs.”

[Read more here]

Story Source:

The above story is based on materials provided by **DOE/Princeton Plasma Physics Laboratory**. The original article was written by Raphael Rosen. *Note: Materials may be edited for content and length.*

Journal References:

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