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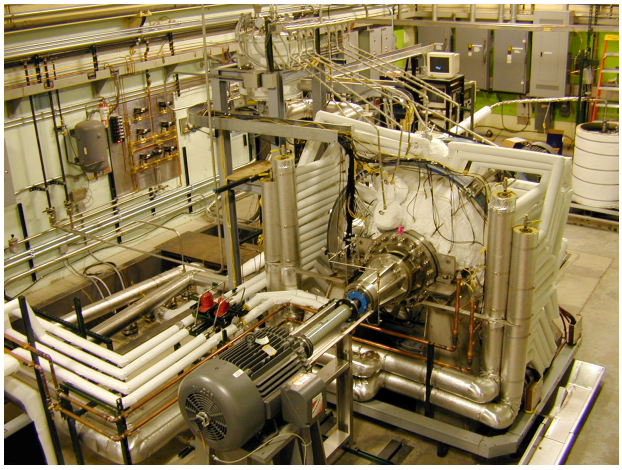
Dynamo provides clues to origin of magnetic fields

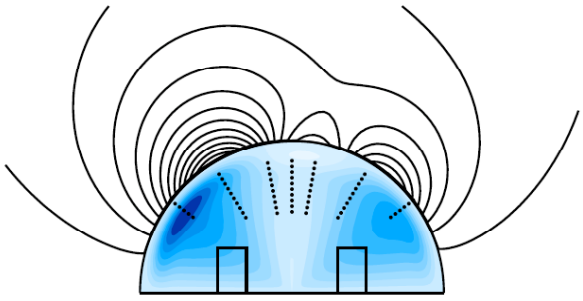
Device replicates the magnetic fields generated at Earth's core

DENVER, Colorado, Oct. 24, 2005 – Research on the Madison Dynamo Experiment at the University of Wisconsin at Madison has revealed new insights into the behavior of the magnetic fields generated by Earth and other rotating objects, including planets, stars, and galaxies.

This research seeks to understand the mechanisms that govern the development and growth of magnetic fields. New experimental results, which will be presented in a review talk at the 2005 APS Division of Plasma Physics Annual Meeting, include:



Madison Dynamo Experiment



Measured magnetic fields: Color contours inside the hemisphere represent the magnetic field going around the axis, and field lines on the outside show the dipole structure generated by turbulence.

- Observation of the shredding of magnetic fields by a turbulent flow. When a relatively smooth magnetic field is applied to the experiment from magnets outside the device, the turbulence in the flow strongly distorts both the shape and strength of the magnetic field.

- A strong internal magnetic field going around the axis of the machine (corresponding to the East-West direction in the Earth) is measured directly by probes inserted into the experimental dynamo. This effect probably exists in the Earth but is yet unobservable.

- The generation of a dipole magnetic field (a simple north and south pole) along the axis of the device, produced by turbulence in the liquid metal.

- Intermittent self-excitation of the dynamo. The turbulent variation in the flow occasionally brings the flow into a state where magnetic fields can spontaneously grow. The fields are observed to grow, but then the flow changes to a state where magnetic fields are damped out.

Research at the Madison Dynamo Experiment uses a spherical vessel that holds a cubic meter of molten sodium. Under experimental conditions, it uses propellers to drive flows and create conditions necessary to generate a magnetic field in a similar manner to that of the Earth and the Sun.

The device's operating parameters can be manipulated to yield experimental data on magnetic-field generating systems—such as entire galaxies, stars, and Earth and other planets—that previously could only be observed and modeled.

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[BI2.00001] Initial results from the Madison Dynamo Experiment
Abstract: **http://meetings.aps.org/Meeting/DPP05/Event/34487**
October 24, 2005
Monday, 9:30-10:00 am
Invited Session BI2: Basic Plasma Physics I
Adam's Mark Hotel - Plaza Ballroom EF

Further information
http://aida.physics.wisc.edu/