The Reversing Magnetic Field of Planet Earth

Jean M. Favre
Swiss National Supercomp. Center
Via Cantonale
CH-6928 Manno
+41 91 610 82 40
jfavre@cscs.ch

Jon Rotvig
Institut für Geophysik
ETH Zürich, NO H 11.2
CH-8092 Zürich
+41 44 633 26 05
jon.rotvig@erdw.ethz.ch

Andrew Jackson
Institut für Geophysik
ETH Zürich, NO H 11.2
CH-8092 Zürich
+41 44 633 73 49
andrew.jackson@erdw.ethz.ch

ABSTRACT

The magnetic field generated in the fluid metallic core of planet Earth is shown. Numerical simulations of the dynamo mechanism, such as this one, exhibit polarity reversals, whereby the north pole moves by 180 degrees; this mimics the behavior documented many times within the geological record.

Our simulation solves the equations of momentum transfer, heat transfer and electrodynamics in an electrically conducting and rapidly-rotating fluid at each point in time. High temperatures in the central part of the core drive thermal convection. The total simulation is equivalent to approximately 40,000 years on Earth.

Our movie shows the magnetic field lines that enter and exit the core. High magnetic field strength is shown by red and yellow colors, and lower strengths by blue. On each field line we place a small compass needle with red and white ends, which orient itself in the direction of the field.

Categories and Subject Descriptors

I.6.6 Simulation Output Analysis, I.6.8 Types of Simulation: Animation, Parallel, J.2 Physical Sciences And Engineering, Earth and atmospheric sciences.

General Terms

Algorithms.

Keywords

Scientific Visualization, Earth Magnetism