EuroMagNET II: A Coordinated Approach to Access, Experimental Development and Scientific Exploitation of all European Large Infrastructures for High Magnetic Fields

The EU-funded EuroMagNET II project, the continuation of EuroMagNET (2005–08), is providing transnational access to Europe's most important research institutions specialising in generation and use of very high magnetic fields. The project is also developing research activities to make the best possible use of these infrastructures, and pushing the boundaries of magnet-based analytical techniques.

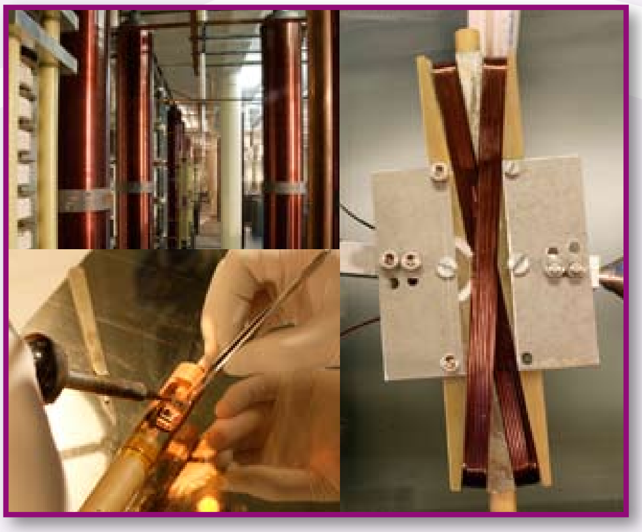
ATTRACTIVE SCIENCE

Inside many a machine is a magnet. Small machines, like computer hard drives and CRT monitors, have tiny but powerful magnets. Large machines, like hospital MRI scanners, NMR and mass spectrometers and the particle accelerators used in nuclear physics, have large magnets. Electric motors, loudspeakers and transformers are other common devices that depend on magnetic fields for their operation.

The strongest kind of ordinary permanent magnet, a neodymium-boron or 'rare-earth' magnet, has a field of less than 2 Tesla (T) – enough to break a finger that gets between the magnet and a heavy steel object. MRI scanners use magnetic fields that are actually no stronger than 2 T at the centre of the machine, though their huge superconducting electromagnets produce wide-reaching fields that can suck in steel objects as large as an office chair.

But when physicists talk about strong magnetic fields, they mean a lot more than 2 T. The most powerful superconducting electromagnets available today can produce steady fields of about 20 T, and non-superconducting ('resistive') electromagnets can reach 35 T. Combining superconducting and resistive magnets (a 'hybrid magnet') allows to go to 45 T.

Even stronger fields, up to 90 T, are produced by energising electromagnets with short pulses of electricity. Keeping the current pulses short ensures that the magnet coils do not melt, but that still leaves magnet designers with another problem. Even with state-of-the-art materials, it is difficult to build a large magnet that will not explode under the forces generated by its own magnetic fields and currents. In fact, the very highest fields (2 000 T for a period of a few microseconds) come from single-use electromagnets that self-destruct when they are switched on.



Engineers go to all this trouble because strong magnetic fields have all kinds of uses in research, especially materials science and the physics of condensed matter. One important application is the study of high-temperature superconductivity, which may one day allow electricity to be generated and transmitted without resistive losses – as well as allowing us to build bigger and better electromagnets.

SEVENTH FRAMEWORK PROGRAMME

EUROPEAN COMMISSION

CREATING A STRONGER RESEARCH FIELD

Building on the success of EuroMagNET, EuroMagNET II is working to further improve access to and the quality of existing European magnetic field user facilities. This will enable the optimal use of Europe's capacity in this field and allow researchers' needs to be fully met.

EuroMagNET is running a successful transnational access programme, funding the access of qualified European researchers to the associated high field user facilities, after evaluation by an external selection committee.

The previous project made significant progress in linking research communities and EuroMagNET II is continuing work in this area. User groups are being encouraged to exchange information among themselves, magnetic facilities and other communities. This increased communication is being fostered through the creation of thematic networks, training and the secondment of researchers.

Finally, to develop advanced experiments and improved magnet performance, four joint research activities are being used. Together they will improve the quality of existing instrumentation to better serve the current user community and create opportunities for new users.

Project acronym: EuroMagNET II

Funding scheme (FP7): Integrating Activities (IA)

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EU project officer: Christian Kurrer

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Completion date: 31 December 2013

Partners:
Centre National de la Recherche Scientifique (FR)
Radboud University Nijmegen (NL)
Forschungszentrum Dresden-Rossendorf (DE)
University of Leipzig (DE)
University of Oxford (UK)
Tallinn University of Technology (EE)
Weizmann Institute (IL)

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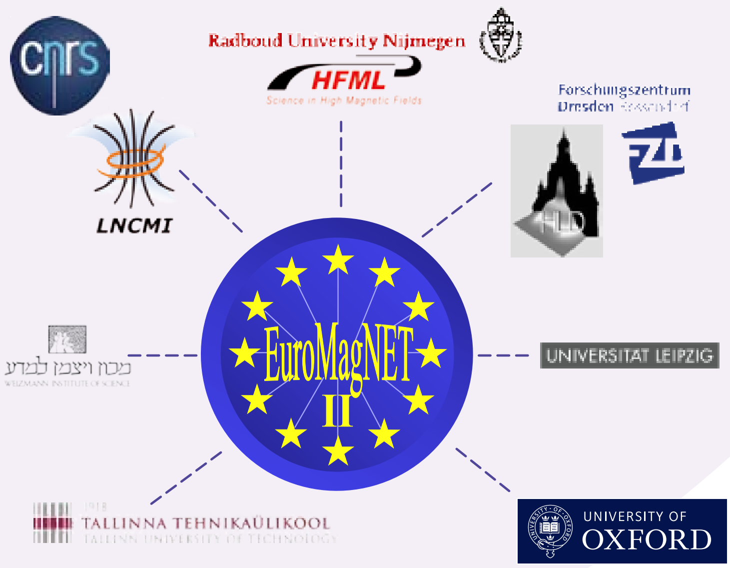

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