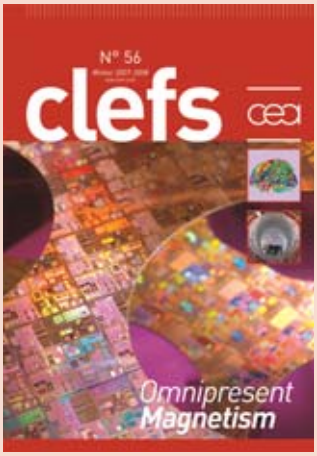

Clefs CEA No 56 – Winter 2007-2008

Main cover picture:
Silicon wafer with magnetic random access memory (MRAM) chips.The CEA is strongly involved in the development of these newcomers to the family of silicon-based memories.
Artechnique-D. Michon/CEA

Insert picture:
top: Diffusion MRI image of the brain. This method, implemented on a large scale by NeuroSpin at CEA Saclay, now makes it possible to map the 'information highways' in the brain.
CEA/DSV/J.-F. Mangin, V. El Kouby, M. Perrin, Y. Cointepas, C. Poupon

bottom: The compact muon solenoid (CMS) is one of the four main detectors in the Large Hadron Collider (LHC) that the CERN is to put into service in 2008.
Cern

Pictogramme on inside pages:
Example of a magnetic domain in a thin layer of CoPt.
CEA/Iramis/Spec

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Editorial

In one way or another, almost all the major developments to which the CEA has recently contributed involve magnetism. Indeed, magnetism plays a primary role in those projects that have required the heaviest investments: from the ITER controlled thermonuclear fusion project to the CERN's Large Hadron Collider (LHC), via the NeuroSpin brain imaging facility.

The use of magnetic fields in systems has also enabled the CEA to deploy its capacity for innovation in the field of communicating devices and the introduction of miniaturised components in everyday objects. The creation in 2007 of the start-up Movea, specialised in motion-sensing technology for healthcare applications, telecommunications, sport, etc., is a concrete example.

The omnipresence of magnetism in science and technology is thus no figure of speech. The award of the 2007 Nobel Prize for physics jointly to Albert Fert and Peter Gründberg is a timely demonstration of its relevance, through the striking example of a groundbreaking discovery in pure science; giant magnetoresistance. This phenomenon has already found applications in our daily lives in record time.

This issue of Clefs CEA, although touching on a range of topics, cannot claim to cover the whole of this vast field.

The first section describes the role of extremely-high-power superconducting magnets in the major physics projects referred to above, and also talks about the development of new hyperfrequency magnetic materials.

The second section focuses on nuclear magnetic resonance and especially on its healthcare applications, essentially in the field of brain imaging.

Nanomagnetism is the theme of a third section, which reviews advances in spintronics to which Albert Fert has contributed so much.

The fourth section is a compilation of articles on the Earth and space seen from a magnetic viewpoint. It looks at the Earth's magnetic field as both subject of study and as frame of reference, and at the different levels of applications for magnetism in space projects. Some years ago at a seminar held by the CEA-LETI, Roland Blanpain, a specialist in systems that make use of weak magnetic fields, expressed the omnipresence of magnetism in words borrowed from André Malraux: "The third millennium will be magnetic or it will not be".

> Bernard Bouquin

In Europe the CEA is one of the leading bodies for technological research in the fields of energy, defence and security, and also in information and healthcare technologies.
It guarantees the permanent capability of the French nuclear deterrent, which is one of its founding missions as the national atomic energy authority.
The CEA is a source of expertise and proposals for public policymakers. It benefits from the joint endeavour of pure and applied scientists that allows dynamic intermeshing of high-level research and technological innovation, exceptional facilities and a real commitment to industrial and economic imperatives. With more than 330 priority submissions in one year, it files more patents than any other public research organisation in France.
The CEA runs nine research centres located all over France. It employs a workforce of 15,000, operates on an annual budget of 3.3 billion euros, and enjoys strong regional ties and solid partnerships with other research bodies, local government, and universities. The CEA's research partnerships are supported by 65 mixed research units (UMRs) associated with 65 corresponding research laboratories (LRCs).
An acclaimed expert in its chosen fields, the CEA enjoys the status of an EPIC (industrial and commercial public body) and is a forefront player in the European research arena. It is involved in 80 projects and coordinates a further 34 under the Sixth Framework Programme (FP6), and is increasingly active internationally.
The CEA is a mayor player in research, development and innovation. Since 1985, when a structure was set up to support technology transfer, it has impelled the creation of some hundred new companies in the advanced technology sector.