Innovative measurement technology: our planet is 'attractive' enough

July 21 2005

The Earth's magnetic field is strong enough for some kinds of analyses – this opens up new opportunities for carrying out examinations under difficult conditions.

Where x-rays no longer manage to see, magnets allow us to look inside. Patients know what that means: they lay down in the "tube" surrounded by an enormous electromagnet, the so-called MRI scanner. Such large pieces of equipment artificially create strong magnetic fields which enable doctors to take the pictures inside the patient's body which they need for their diagnosis. Now scientists from the Research Centre Jülich, a Helmholtz Association institution, and the RWTH Aachen University of Technology have extended the spectrum of magnetic field scanning. Because they have discovered that the Earth's natural magnetic field is strong enough for some examinations. And this closes a gap. Because it makes measurement with magnetic fields outdoors and under difficult conditions possible for the very first time. Although the applications will not initially be used in the field of medicine, they will make chemical analyses possible, such as when examining oil directly at source.

20,000 times weaker

When measuring with magnets, researchers use a natural phenomenon, namely that nuclei spin like a top, a property appropriately called "spin". The spin can be focused in a magnetic field to generate typical signals, so-called nuclear magnetic resonance. And it is this that opens up a wide range of insights for scientists into the composition and structure of matter. As a rule, they need very strong artificially produced magnetic fields for such work.

In experiments with the inert gas xenon, Helmholtz scientists were now able to show that under certain circumstances they can also use laser light to influence the spinning movement of the nuclei. In these cases, a weak magnetic field is already powerful enough for the analysis. Often, the Earth's natural magnetic field is even strong enough. By comparison, the Earth's magnetic field is around 20,000 times weaker than the field strengths used in these large pieces of equipment.

From inside Earth to solar wind

As Dr. Stephan Appelt from the Research Centre Jülich explains, a wide and diverse range of application options are conceivable. Besides chemical analyses outdoors and at hardly accessible places, geophysical examinations are also imaginable. "For example, we could survey the Earth's magnetic field with the highest precision," explains Appelt. "Furthermore, we could also look into the Earth, so to speak." That would make it possible to gain a better understanding of the earthquake risks along local fault lines, such as the San Andreas Fault in California or of volcanism. A third field of application would be in astrophysics. "Nuclear magnetic resonance in the Earth's magnetic field might also make it possible to measure the solar wind," believes Appelt. This wind is made up of particles ejected by the Sun and deviated by the Earth's magnetic field – the Northern Lights, "Aurora Borealis", are a side-effect of this.

Finally, another possible area of application is also the measurement of very weak magnetic fields inside patients. This would enable doctors to produce detailed pictures for the examination of diseased organs. "It's conceivable that contrast media could be used that contain xenon," explains Dr. Wolfgang Häsing from the Research Centre Jülich. "Patients could inhale these contrast media or they could be injected into them." All that would then be needed to carry out an MRI scan is a small additional magnetic field – the patient would be spared from the confines of the narrow tube. In fact, they would hardly notice the examination, because xenon is already used in medicine today, namely as an anaesthetic.

Source: Helmholtz-Gemeinschaft

Citation: Innovative measurement technology: our planet is 'attractive' enough (2005, July 21) retrieved 10 April 2024 from https://phys.org/news/2005-07-technology-planet.html

provided for information purposes only.