PRESS RELEASE

X-ray laser FLASH uncovers fast demagnetization process

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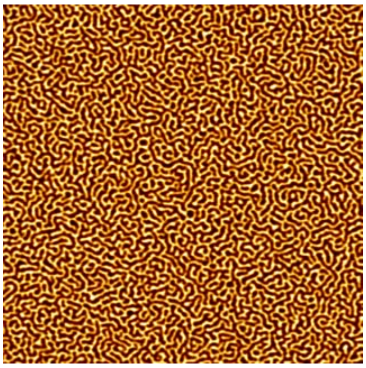
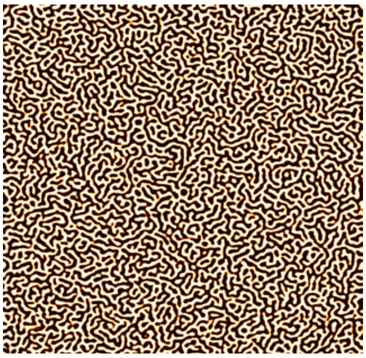
With the help of free-electron laser FLASH at the Helmholtz Research Centre DESY, an international team of researchers has recently described a most surprising effect that can result in faster demagnetization in ferromagnetic materials. This effect could be key to the continued miniaturization and acceleration of magnetic storage. Now, Prof. Dr. Stefan Eisebitt of the Helmholtz Zentrum Berlin (HZB) and TU Berlin and his team have published their findings in the current issue of the scientific journal *Nature Communications* (DOI 10.1038/ ncomms2108).

"The ability of a light pulse to effect localized changes to a material's magnetization is a well-known fact, but not until now have we been able to more closely observe the process, which has led to the discovery of a new mechanism," explains Stefan Eisebitt. This is because most ferromagnetic materials consist of a number of individual, differently oriented magnetic domains. "When bombarded with laser light, free electrons rush through the material, moving from one domain into an oppositely magnetized domain. These electrons carry part of the magnetization through the sample and are thus able to destroy the localized magnetization," explains TU Berlin's Bastian Pfau, junior researcher and the study's primary author.

The TU Berlin, HZB, and DESY researchers along with their colleagues from the Universities of Hamburg and Paris, and from six other research institutes including SLAC – the Stanford Linear Accelerator Center in the US – all conducted their experiments at DESY's Hamburg-based free-electron laser FLASH. Previously, they had characterized the domain patterns at HZB's own synchrotron radiation source BESSY II and at Paris-based SOLEIL where they examined samples obtained from cobalt-platinum thin films whose nanoscale magnetic domains form labyrinthine structures. "Our results further demonstrate that the position and density of magnetic domain boundaries can influence demagnetization behavior," explains Stefan Eisebitt. "Our work has set the stage for a new approach to developing faster and smaller-sized magnetic storage specifically by building magnetic nanostructures."





Magnetic force microscope image of a 10 by 10 micron sample showing the magnetic domains' labyrinthine structure.

Images: Bastian Pfau

The **Helmholtz Zentrum Berlin für Materialien und Energie (HZB)** operates and develops large-scale equipment for photon (synchrotron radiation) and neutron research in internationally competitive - and even singular - research facilities. Each year, HZB's facilities are used by more than 2,500 international researchers from university- and non-university-affiliated research institutes. HZB scientists conduct materials research in areas that pose special challenges to the Centre's large-scale equipment. Research topics include materials research for energy technologies, magnetic and functional materials. Development of thin-film solar cells is a major solar energy research emphasis, although sunlight-derived chemical fuels represent yet another important focus. Approximately 1,100 people are currently working at HZB - some 800 at the Lise-Meitner Campus in Berlin-Wannsee and an additional 300 at the Wilhelm-Conrad-Röntgen Campus in Berlin-Adlershof.

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