Laser heating hits the spot

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A method for accurately measuring the thermomagnetic properties of heat-assisted magnetic recording (HAMR) media reveals what the minimum bit size and ultimate data density might be for this next generation storage technology.

Existing hard disk technology is approaching fundamental physical limits on the amount of data that can be stored on magnetic disks. One of the most promising technologies capable of breaching these limits is HAMR, which heats small areas to allow for smaller magnetic bits and higher data densities. The minimum possible bit size has been the subject of considerable debate. Yang Hongzhi and Yunjie Chen from the A*STAR Data Storage Institute (DSI) have now developed a method using two lasers to put this debate to rest.

"The basic idea of HAMR is to use a tiny laser spot to heat the magnetic material on the disk to its critical 'Curie' temperature, which makes it more easily writable," explains Chen.

Writability sets the upper limit on data density as it determines how small an area can be magnetically 'switched' using the weak magnetic field of conventional data writing heads. By heating the magnetic disk to a certain temperature, a material with an intrinsically finer-grained magnetic fabric can be used, resulting in smaller bits. One of the unknowns surrounding the technology is how far each bit would need to be separated in order to maintain reliable switching without affecting neighboring bits.

"The switching field distribution at the heating temperature is directly related to how narrow a magnetic transition can be recorded, which will decide the data density that could be achieved," says Chen. "Using a lab-built multifunctional HAMR writing and measurement system here at the DSI, we developed a method that allows us to accurately measure the thermomagnetic properties of HAMR media at the Curie temperature."

The team's approach uses two laser beams, one to spot-heat the media to exactly the right temperature, and the other to measure the magnetic signal based on an unusual interaction between magnetism and light known as the magneto-optic Kerr effect.

Using this approach, the researchers were able to run a range of tests on experimental HAMR media, providing unprecedented insight into its thermomagnetic response. "We expect this test method to be helpful for characterization and development of HAMR media as the major candidate for the next generation of hard disk drive technologies."

More information: H.Z. Yang et al. Measurement of magnetic property of FePt granular media at near Curie temperature, *Journal of Magnetism and Magnetic Materials* (2017). DOI: 10.1016/j.jmmm.2016.09.071

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