# MAGNETIC REVERSALS

**Laura Thevenard** – In most computers, there are two broad families of materials, semiconducting materials, used for the processor, all the logic operations and the calculations of the computer, and magnetic materials, used to store the data that will be used by the computational side. If the same material were used to perform every task, it would (in theory but it's not quite as simple as that) speed up the flow of information. So my research topic is to study a material that happens to be both at once, both semiconducting and magnetic. This material is called GaMnAs, Gallium Arsenide doped with Manganese. The Gallium Arsenide is the semiconducting part, and the Manganese the magnetic one. For now, it doesn't work at room temperature, so it's rather unlikely it'll end up in your computer in the near future, but it's nevertheless very interesting for physicists because it allows testing of theoretical models, in particular because its characteristics can be easily adjusted.

So for a long time, data stored magnetically was manipulated by magnetic fields, but people soon realized that if they wanted to keep on reducing the size of these magnetic bits, they couldn't go on much longer using magnetic fields. Because magnetic fields have a rather problematic spatial extension, so that if bits are too close one from another, when trying to reverse one bit we might end up switching another. So part of our work consists in trying to manipulate the main property of this material, the magnetization, other than by a magnetic field. Using light for instance, or an electric field, or an electric current, or even an acoustic wave.

So on the one hand we do optical imaging experiments called Kerr microscopy, it's a type of microscope capable of seeing whether magnetization is pointing north or south, and on the other hand we have another set-up, on which we send repetitive laser pulses; these laser pulses are very short, and we split the laser beam in two, a first part excites the sample and the second one is time-delayed with respect to the first one and probes what the first pulse did to the sample.

On the other hand, we try to reverse magnetization with acoustic waves. The materials we are studying are deposited by molecular beams in the form of nanometric layers. In particular, we use surface acoustic waves that deform atoms from the surface of the material to several microns deep. And we showed recently that in certain geometries, we could very efficiently assist the reversal of magnetization using a surface acoustic wave. For us, it was a great joy to see the image on the screen, the magnetization having switched with an acoustic pulse, because beforehand we had done calculations, to predict the optimum conditions that would lead to this reversal, and by an incredible stroke of luck, well it worked almost on the first attempt…

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