New microscope technique offers a better way to measure magnetic field of individual atoms

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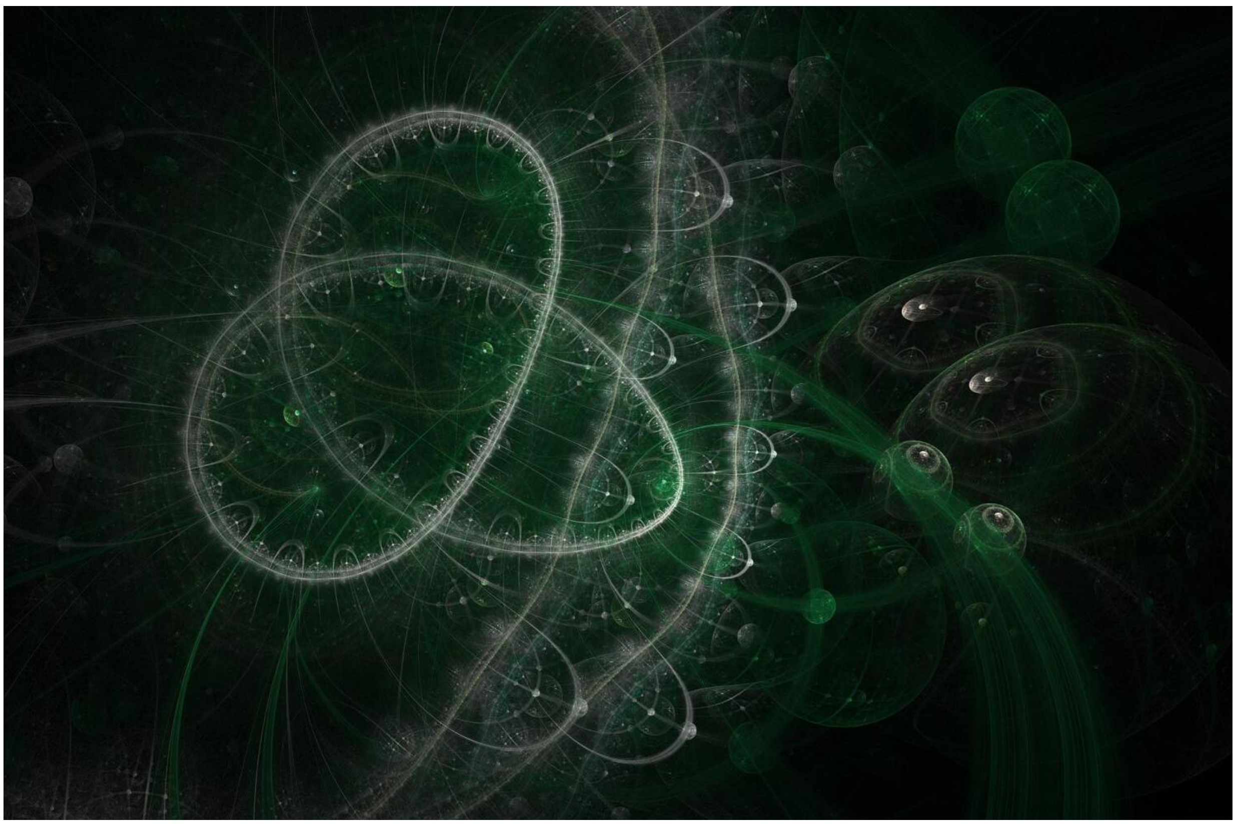

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A team of researchers at IBM has developed a new way to measure the magnetic field of individual atoms that offers 1000 times the energy resolution of conventional techniques. In their paper published in the journal *Nature Nanotechnology,* the team describes their approach, how well it works and their hope that they will be able to modify it in such a way as to allow others with less specialized hardware to use it.

Scientists are eager to better measure the magnetic fields of individual atoms because they believe it will lead to a better understanding of material and biological interactions—most particularly those involving weak magnetic interactions. Current methods rely on using defects in diamonds, though the team at IBM notes that prior work at their lab shows that it is possible to measure weak interactions in another way, an approach described as challenging. In this new effort, the team has come up with a way to get the job done that is relatively simple, though, they note, it requires special hardware.

In the new approach, an atom called a sensor is placed near a target atom inside of a scanning tunneling microscope—a magnetic field is then applied to the microscope followed by a jolt of electricity to the tunnel junction. From there on, the frequency of the atom is monitored—when it matches the spin of the precess (the axis of rotation around a magnetic field that reflects its degree of magnetism), it reveals the measure of the magnetic field. The change in orientation is measured by moving the sensor atom to the microscope's sensor tip.

The researchers found their approach to be far more accurate and easier to read than other methods, pointing out that the signal they got from the technique was both stronger and more robust. They note also that few other labs likely have the combination of equipment (such as the high frequency cabling added to the microscope) required to replicate their technique, so they plan to continue the work in hopes of achieving the same results under more relaxed conditions.

More information: Taeyoung Choi et al. Atomic-scale sensing of the magnetic dipolar field from single atoms, *Nature Nanotechnology* (2017). DOI: 10.1038/nnano.2017.18