

Creating and Destroying Magnetic Fields at a Distance

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P.S.J. spotted and shared this story, and it's definitely in the "whopper doozie" category. First, a bit of basics (which are covered in the article). We all know magnets (or electrical coils) can set up a magnetic field around them. Put bluntly, no coil or magnet, no magnetic field. The corollary of this is that while magnetic fields can exist in space, they have to have source, where the field strength will be greatest. With that, let's turn to the story P.S.J. spotted:

[Physicists could do the 'impossible': Create and destroy magnetic fields from afar](#)

Here's the essence of the technique:

Mach-Batlle and her colleagues, though, thought they might be able to get around that problem. They were inspired by work in optics that uses engineered materials known as metamaterials (designed to have properties not found in any naturally-occurring material) to get around limits on resolution set by the wavelength of light. Similarly, they thought, hypothetical magnetic materials might enable the impossible in the world of magnetic fields.

The researchers envisioned a material with a magnetic permeability of negative 1. A material's magnetic permeability indicates how much that material increases or decreases a magnetic field when exposed to that field. In a

material with a magnetic permeability of negative 1, the direction of the [magnetism induced within the material](#) would be the opposite of the direction of the initial magnetic field.

Of course, a new method of inducing magnetic fields that relied on materials that don't exist wouldn't be particularly useful. But even though this hypothetical material with negative permeability doesn't exist, physicists can create a sort of temporary "material" out of electric current running through a specific arrangement of wires. That's because current induces magnetism and vice versa, a consequence of Maxwell's Equations of electromagnetism.

"In the end, we do not use any material, we use a precise arrangement of currents that can be regarded as an active metamaterial," Mach-Batlle told Live Science.

To create the field from a distance, Mach-Batlle and her team created a hollow cylinder made of about 20 wires surrounding one long interior wire. When current runs through these wires, it creates a magnetic field that looks the same as if the long interior wire were actually outside the device. It's the electromagnetic equivalent of a ventriloquist throwing her voice; the source of the field is not actually outside the device, but the field itself is indistinguishable from the field that would have resulted if the source were outside the device.

"We create the illusion of having this source at a distance," Mach-Batlle said. The researchers published their findings Oct. 23 in the journal [Physical Review Letters](#).

Now what's intriguing here is that as usual, the "selling point" for the idea is how much wonderful human health benefits the technique might be able to achieve. For example, the article notes the following immediately after the above description of the technique:

Possible applications beyond drug delivery include canceling out magnetic fields from afar, a technique that could be useful in quantum computing to reduce “noise” from external fields that can interfere with measurements. Another use might be improving transcranial magnetic stimulation, which uses magnets to stimulate neurons in the brain to treat [depression](#). Being able to control magnetic fields at a distance could improve the targeting of transcranial magnetic stimulation, so that doctors could better focus on particular regions in the [human brain](#).

As one might imagine, however, I have my own high octane speculations about what this development might actually portend. Note that first sentence in the quoted paragraph above: “Possible applications beyond drug delivery include canceling out magnetic fields from afar, a technique that could be useful in quantum computing to reduce “noise” from external fields that can interfere with measurements.” Stories abound in the alternative research field of electromagnetic interference with motors and engines. For example, there is the story of Italian dictator Benito Mussolini telling his wife, who wanted to take a country drive, to travel down a particular highway at a particular time because at that particular time something noteworthy would happen. Mrs. Mussolini dutifully complied so the story goes, and at the precise time her husband indicated on that particular highway, her automobile engine died. Similar stories of massive electrical installations causing disruptions in motors occur from Nazi Germany, and so on. Many of these stories – particularly the ones from Germany – also involve coil arrangements.

So imagine, now, the technique outlined in this article is “scaled up” to massive proportions. One might have a means not only of cancelling “noise” from external fields that could interfere with quantum computing, one might also have a means of interfering with magnetic fields in dynamos, generators,

and electrical motors of all types, in effect shutting them down in a fashion similar to electromagnetic pulse (EMP), typically produced by nuclear bombs when detonated. Only the difference here is that one would have a means of “firing” that could be reused over and over. With some tweaking, one might be able to “scramble” the electromagnetic functioning of the brain, inducing, or wiping, memories, and so on.

On and on the list could go. The bottom line?

Well, I for one suspect that maybe this latest technique really isn't so new. Rather, I suspect that what has been discovered is perhaps the basis behind some of those stories we've been hearing about for a while...

And if, as the article suggests, a metamaterial with a negative magnetic permeability were ever found... well, one can imagine the uses to which it might be put. Any takers for a bet they're *not* already looking for it?

See you on the flip side...