Magnetic monopoles make acoustic debut

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Credit: University of Oxford

University College Cork (UCC) & University of Oxford Professor of Physics, Séamus Davis, has led a team of experimental physicists in the discovery of the magnetic noise generated by a fluid of magnetic monopoles.

In a world first, the team created a magnetic-field-noise spectrometer

which allows magnetic monopole noise to be audible to human perception.

For the research, published in *Nature* today, Professor Davis worked as part of an international collaboration alongside Stephen J Blundell at the University of Oxford, who led the theoretical physicists, in developing a new approach to detecting and studying 'emergent' magnetic monopoles.

On the exciting breakthrough, Professor Davis said: "Scientists will now be able to study novel aspects of the physics of magnetic monopoles, which are fundamentally important but highly elusive elementary particles, for the first time."

Magnetic monopoles are elementary particles exhibiting quantized magnetic charge, with improved prospects for studying them in recent years with the theoretical realisation that, in certain classes of magnetic insulators the thermally excited states exhibit all the characteristics of magnetic monopoles.

Last year, Blundell and his colleagues Dr. Franziska Kirschner and Dr. Felix Flicker predicted that the random motion of magnetic monopoles inside these compounds would generate a specific kind of magnetization noise. Any crystal of one of these magnetic insulators should be spontaneously generating wildly and randomly fluctuating magnetic fields. However, the catch was that the magnitudes of such fields were predicted to be near one billionth of the Earth's field.

In response, Davis and his colleague Dr. Ritika Dusad built an exquisitely sensitive magnetic-field-noise spectrometer based on a superconducting quantum interference device—a SQUID. Virtually all the predicted features of the magnetic noise coming from a dense fluid of magnetic monopoles were then discovered emerging from crystals of $Dy_2Ti_2O_7$.

Extraordinarily, because this magnetic monopole noise occurs in the frequency range below 20kHz, when amplified by the SQUID it is actually audible to humans.

More information: Magnetic monopole noise, *Nature* (2019). DOI: 10.1038/s41586-019-1358-1 , nature.com/articles/s41586-019-1358-1

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