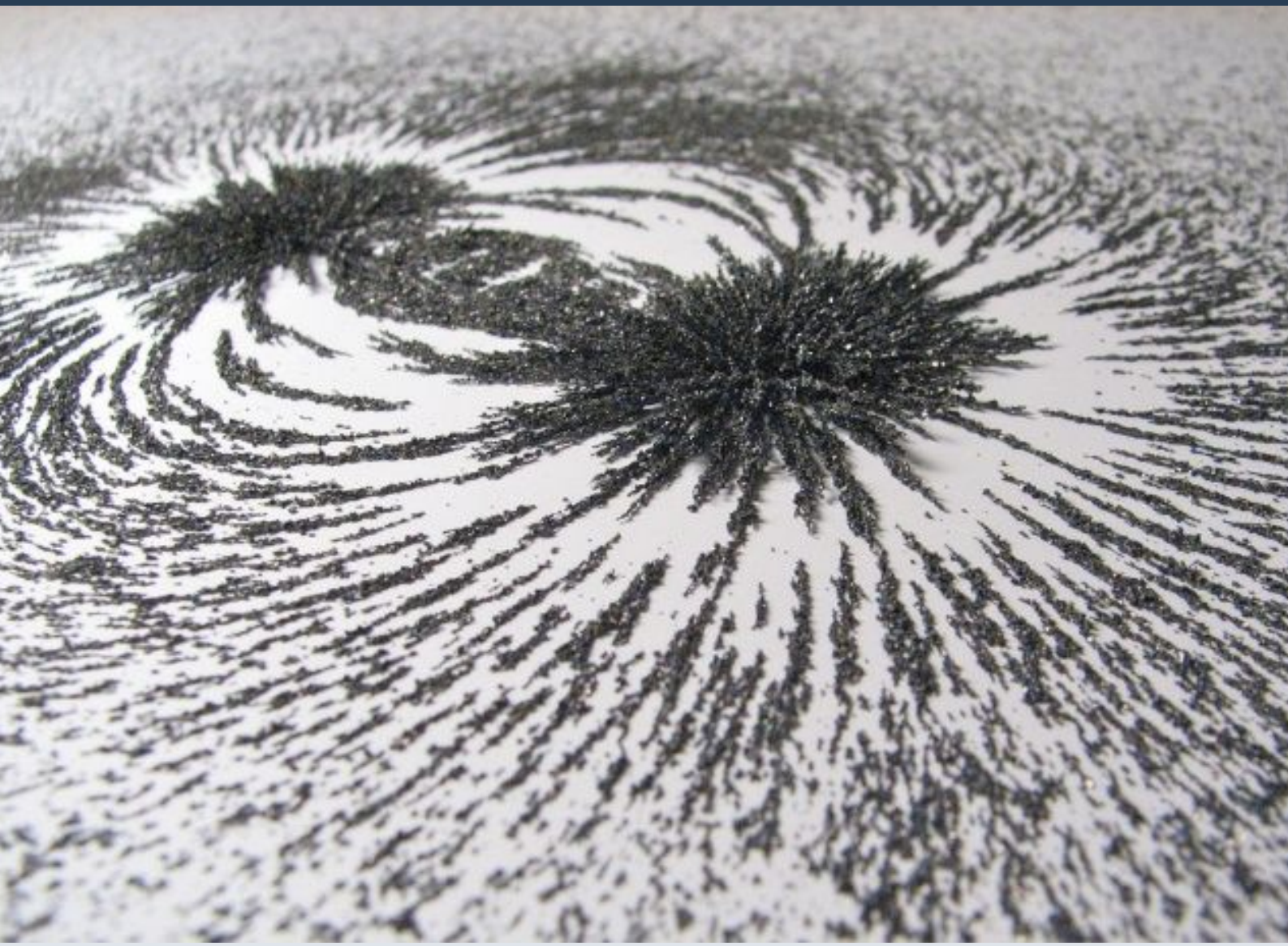
UNIVERSITY OF BIRMINGHAM

Powered by: IN-PART

Quantum Technology Hub for Sensors and Metrology

Using quantum sensors to convert the next generation of quantum technologies from laboratory science into innovative products.



Please note, header image is purely illustrative. Source: Windell Oskay - Flickr - CCby2.0

About **University of Birmingham**

At the University of Birmingham our research leads to new inventions and fuels innovation and business growth.

Background

Quantum sensors and metrology using atoms and ions has been established by more than two decades of laboratory research. Sensitivities beating classical technologies have been demonstrated in measurements of gravity, gravity gradients, magnetic fields, rotation, time, and in quantum imaging.

In recent years, there have been many new ideas and promising proof-of-principle demonstrations including: the realisation of large momentum beamsplitters that offer two or more orders of magnitude sensitivity enhancement; the invention of phase-shear atom interferometry to enable simultaneous measurements of gravity/acceleration and rotation in multiple axes; progress on high-bandwidth atom interferometers; adiabatic rf potentials for smooth guiding geometries; the development of grating reflectors to allow single-beam trapping; and the invention of compact atom sources promising smaller, more robust, sensors.

In addition there have been recent breakthroughs in controlling photon distribution in laser beams, the so-called multimode entanglement, which promises noise reduction in both imaging and optical position measurements.

The Hub aims to convert the next generation of quantum technologies from laboratory science into innovative and marketable products that are able to deliver long-term societal benefits.

Tech Overview

The Hub's work will dramatically improve the accuracy of measuring time, frequency, rotation, magnetic fields and gravity. The research will have a tangible impact across a wide range of fields, including:

- Electronic stock trading;
- GPS navigation;
- Providing a non-invasive way of measuring brain activity to further research into dementia;
- Facilitating the mapping of pipework and cabling under the road surface before digging takes place, thereby reducing disruption and traffic delays

Applications

These sensors will measure rotation, gravity, magnetic fields, light and time and be translated into new applications in areas as diverse as medical imaging and brain diagnostics, locating pipes and detecting leaks, archaeological surveying, navigation, assessment of railway infrastructure, network timing, sinkhole detection and space missions. The Hub is focusing on five prototyping areas:

- Clocks
- Rotation Sensors
- Magnetic Sensors

- Gravity Sensors
- Quantum Imaging

Opportunity

The objective of the Quantum Technology Hub is to produce quantum sensors that outperform existing classical devices.

Key to the success of these technologies is working collaboratively with industry to support the development of smaller, lighter and cheaper components to make quantum devices a commercially-viable reality. The resulting sensors will have improved sensitivity at a fraction of the cost, weight, size and power consumption of existing devices.

The university is seeking to work with industry partners interested in engaging with quantum sensor technology, across a broad range of applications.