LSBB
Laboratoire Souterrain à Bas Bruit
Low Noise Inter-Disciplinary Underground Science & Technology

UNIVERSITY OF OXFORD

Hertford College

# UNIVERSITY OF OXFORD, HERTFORD COLLEGE

## IDENTITY


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## RESEARCH THEMES

Superconducting Quantum Interference Devices
Theory and Applications
Magnetometer for neutron EDM experiment
Geomagnetic monitoring
Tracking groundwater flow
Magnetotellurics-mapping the subsurface with natural geomagneti probe
Technical challenges
Future, hybrid magnetometers, options for cooling

## KEY WORDS

*particle physics / astroparticle physics magnetometer/ SQUID magnetometry./ cryogenic experiment/ Underground laboratory*

## PRESENTATION

Technology developed for a neutron EDM experiment has potential further applications in many other areas of physics, including research using SQUIDs for geomagnetic studies, and industrial applications for geophysical exploration. In collaboration with the LSBB underground laboratory, we have carried out a series to field trips to take measurements using multiple SQUID magnetometers to monitor magnetic field fluctuations and search for a signal correlated with the groundwater flow rate. We have investigated whether SQUID sensors could lead to improvements in geophysical exploration using the magnetotelluric (MT) technique (supported by the STFC Follow on Fund and ISIS Innovation).

## WEBSITE LINK

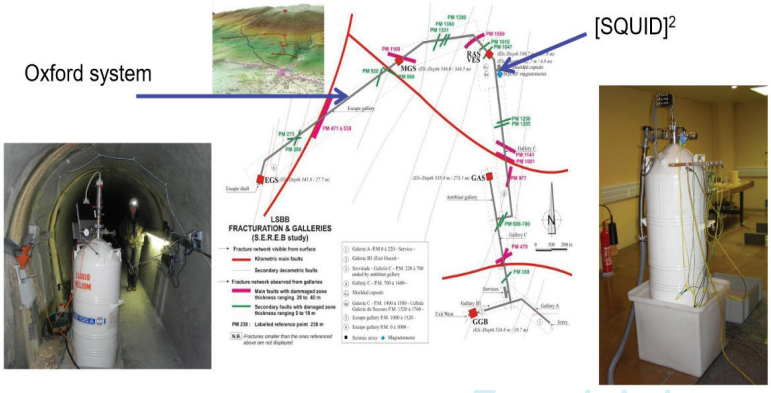
http://www.lsbb.eu/index.php/fr/ct-menu-item-19/ct-menu-item-126/ct-menu-item-140/ct-menu-item-154

## LSBB PROJECT

### Monitoring geomagnetic signals of groundwater movement using multiple underground SQUID magnetometers

Groundwater can influence the geomagnetic field measured underground in at least two key ways. The water levels in rock will determine its electrical conductivity, and thus change the magnitude of the telluric currents induced in the rock by changing magnetic fields generated in the ionosphere. This can be studied by using multiple magnetometers at different underground locations. Secondly the flow of water through rock will generate a small magnetic signal, of unknown magnitude, through the electrokinetic effect. SQUID magnetometry has the potential to allow passive studies of groundwater changes in complex systems such as karst. The LSBB low noise underground laboratory in SE France is an ideal site to study the propagation of geomagnetic signals underground (www.lsbb.eu). We have monitored magnetic signals using two SQUID magnetometers at different depths. Precision magnetometry has the potential to allow passive studies of groundwater dynamics in complex systems such as karst. By measuring the magnetic signals generated by ionospheric currents and telluric currents, we can infer the electrical conductivity of the rock by the magnetotelluric method. The flow of water through rock is known to produce a small magnetic signal of unknown magnitude due to the electrokinetic effect. Our measurements have shown that the magnitude of this electrokinetic signal is below 0.2nT. We are now taking further measurements using three SQUID systems, as well as fluxgate sensors, to better study fluctuations in the gradient of the magnetic field across the underground medium.

### Hydrogeology with SQUIDs



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## THÈMES DE RECHERCHE

## MOTS CLÉS

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## PRÉSENTATION

## LIEN SUR LE SITE DU LSBB

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## PROJET LSBB

## Hydrogeology with SQUIDs

Oxford system

[SQUID]²