A wearable multi-channel OPM-MEG system: from construction to application

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Magnetoencephalography (MEG) is a non-invasive measure of brain function with high spatial and temporal resolution. Current devices based on a fixed array of superconducting quantum interference devices require participants to remain very still during measurements to avoid loss of data quality. This limits utility in some experimental cohorts that can be scanned, particularly children and adults with movement disorders, and the experimental questions that can be addressed.

We have developed a wearable MEG system [1] using QuSpin optically-pumped magnetometers [2] which can be mounted on the scalp and if background fields are appropriately nulled [3], MEG data can be acquired even when individuals make natural head motions. This system provides a more comfortable experience than in traditional neuroimaging systems, like MRI.

Using our system we have measured brain activity arising from natural tasks. These include bouncing a ping-pong ball on a bat [1]; measurements in children as young as 3 years old; language lateralisation measurements to aid pre-surgical planning [4]; experiments using an Occulus Rift virtual reality headset to provide an immersive and realistic environment [5]; investigations of motor learning and measurements of deep brain structures such as the cerebellum [6]. Here, we present the development of the system and outline key results.

References

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