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Development of an NMOR gradiometer for human brain stimulation

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In recent work [1], we showed the efficacy of an intrinsic axial gradiometer for the detection of human biomagnetism. We now present the next generation of this sensor, which employs the nonlinear magneto-optical rotation effect. By using simplified integrated optics, printed circuit boards, and a modular design, we have improved the mechanical rigidity and decreased the standoff from the human scalp. Due to these factors, the extraction of human brain signals is more robust and can be achieved with fewer trials. The sensitivity has remained stable at 15 fT/√Hz/cm, which, at a baseline of 5 cm, corresponds to 70 fT/√Hz in absolute units. The purpose of this sensor is to combine it with transcranial magnetic stimulation, in which a strong and fast (around 0.1 T/μs) magnetic field is delivered to the brain to induce neural currents. We will describe the setup used to perform the experiment and we hope to have preliminary results by the time of the WOPM meeting.
[1] H. Cook et al., An optically pumped magnetic gradiometer for the detection of human biomagnetism, Quantum Sci. Technol. 9 035016 (2024).

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