Biomagnetism of Venus flytrap plants

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In this experiment, we aim to detect the magnetic fields produced by living plants. Our group previously conducted atomic-gradiometry measurements of a blooming titum arum, also known as the "corpse flower", at the Berkeley Botanical Garden in California [1]. As far as we know, the only reported successful detection of magnetic fields produced by intact plants occurred in 2000 [2]—an array of SQUID magnetometers was used to measure signals from wounded bean plants in a magnetically shielded room at Physikalisch-Technische Bundesanstalt (PTB) Berlin.

We chose to launch a new biomagnetism experiment using the Venus flytrap, *Dionaea muscipula*. This carnivorous plant is relatively easy to stimulate mechanically, and one can generate action potentials (APs) consistently. In our lab we set up surface-electrode measurements for AP monitoring, and we conducted preliminary magnetometry measurements in a small magnetic shield using QuSpin optically pumped magnetometers (OPMs). However, our measurements were dominated by mechanical noise due to the stimulation method. Therefore we have carried out two data runs in the shielded room at PTB, where we are able to conduct measurements without spatial constraints and with more sensors simultaneously.

Our first PTB data run, in December 2018, took place in the 3-layer magnetically shielded room using 8 OPMs. Promising initial results were presented at the Today's Noise Tomorrow's Signal workshop at PTB in February of this year. Based on our gained experience, we carried out an improved measurement run this March in the newly upgraded BMSR-2, using both OPMs and the SQUID system. Data analysis from these experiments is currently underway.

Beyond proof of principle, the long-term goal of the project is to develop a novel and robust system for measuring biomagnetic signals from a variety of living plants (e.g. agricultural species), ideally based on compact atomic sensors. Such measurements will pave the way for understanding current (ionic-flow) distributions in plants, as well as investigation of signaling pathways in response to various external stimuli.

References

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