

Towards low-cost and open-source electronics for a magnetically pulsed OPM

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We will present our work towards a low-cost and open-source integrated electronics for operating a free spin precession optically pumped magnetometer (OPM), which is pulsed magnetically for efficient optical pumping [1]. The OPM for which the electronics was designed is composed of a microfabricated Cs cell (Leibniz IPHT Jena), a 895 nm, 0.2 mW VCSEL Diode (L895VH1, Thorlabs), a lens, linear polarizing sheet, a quarter-wave-plate, a photodiode, and a prepolarization coil, as shown in Figure 1.

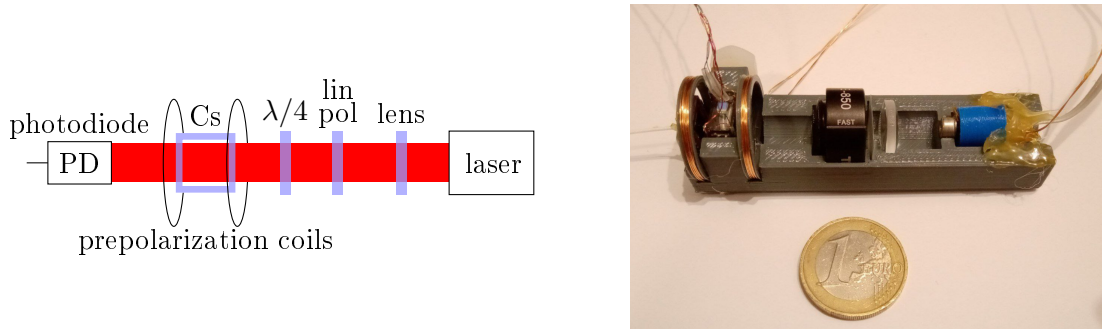


Figure 1. Magnetically pulsed OPM setup: schematic (left) and photo (right).

The electronics includes:

- a low-noise constant current laser diode driver with manual setpoint (potentiometer) and software-controlled status (on/off)
- a pulsed voltage mode coil driver for the prepolarization coil,
- two pulse drivers for pulsed heating of the Cs cell and the laser,
- two temperature resistance inputs for connecting the PT100 sensors of the Cs cell and the laser,
- a transimpedance amplifier with manually selectable gain (dip switches) for the photodiode, and
- a trigger input or output for synchronization with external systems.

The electronics is controlled by a RP2040, with precise timing ability due to the internal PIO (CPU-independent state machine), and a user-friendly command line interface.

The performance of the system is currently being investigated.

[1] D. Hunter et al., Optical pumping enhancement of a free-induction-decay magnetometer, *JOSA B*, **40**, 10 (2023).