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Spin-Exchange Relaxation Free Magnetometer for the Global Network of Optical Magnetometers for Exotic Physics (GNOME)[1]
DHRUV TANDON, ELEDA FERNALD, JAY MCCLENDON, PERRIN SEGURA, HEATHER PEARSON, SUN YOOL PARK[2], JASON STALNAKER, Oberlin College, GNOME COLLABORATION — Ultralight axion-like particles are a possible candidate for dark matter. These particles could result in cosmic topological defects such as domain walls or axion stars. The Global Network of Optical Magnetometers to search for Exotic Physics (GNOME) is looking for a transient signal caused by exotic-spin couplings as the Earth passes through such topological defects. We describe the Oberlin magnetometer station and present its performance during the latest GNOME science run. The magnetometer consists of a single-beam, spin-exchange relaxation-free (SERF) magnetometer that uses a vapor cell of potassium atoms with helium as a buffer gas. The cell is housed inside a four-layer magnetic shield. We use circularly polarized light resonant with D_1 transition to optical pump the atoms into a magnetically sensitive dark state. The transmission through the vapor cell is monitored and fed back to magnetic field coils to maintain zero field inside the cell. We also discuss the implementation of a co-magnetometer configuration that has the potential to improve the sensitivity of the detector.

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