The Mesospheric Magnetometry project: Remotely measuring the magnetic field with a laser.

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By means of laser optical pumping and Larmor-resonance detection, it is possible to use the naturally occurring sodium layer in the mesosphere to measure Earth's magnetic field magnitude at 90 km above ground. This is an altitude otherwise only accessible by rockets, which only will provide point measurements of very short time scales.

In December 2019, for the first time, we were able to remotely measure the magnetic field in the mesospheric sodium layer, in the auroral zone.

During the winter of 2019-2020 we applied a CW sum-frequency FASOR/laser for probing the sodium-atom Larmor resonance at the Artic Lidar Observatory for Mesospheric Research (ALOMAR) at Andøya in northern Norway in order to measure and monitor the magnetic field in situ in the high latitude mesosphere over longer time scales.

The technique, which has been proved earlier at mid-latitudes, has now been confirmed and applied to high latitudes in the auroral zone during disturbed auroral and geomagnetic conditions. The magnetic field in the auroral zone is close to vertical making our measurements a notable achievement since the beam is closer to parallel with the magnetic field, contrary to earlier measurements being closer to perpendicular as shown as best by theory.

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