

Laser Investigation of the Mesospheric Magnetic Field in the Auroral Zone

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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 scalar magnetic field 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.

During the winter of 2018-19 we have installed a cw sum-frequency laser for probing the sodium-atom Larmor resonance at the Arctic Lidar Observatory for Mesospheric Research (ALOMAR) at Andøya in northern Norway, 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, will in our project be applied to high latitudes in the auroral zone. This opens for a completely new domain of measurements of externally generated geomagnetic variations related to currents in the magnetosphere-ionosphere system.

Here we report on the instrumental setup and present initial measurements of the mesospheric magnetic field. Furthermore, we discuss future improvements and plans.