Optical instruments

Despite new observation methods provided by radar (see incoherent scatter) and satellite instrumentation, optical measurements are still important when studying auroras.

TV- and all-sky-cameras (ASC)

To be written.

Photometers

Photometers measure the absolute luminous intensity of a light source. Because of the monochromatic nature of the auroral light, photomultiplier tubes with very narrow band filters were used in the measurements. The typical wavelengths that have been measured are:

- 427.8 nm (blue)
    - Molecular nitrogen first negative (rotational) band
- 486.0 nm (blue)
    - Hydrogen Balmer line
- 557.5 nm (green)
    - Atomic oxygen, emission from state O1S
- 630.0 nm (red)
    - Atomic oxygen, emission from state O1D

From these emissions one can make estimates of the characteristic energy and energy flux of the auroral particle precipitation, especially when the measurements are made along the field line the particles (in most cases electrons) are coming down. The photometers are, however, often made to operate in two possible modes, i.e., field aligned or scanning. In the scanning mode a moving mirror is used to scan a larger part of the sky, to get a broader view of the auroral distribution. With typical quiet, slowly drifting east-west aligned auroral arcs this gives good results when the scanning is done along the magnetic meridian. For example Doe et al. (1997) have discussed a tomographic method to utilize this kind of optical data.

When analyzing photometric measurements, some corrections are needed. First of all, background light should be removed. The only way to know what to subtract is to measure also the background intensities, either continuously with a dedicated channel, or every now and then during the measurements by slightly tilting the filters, altering the passband of the filter this way. The spectra of the background emissions from atmospheric impurities (clouds, ice crystals, etc.) is rather continuous, and measurements just outside the auroral emission lines are valid for the line itself. Another important correction is the distance the light has to travel from the generation region to the photometer: especially for scanning photometer mode this varies considerably from the zenith to the low elevations.

Spectrometers

To be written.

References

- Doe, R. A., J. D. Kelly, J. L. Semeter, and D. P. Steele, Tomographic reconstruction of 630.0 nm emission structure for a polar cap arc, Geophys. Res. Lett., 24, 1119-1122, 1997.