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16 years of airglow measurement with astronomical facilities

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Observations taken with ground-based astronomical telescopes are affected by various airglow emission processes in the Earth's upper atmosphere. This chemiluminescent emission can be used to investigate the physical state of the meso- and the thermosphere. By applying a modified approach of techniques originally developed to characterise and remove these features from the astronomical spectra, which are not primarily taken for airglow studies, these spectra are suitable for airglow research.

For our studies, we currently use data from two observing sites on both hemispheres for our studies: The European Southern Observatory operates four 8m telescopes at the Very Large Telescope (VLT) in the Chilean Atacama desert (24.6°S, 70.4°W). The 2.5m Sloan Digital Sky Survey telescope (SDSS) located in New Mexico/USA (32.8°N, 105.8°W) provides observations from the northern hemisphere. Each of these telescopes is equipped with several astronomical instruments. Among them are several spectrographs operating in the optical and near-IR regime with medium to high spectral resolution.

Currently, we work on data from the following three spectrographs:

(1) UVES@VLT (Ultraviolet and Visual Echelle Spectrograph): This instrument provides spectra in the wavelength regime from 0.3 to 1.1μm in small spectral ranges. Its high resolving power (up to R$\sim$110 000) allows a detailed study of oxygen (OI@557nm, OI@630nm), sodium (NaD@589nm), nitrogen (NI@520nm), and many OH bands. UVES has been in operation since 1999 providing the longest time series. (2) X-Shooter@VLT: This spectrograph is unique as it provides the whole wavelength range from 0.3 to 2.5μm at once with medium resolving power (R$\sim$3 300 to 18 000, depending on the setup). This enables us to study the dependency of optical and near-IR airglow processes simultaneously, e.g. the OH bands. In addition, weak airglow continuum emission, e.g. arising from FeO and NiO can be studied. In operation since 2009, the data cover half a solar cycle. (3) MaNGA spectrograph@SDSS: This instrument combines two spectrographs covering the wavelength range from 0.36 to 1.03μm with a resolving power of R$\sim$2 000. It is equipped with a multi-fibre device and is used for this specific survey that started in 2014 (aimed to finish in 2020).

In this poster we give an overview on the status of the project, some first results, and an outlook.