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# Airglow continuum emission in the visible wavelength regime

Stefanie Unterguggenberger (1), Stefan Noll (1), Wolfgang Kausch (2,1), Bastian Proxauf (1), Stefan Kimeswenger (3,1)

(1) University of Innsbruck, Institute for Astro- and Particle Physics, Innsbruck, Austria (stefanie.unterguggenberger@uibk.ac.at), (2) University of Vienna, Department of Astrophysics, Vienna, Austria, (3) Instituto de Astronomía, Universidad Católica del Norte, Antofagasta, Chile

To probe dynamics and chemistry of the atmosphere at high altitudes ($\sim$ 80-100 km), we need to understand airglow line and continuum emission. Accounting for the continuum emission is harder than for the emission lines. Gaining knowledge of the upper atmospheric continuum emission needs e.g. a proper subtraction of the other continuum components, and a very good subtraction of the other emission lines which requires a high spectral resolution. In this study, we want to focus on FeO continuum emission. FeO emits in the wavelength range from 0.5 to 0.72 $\mu$m and probes an altitude of about 89 km. The altitude of the emission peak lies between those of OH (87 km) and NaD (92 km). Fe and Na are linked by their source, meteors, and their common reactant $O_3$, which holds also for OH emission. Lidar and limb sounding studies provide measurements about the continuum contribution of the FeO and Fe density in the upper atmosphere, but for a more detailed analysis in terms of emission structure and variability a ground-based high resolution and high signal-to-noise spectrum would be preferable.

The European Southern Observatory (ESO) provides the necessary instruments for this purpose. The four 8m sized telescopes operate in Chile at Cerro Paranal in the Atacama desert at an altitude of 2.635 m since fall 1998. The instruments we are using for our study are UVES (0.3 -1.$\mu$m, $\lambda/\Delta\lambda$ = 20.000 to 110.000) and X-shooter (0.3-2.5 $\mu$m, $\lambda/\Delta\lambda$=3.000 to 18.000). UVES covers its optical to near-IR wavelength regime in windows of about 0.4 $\mu$m width, whereas X-shooter is able to observe its whole wavelength range simultaneously. All data taken with these instruments are stored in the ESO archive. In our case, we cover a time span from 2006 to spring 2013, taking the data which were suitable in terms of high signal-to-noise and suitable wavelength range from the archive.

A study by Saran et al. (2011), Journal of Geophysical Research, Vol. 116, at Kitt Peak Observatory detected FeO in the night-sky continuum. They studied FeO emission for nine nights to gain information on its nocturnal behaviour. With our larger dataset of 6 years, we can not just make a statement about the nocturnal behaviour of FeO, but we are also able to detect intra-annual intensity changes and nocturnal variations for different seasons. The intra-annual changes are dominated by the semi-annual oscillation. We can also study the variation of the intensity ratios of the FeO main peak and its side peaks, which are clearly distinguishable in the spectra of both instruments. And finally, comparing FeO to NaD and OH allows us to distinguish between variations by atmospheric dynamics and changes in the Fe concentration and chemistry.