



Contribution ID: 34

Type: **Invited oral presentation**

Frequency Combs for High Precision Spectroscopy in Astronomy

Wednesday, 30 November 2011 13:00 (30 minutes)

The past years have seen the birth of precision spectroscopy in astrophysics. Outstanding scientific questions can be tackled with this technique. Possible slow variations of fundamental constants, such as the fine structure constant or the electron-proton mass ratio, may be detected or limited in magnitude by observing fine structure multiplets in gas clouds and comparison with current laboratory values. Small periodic Doppler shift modulations of stellar spectra caused by their recoiling quiver motion can reveal the existence of extra solar planets that cannot be resolved by optical means. Ultimately, the direct observation of the acceleration of the cosmic expansion is envisioned to be detectable with next-generation, extremely large telescopes. Doppler shifts of about 1 cm/s, corresponding to ~20 kHz at 500 nm would need to be resolvable to realize these observations. Traditional calibration sources like spectral lamps or absorption cells, however, are limited in their repeatability at the 10-100 cm/s level. Frequency combs have therefore been proposed to serve as calibrators for astronomical spectrographs. They can outperform the traditional sources in all important characteristics such as line density, line intensity distribution and line tunability. But most important, their repeatability is fundamentally limited only by the atomic clock to which it is referenced.

We have set up a frequency comb capable of calibrating an astronomical spectrograph and tested it at the HARPS instrument at La Silla observatory in Chile. The major challenge is to match the comb's parameters to the spectrograph's resolution and spectral bandwidth. In my talk I will present the comb system we have developed and some of the results we could obtain in our calibration campaigns at the telescope.

Presenter: Dr WILKEN, Tobias (Laser Spectroscopy Division)

Session Classification: Spectroscopy