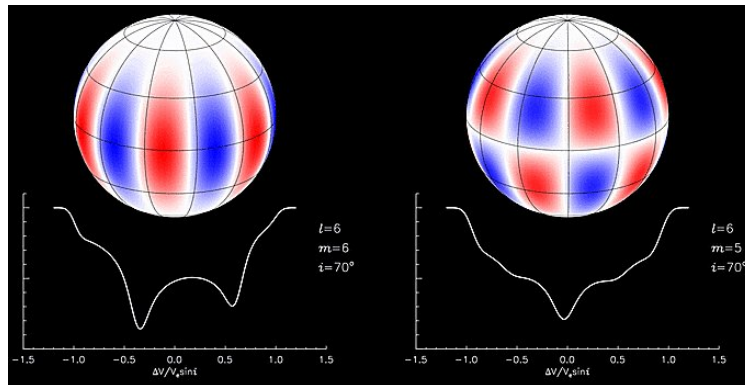


Observation report of non-radial pulsations of δ Sco

by Ernst Pollmann & Carl Sawicki (2015/04/12)

Stellar pulsations are analogous to the oscillations of strings. A string can show different oscillation patterns, called normal modes. The modes have distinct characteristics, such as the wavelength, the number of nodes and the frequency of the oscillation. The surface shape of pulsating stars is caused by that kind of oscillations periodically distorted in a complex way. The main effect on the spectral line profiles is their differential Doppler shift due to variation of the local (radial) velocity (RV) respect to distant observer. The corresponding perturbations in the spectral lines can propagate both from blue to red or from red to blue. This variability strongly depends on the l and m numbers of the dominant pulsation mode excited in the star.



We have performed trial observations of the Si III 4552 Å of the B0.3 IV star δ Scorpii and reports here of results of an analysis of the pulsations in this star over four observation runs. An exemplary spectra series of the night 2013-03-14 (Pollmann) is shown in Fig. 1. Interesting is the comparison to Si III 4552Å 1984 spectra of M. Smith (Fig. 2), what shows a high similarity in profile variation to our spectra. Radial velocities we found within the four runs are shown in Fig. 3 with a measurement accuracy of approx. +/- 10 km/s.

To find out periodic RV oscillations, we used the phase dispersed minimization method, a data analysis technique, developed by Stellingwerf (ApJ 224, 953, 1978), that searches for periodic components of a time series data set. It is useful for data sets with gaps, non-sinusoidal variations, poor time coverage or other problems. In case of a correct found period the parameter theta will reach a minimum compared with neighboring period, and should be ideally near zero. Our PDM periodogram (Fig. 4) shows theta almost zero with a period of 7.23 hrs (± 1.66) hrs, close to a low-degree, stable mode with a period of 6.8 hrs (± 0.5), found by Smith in 1984.

Observation runs: 2013-03-14 (8 spectra, Pollmann), 2013-05-06 (7 spectra, Sawicki), 2013-05-17 (6 spectra, Sawicki), 2013-05-20 (13 spectra, Sawicki)

Instruments used: Pollmann, C14 & LHIRES III, R ~17000, Observatory VdS Köln
Sawicki, C14 & LHIRES III, R ~17000, Alpha Observatory Alpine, TX

Calibration: Xenon-Argon gas tube in front of the telescope

Spectra reduction: Pollmann, program used: MaximDL & VSpec
Sawicki, program used: ISIS

RV evaluation: program used: SpecRave (developed by R. Bücke, Germany)

Period analysis: program used: SpecTSA (developed by R. Bücke, Germany)

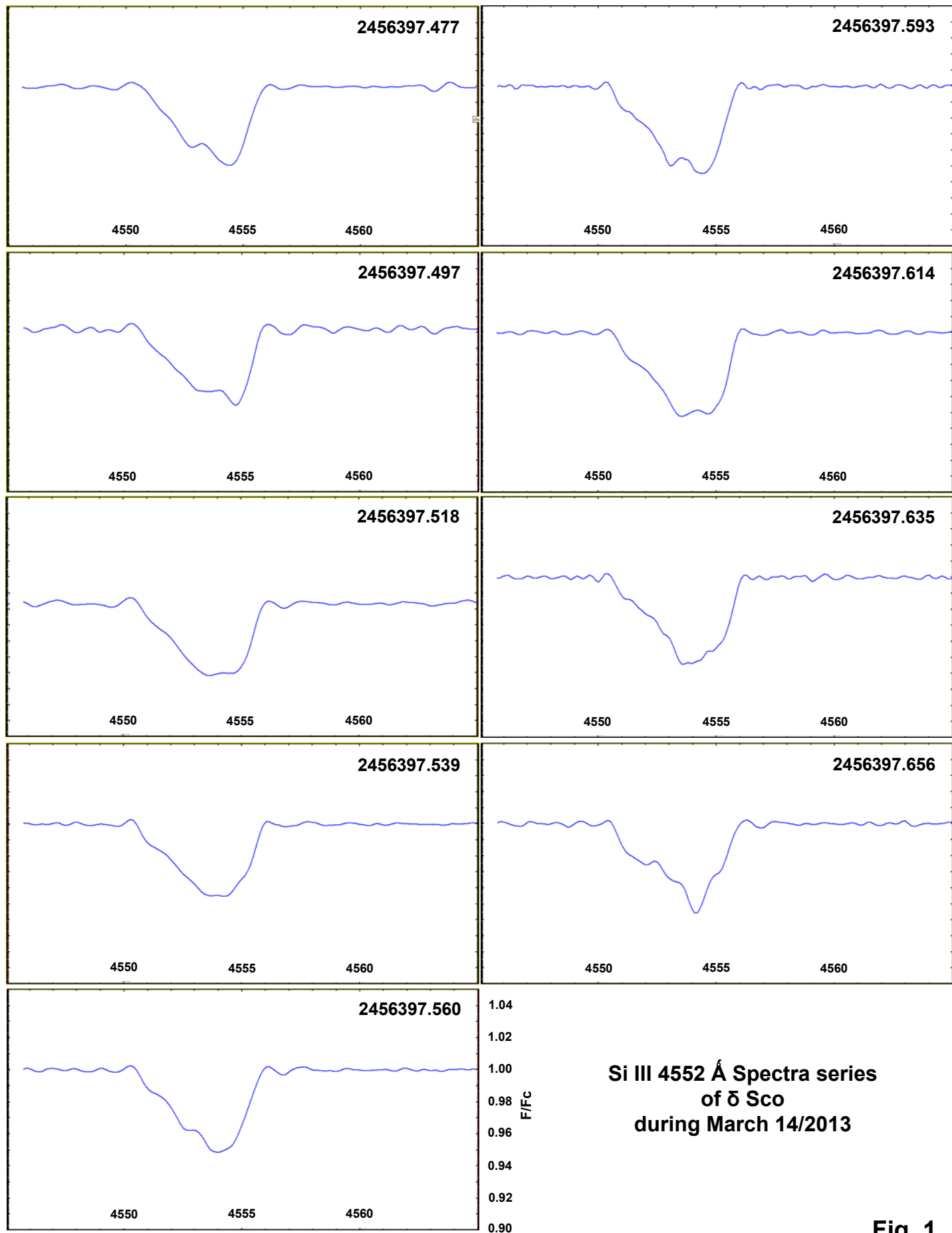
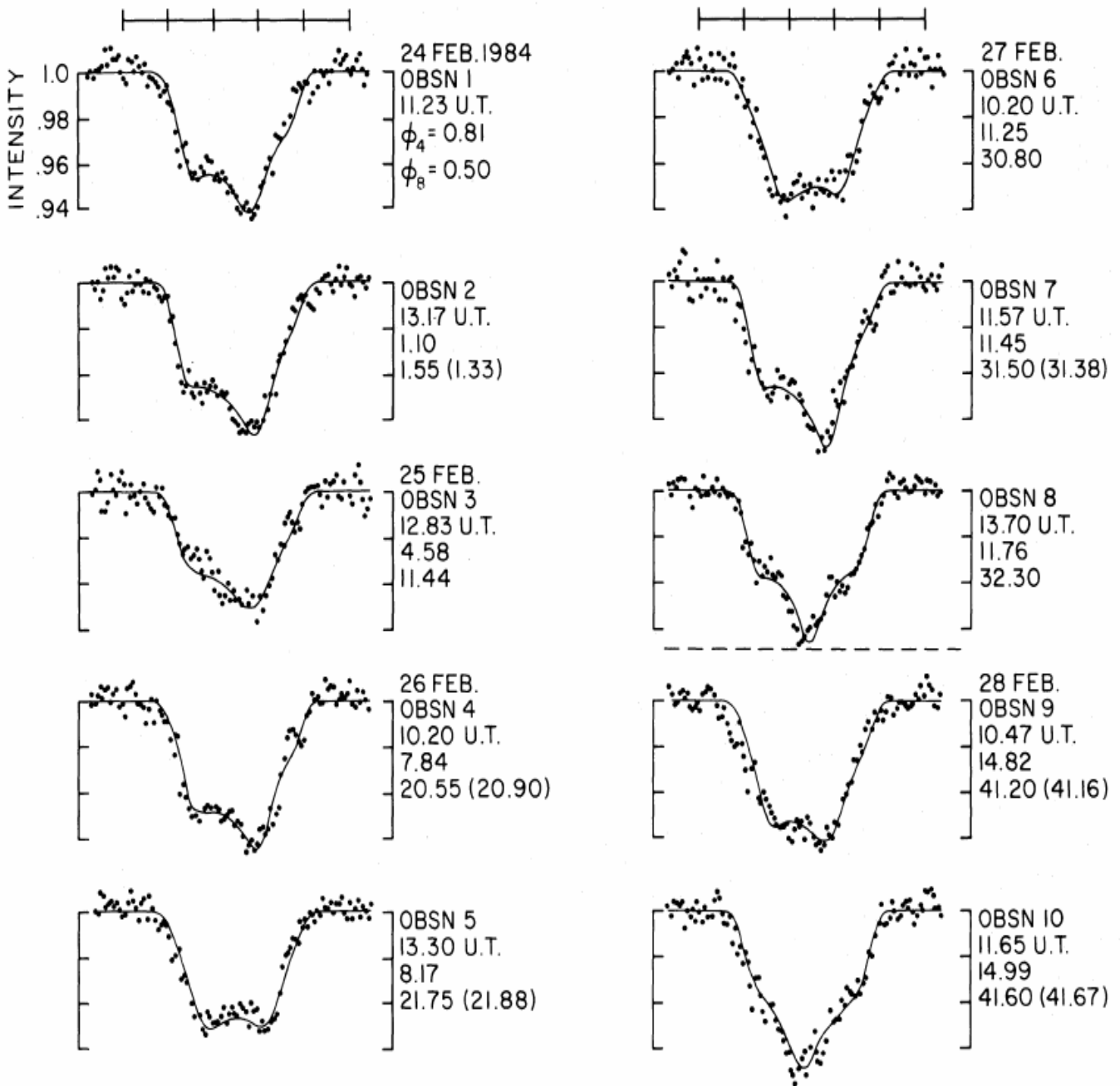


Fig. 1



Februar 1984 spectra of M. Smith are shown a low-degree, stable mode with a period of 6.8 ± 0.5 hr
 (from ApJ, 304, 728, 1986, May 15)

