

Monitoring the H α emission profile of ζ Tau (Renewal the circum stellar disk ?)

The appearance of the H α emission profile for the time period November 2000 to March 2016 in Fig. 1 shows one view in four sections: 11/2000-04/2003, 09/2003-03/2007, 09/2007-04/2011, 08/2011-03/2016. Beside the V/R variability ($V>R$; $V=R$; $V<R$) the temporal appearance of the triple-peak characteristic of the profile is shown for certain phase sections (white phase references). Spectra from 11/2000 to 03/2007 were taken by me with a classical self-built spectrograph, spectra from 09/2007 to 03/2016 with the LHIRES III spectrograph (both with a 2400 L/mm grating) and the C14-telescope at the observatory of the Vereinigung der Sternfreunde Köln.

The EW long-term monitoring in Fig. 2 (above) shows a historic minimum between 2012 and 2014, which appears in agreement with a minimum of disk mass for the almost same time section found by Tycner & Sigut (<http://adsabs.harvard.edu/abs/2015IAUGA..2255073T>). The V/R monitoring (Fig. 2 bottom) shows that the decrease in the disk mass is accompanied by a decrease in the V/R amplitude.

The appearance of the bizarre and mysterious triple-peak emission profiles is indicated by solid vertical bars and “3pk” (in red). As can be seen in Fig. 2 (bottom), the onset of the triple-peak interval is typical fairly close to V/R phase 0.4-0.5 [calculated with: JD 2450414 + 1429 * E; (Stefl et al., A&A 504, 929, 2009)] and lasts approximately up to the maximum of the rising branch.

Because of the fact that ζ Tau has an unseen companion, any variability must be checked for a relation to the 132.9 d orbital period established by Harmanec (Bull. Astr. Inst. Czechol., 35, 164, 1984). This particularly for the time section during and after the disk mass minimum. Fig. 3 (above) shows an enlargement view of the V/R data after the historical disk mass minimum from JD 2455059 until now.

The PDM analysis of these data in Fig. 3 (middle) shows this characteristic present with a period of 132.6 d also in that time section, although with a clear low amplitude (see also the period plot in Fig. 3 bottom).

It should be mentioned that Stefl et al. wrote in 2007 (ASP Conference Series, Vol. 361) “*We do not understand under which conditions the synchronization of V/R variations with the orbital period occurs*”. In this context also the question will be, whether the 70d-period appears again, as it was found by Pollmann & Rivinius (IBVS, No. 5813) and confirmed by Ruzdjak et al. (A&A 506, 1319, 2009).

As can be seen in Fig. 2 (above), since 2014 the EW is obviously on the way to a higher development (and hence the disk mass too). It will be of large interest, how this development during the coming years will offer analytical opportunities in that sense.

Ernst Pollmann, March 21, 2016

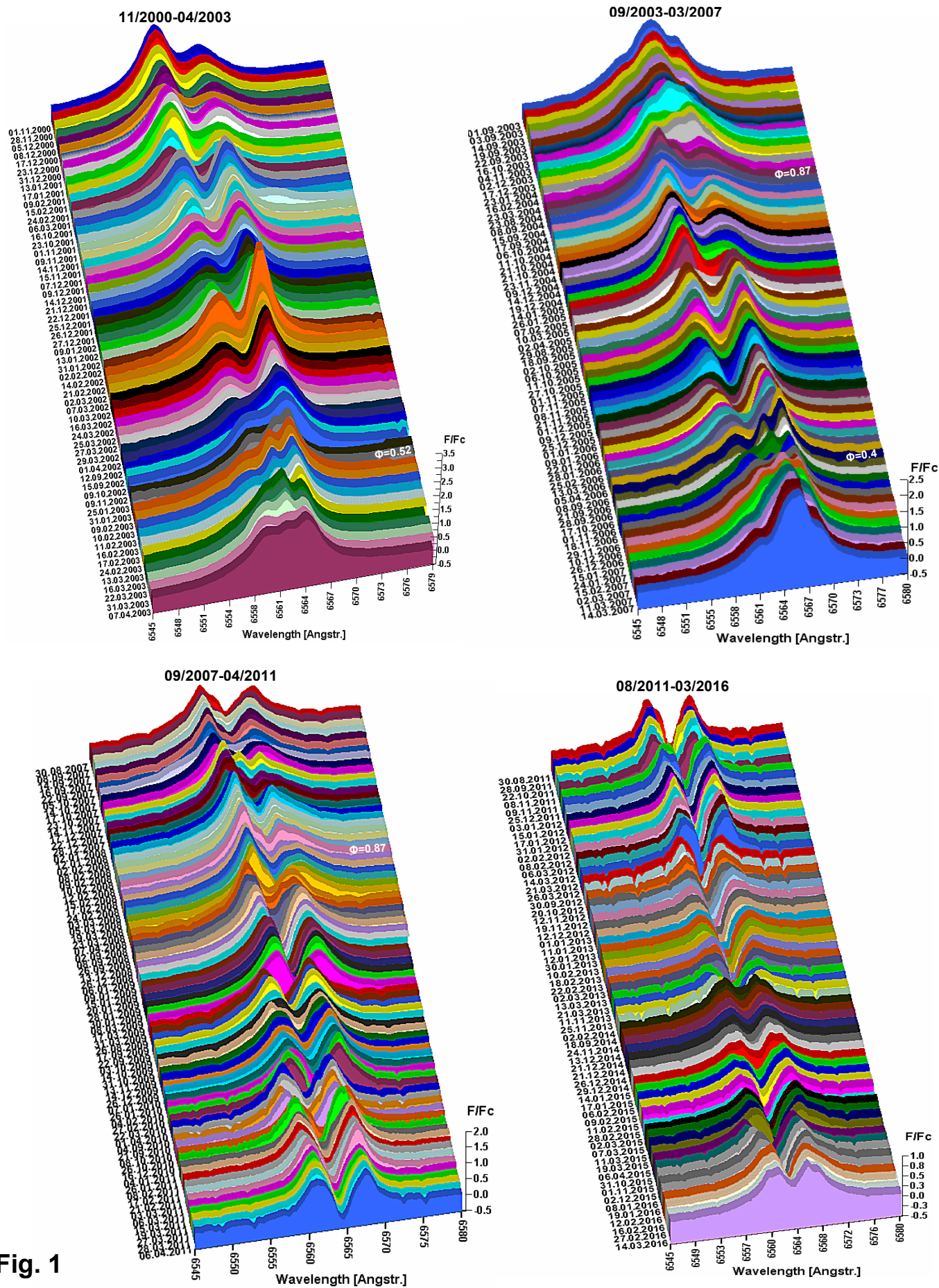


Fig. 1

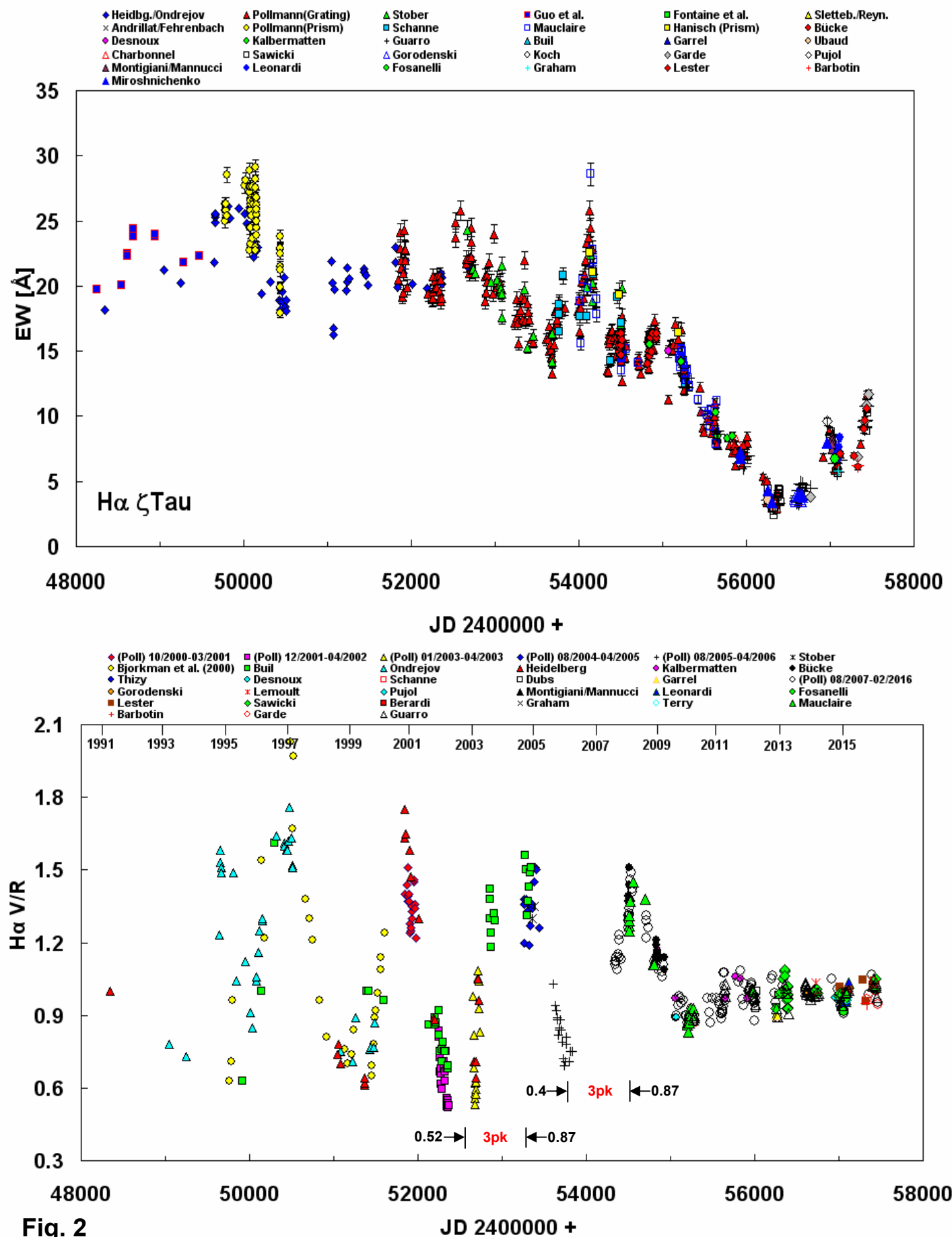


Fig. 2

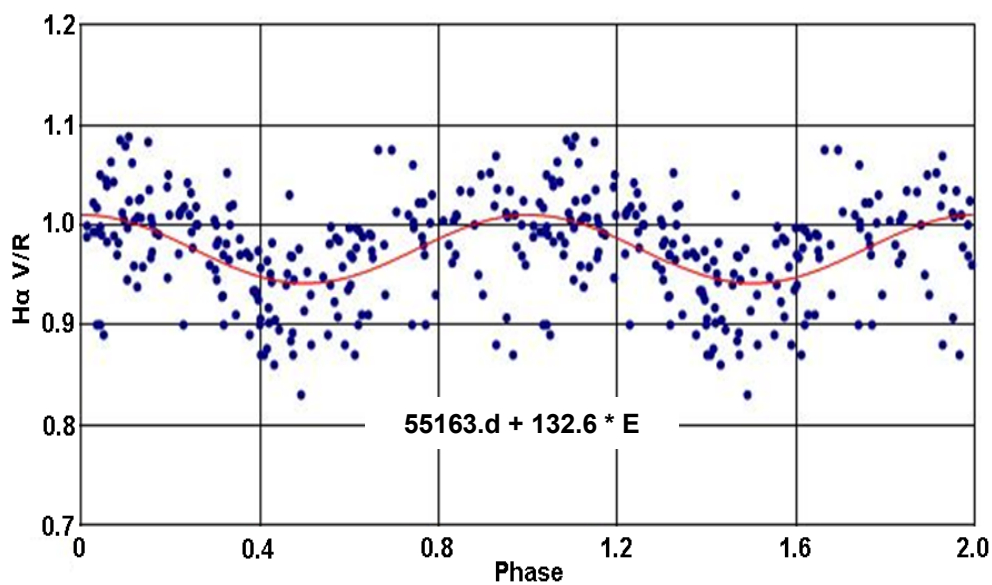
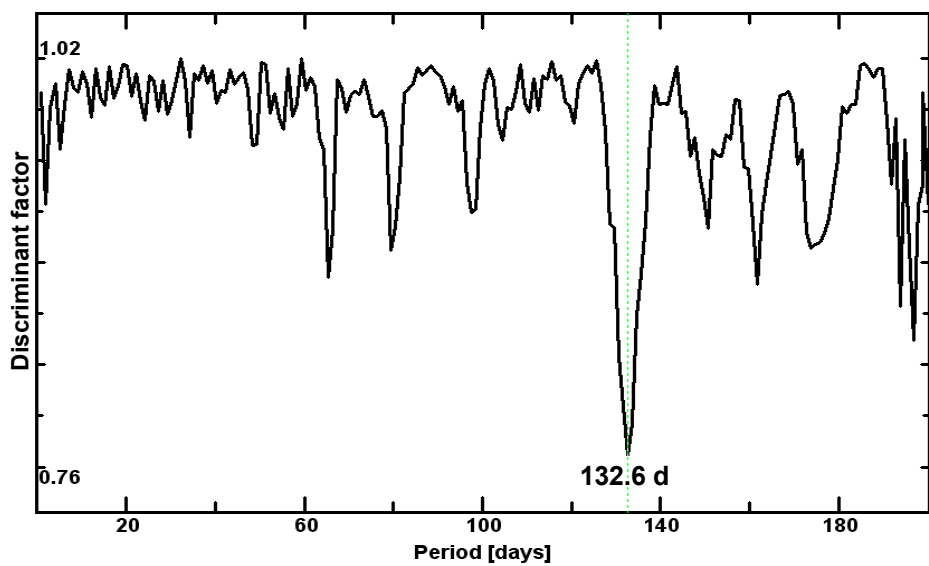
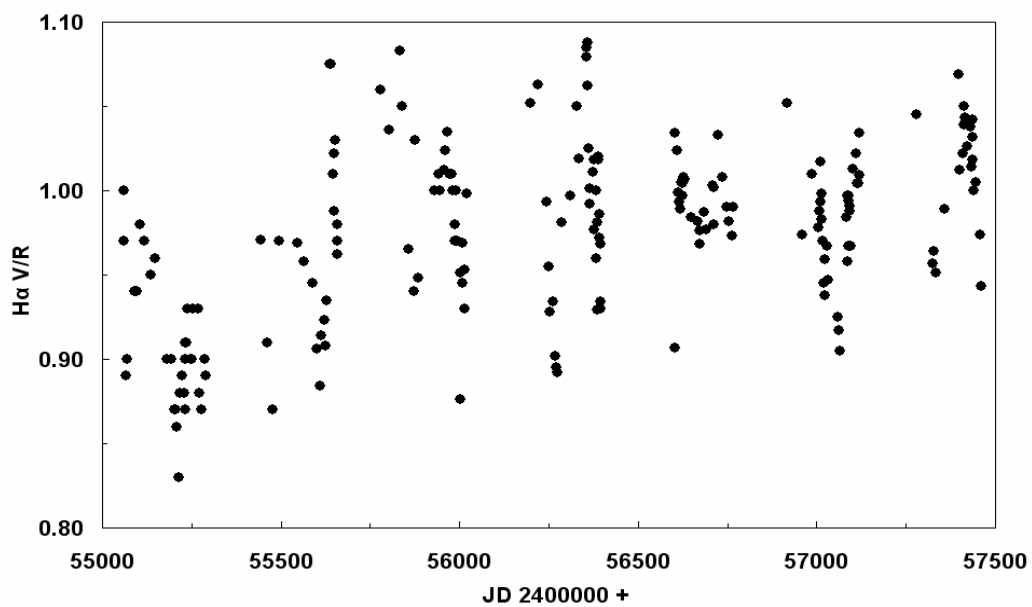


Fig. 3