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SPECTROSCOPIC CLASSIFICATION OF PZ NORMAE

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PZ Nor is first mentioned as a variable star by Hoffmeister (1963). He and later Gessner & Meinunger (1975) describe the object as a slow irregular variable showing a constant brightness at a low level over several months and brighter values afterwards. The magnitudes they give range from $14\overset{m}{.}5$ to $15\overset{m}{.}5$. Cieslinski et al. (1997) found the object at V=$13\overset{m}{.}9$ and also determined its colours which showed the object to be rather red. Later, PZ Nor has been classified as probable cataclysmic variable (CV) showing frequent outbursts (Kinnunen, 2002) and is such listed in Downes et al. (2001).

We have recently performed spectroscopic observations with the aim to classify the object. Here, the results of this analysis are presented.

The data have been obtained on 2003-05-09 at ESO, La Silla, using EMMI at the NTT with grism #3 and a 1.0 arcsec slit for the low resolution spectrum and FEROS at the 2.2 for the high resolution spectroscopy. We get respective FWHM resolutions of 1 nm and 0.015 nm. Standard reduction has been performed with IRAF for the EMMI data. For FEROS, the data have been reduced with the provided MIDAS–pipeline. Further analysis of all data has been done with MIDAS only. Both data sets have been corrected for the instrument function and flux–calibrated via a spectrophotometric standard. However, due to very poor weather conditions, the absolute flux–values have to be regarded with caution.

The spectrum of PZ Nor is given in Fig. 1. It is dominated by the strong TiO absorption features and shows only very weak Balmer–lines in emission (see Fig. 2 for the high resolution spectrum of these lines, Table 1 for their properties). No other emission lines have been found in the spectrum. The FWHMs of these Balmer lines lie around 0.08 nm (see Table 1). This is about the minimum line width expected for CVs at an inclination $i = 0$ which makes this classification very improbable. If anyway a CV is assumed, the low equivalent widths of the lines and the strongly inverse Balmer decrement would indicate a very hot and dense accretion disc that would dominate the optical spectrum and subdue any sign of molecule bands which are instead very strong in the spectrum. We therefore conclude that PZ Nor cannot be classified as a cataclysmic variable (CV).

Instead, the spectrum reveals the object to be a late–M giant, best agreement is achieved with type M5 III (Silva & Cornell, 1992). To further check the CV classification, we have subtracted the normalised standard M5 III spectrum from the spectrum of PZ Nor. The result shows a flat continuum plus emission lines. In particular, no evidence is found for any additional blue component like white dwarf or accretion disc. This supports our conclusion that PZ Nor had been misclassified as a CV.

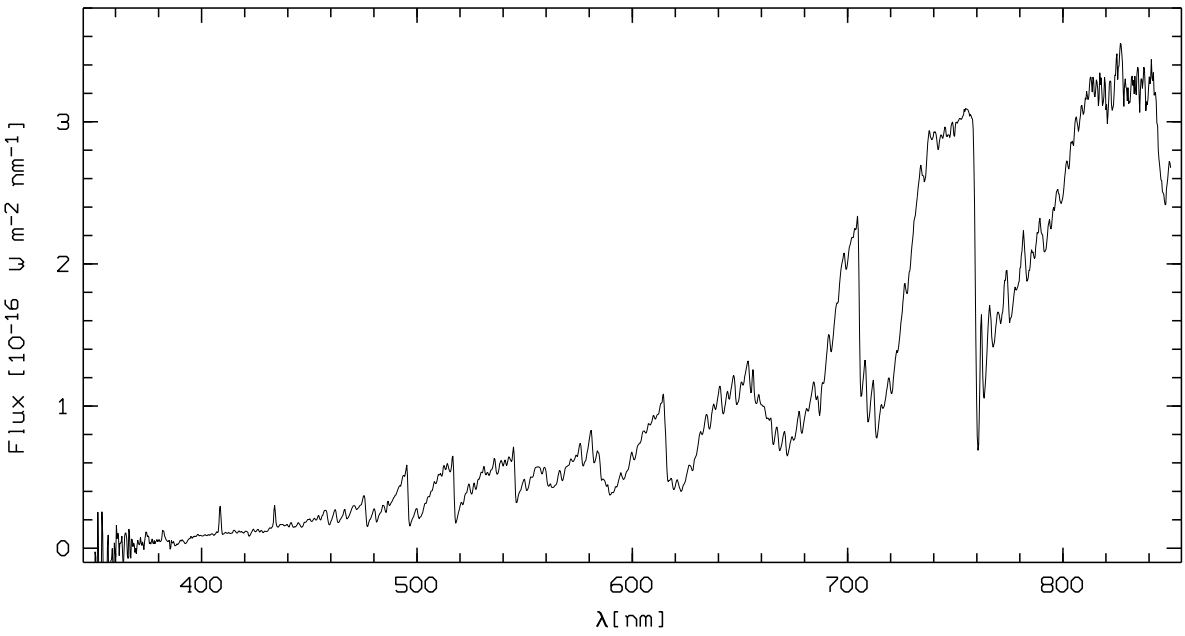

Figure 1. The low resolution spectrum of PZ Nor resembles that of an M-type giant.

The object has shown photometric variability on time scales of months, but no periodicity has been detected so far (Hoffmeister, 1963; Gessner & Meinunger, 1975). On our acquisition images the object appeared to be brighter compared to surrounding field stars than on the finding chart. Although we can give no numerical value for the brightness due to the poor weather conditions, we can assert that for these observations, the object was in or close to a high state phase. This fits with the presence of the Balmer lines which are expected for late–type variables with unstable atmospheres around maximum light. Also the decrement of Hγ/H$\delta \approx 0.5$ points to a phase close to maximum light (Crowe & Garrison, 1988). We searched the high resolution spectrum for metal emission lines like SiI (410.295 nm), MgI (457.110 nm), and FeI (430.791 nm; 420.203 nm), which have been observed in Mira–type stars (Fox et al., 1984) but found none of them. Whether PZ Nor is actually a real Mira–type variable with a long - and hence not yet detected - period or some late–type semi–regular variable has yet to be investigated.

Table 1: FWHM, and equivalent widths of all identified emission lines are listed. The FWHM has been measured in the high resolution spectrum, as the lines are not resolved in the low resolution one. The equivalent widths in both spectra are the same within the errors. The line fluxes have not been included due to non–photometric weather conditions.

Transition	FWHM [nm]	$-W$ [nm]
Hα	0.082(1)	0.16(1)
Hβ	0.083(3)	0.15(2)
Hγ	0.082(2)	1.12(8)
Hδ	0.075(4)	2.13(5)

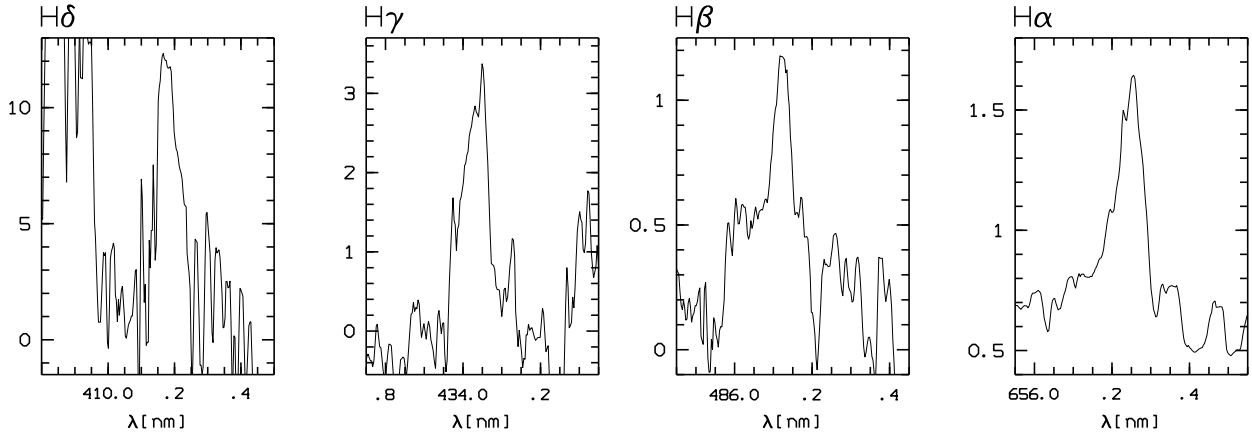

Figure 2. High resolution spectrum of PZ Nor around Hα, Hβ, Hγ, and Hδ (from right to left) in relative flux units (10^{-16}Wm^{-1}nm^{-1}). As in the low resolution spectrum, all four lines are clearly visible. The high resolution reveals the narrowness of the emission lines which have an average FWHM of 0.08 nm.

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