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EMISSION-LINE FLARE OF ES 560B

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ES 560 (ADS 2594) is a visual double star with the separation of 9^s.5. We observed it spectroscopically starting from 1996 to calibrate an orientation of the frame of the Multi-Pupil Field (Fiber) Spectrograph of the 6m telescope (MPFS, Afanasiev et al. 1996, <http://www.sao.ru/~gafan/devices/mpfs/>) during our investigation of stellar populations in the centers of nearby galaxies; later the brighter component of the double, ES 560A, which has a spectral classification of K2 (SIMBAD), was used by us as a line-of-sight velocity standard for cross-correlation with the galactic spectra. The spectra of ES 560B were not used but were still stored in the archive of our observational data. The detailed log of the observations of ES 560 with the MPFS is given in Table 1.

Table 1. Log of the spectral observations of ES 560 with the MPFS of the 6m telescope

Date	UT (start)	Exposure (s)	Detector	Spectral range
1996 Aug 17	00:50	180	CCD K585 520 × 580	4800–5600 Å
1996 Aug 18	01:14	180	CCD K585 520 × 580	4800–5600 Å
1996 Oct 10	03:19	180	CCD ISD017A 1040 × 1160	4100–5500 Å
1997 Nov 1	02:38	270	CCD K585 520 × 580	4700–5500 Å
1998 Jan 19	16:12	180	CCD K585 520 × 580	4700–5500 Å
2001 Jan 28	19:00	60	CCD TEK 1024 × 1024	4250–5600 Å
2001 Sep 22	01:58	240	CCD TEK 1024 × 1024	4250–5600 Å
2002 Mar 9	17:03	240	CCD TEK 1024 × 1024	4250–5600 Å

During our last observational run with the MPFS, in March 2002, we have exposed ES 560 as usually and have immediately seen that the spectrum of ES 560B has noticeably changed: now it contains strong narrow Balmer emission lines, H β with $EW = 13\text{\AA}$ and H γ with $EW = 11\text{\AA}$ falling into our spectral range. Careful examination of the past spectra of ES 560B, starting from August 1996, has revealed an early presence of the very weak emission H β comparable to the noise; now its intensity has risen by more than an order. The full evolution of the spectrum of ES 560B in the spectral range of 4300–5450 Å is shown in Figure 1; all the continua are normalized to the same level and after

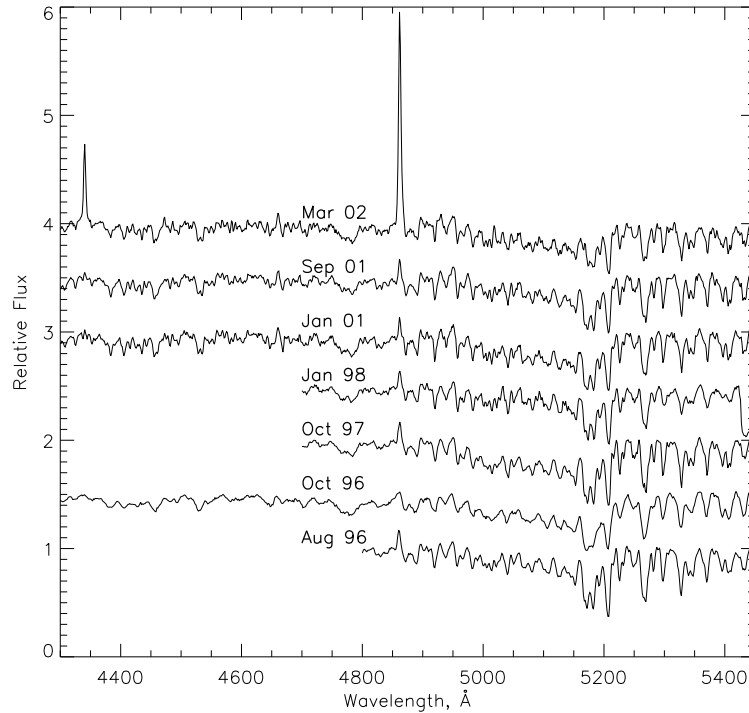


Figure 1. The evolution of the spectrum ES 560B from 1996 to present (two spectra of August 1996 are co-added); the continua are normalized and subtracted

that subtracted, and the shift along the ordinate axis for every spectrum is selected to provide a clear presentation.

Table 2. The ratio of brightnesses of two components of the double star ES 560

Date	$Flux_B/Flux_A$
1996 Aug 17	0.086
1996 Aug 18	0.076
1996 Oct 10	0.060
1997 Nov 1	0.048
1998 Jan 19	0.047
2001 Jan 28	0.115
2001 Sep 22	0.187
2002 Mar 9	0.037

By using SIMBAD, we have made cross-identification of ES 560B over some catalogues. The star is mentioned as V 577 Per by Kazarovets et al. (1999) in their 74th list devoted to variable stars discovered by HIPPARCOS (the Hipparcos name of ES 560 is HIC 16563). A more close examination of their description shows that HIPPARCOS has presented a photometry of two the stars of the double system ES 560 **together**, and the summed magnitude varies by some 0.1 mag. What star is variable, ES 560A or ES 560B, has been still unknown. With our integral-field spectroscopy, we are able to calculate a ratio of the two star's fluxes; these ratios measured in the 100 Å -band centered at the wavelength of

5000 Å, from 1996 to March 2002, are presented in Table 2, and their typical accuracy is 0.003–0.005. One can see that the relative brightness of ES 560B varies by a factor of 5, the SIMBAD information about $V_A = 8^m3$ and $V_B \approx 10^m5$ being related rather to the close-to-high state of ES 560B. Since the summed magnitude, according to HIPPARCOS, varies by ~ 0.1 mag, and not by 1.5 mag as it would be if the brighter component changes its flux by a factor of 5, we should conclude that it is ES 560B that is the variable star. Interestingly, the bright flare of emission lines occurred some month later (March 9, 2002) than the maximum continuum brightness (September 22, 2001, according to Table 2). We can suggest that there is either a few month delay between the emission line and continuum brightening, or the two events are two independent short flares with fast evolution.

What may be the nature of the variable star ES 560B? Another result of the cross-identification of ES 560 over various catalogues is a finding that a bright extreme-ultraviolet source is related to this double system. Firstly, ROSAT WFC survey in the spectral range of 60–200 Å (Pounds et al. 1993), and later EUVE all-sky survey at the wavelength of 100 Å (Bowyer et al. 1994) have mapped a rather bright source near ES 560 – 2RE J033314+461549 and EUVE 0333+462. As the spatial resolution of both surveys is about one arcminute, it is impossible to identify the UV source with ES 560A or ES 560B unambiguously. Mason et al. (1995) made spectral observations of the optical counterparts of the ROSAT EUV sources, and have found weak emission activity in both stars: an emission line of CaII3933 with $EW = 0.3$ Å, but no Balmer emissions, in ES 560A and an emission line H α with $EW = 2$ Å in ES 560B; the latter star is classified by them as dMe. The possibility that ES 560B is a flaring late-type dwarf may explain the most phenomena described here; however it is somewhat strange that a rather bright ($V \approx 10.5$) nearby flaring star has not been discovered yet.

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