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THE RADIAL VELOCITY OF THE roAp STAR γ Equ

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The sharp-line cool magnetic SrCrEu star γ Equ (HD 201601) is a very slowly rotating star ($P \simeq 74$ years, Leroy et al., 1994) and is well known as a roAp star with at least four excited unstable modes (Martinez et al., 1996). The radial velocities obtained during the history of investigations of this star did not show any long-term variations larger than the observational errors. Recently, Scholz et al. (1997) published their results of radial velocity measurements of γ Equ made in 1995 and 1996. Nine of their radial velocities show a rapid increase from a mean value of -16.81 km s^{-1} up to a maximum at -4.28 km s^{-1} within the interval JD 2449608 - JD 2450356, while two later measurements (on JD 2450391 and JD 2450410) show a decreasing V_r which seems to converge towards previous values. They suggested that γ Equ is a long-period binary star with a high eccentricity.

The results of Scholz et al. (1997, hereafter S97) disagree with our 758 homogeneous radial velocity estimations for γ Equ collected using a cross-correlation technique, during 27 nights in 1994, 1995 and 1996. The epochs of our measurements encompass the phase of the magnetic minimum and many of the nights on which S97 observed, including a most critical one.

The main part of our observations were carried out within a collaboration between Odessa Observatory (Ukraine) and Institute of Astronomy, Russian Academy Sciences (Russia) on radial velocity investigations of selected chemically peculiar stars (Mkrtichian et al. 1997). We have used the 1.0m and 0.6m telescopes of Simeiz Observatory (Mt. Koshka, Crimea, Ukraine) and the 0.7m telescope of Sternberg Institute (Moscow, Russia) equipped with the transportable CORAVEL-type scanner (hereafter RVS), (Tokovinin 1987). Brief reports on rapid photometric and radial-velocity variations of the roAp star γ Equ will be given in two papers by Mkrtichian (1998) and Mkrtichian et al. (1998), while the present publication is devoted to the long-term behaviour of the radial velocity of γ Equ. Two radial velocity measurements – one of which at a most critical date – were also acquired at Observatoire de Haute-Provence (CNRS, France), using the 1.0m Swiss telescope equipped with the CORAVEL scanner (Baranne et al. 1979), as part of a programme of search for binaries among cool Ap stars.

The observational procedure on RVS and CORAVEL scanners includes blocks of measurements of the star, immediately preceded and followed by a velocity calibration exposure using an internal Ne discharge lamp (RVS) or a Fe hollow cathode lamp (CORAVEL). During every night, several measurements of radial-velocity standard stars were used for correction of low amplitude instrumental drifts.

In Table 1, the journal of radial velocity observations is presented.

Table 1. The journal of 1994 - 1996 radial velocity observations of γ Equ.

$HJD_{start} - HJD_{end}$	Mean V_r km s^{-1}	Error $\pm \text{km s}^{-1}$	N	Tel. m	Observatory	Observer(s)
2449530.536 - .556	-17.00	0.144	17	1.0	SO	RAS
2449556.540 - .549	-16.03	0.302	8	1.0	SO	SNN
2449569.424 - .437	-17.13	0.094	8	0.6	SO	SNN&GNA
2449607.393 - .407	-16.61	0.289	11	0.6	SO	SMG&SME
2449608.300 - .351	-17.08	0.216	24	0.6	SO	SMG&SME
2449609.425 - .439	-17.38	0.220	11	0.6	SO	SMG&SME
2449636.170 - .259	-15.350	0.131	44	0.7	SAI	SNN
2449648.195 - .284	-19.816	0.068	49	0.7	SAI	SNN
2450042.261	-16.86	0.46	1	1.0	HP	MJC
2450254.5347 - .5416	-16.91	0.135	11	1.0	SO	RAS
2450255.5216 - .5355	-16.40	0.149	19	1.0	SO	RAS
2450256.5265 - .5397	-16.39	0.285	18	1.0	SO	RAS
2450257.5273 - .5432	-16.74	0.224	22	1.0	SO	RAS
2450258.5280 - .5405	-16.70	0.179	17	1.0	SO	RAS
2450264.5472 - .5604	-17.05	0.145	18	0.6	SO	RAS
2450265.5479 - .5618	-17.07	0.110	19	0.6	SO	RAS
2450267.5501 - .5647	-16.83	0.303	18	1.0	SO	GEV
2450268.558 - .567	-16.97	0.293	13	1.0	SO	GEV
2450269.551 - .559	-16.97	0.246	11	1.0	SO	GEV
2450270.549 - .556	-16.64	0.308	10	1.0	SO	GEV
2450271.554 - .559	-16.17	0.463	8	1.0	SO	GEV
2450272.5592 - .5636	-16.89	0.304	10	1.0	SO	GEV
2450285.4864 - .4954	-18.15	0.168	11	0.6	SO	SME
2450316.4801 - .5783	-16.69	0.054	115	0.6	SO	AS&MDE
2450319.3284 - .4489	-16.60	0.049	126	0.6	SO	AS&MDE
2450321.3158 - .4652	-16.86	0.055	137	0.6	SO	AS&MDE
2450355.384	-16.77	0.45	1	1.0	HP	vES

Observatory:

SO - Simeiz Obs., SAI - Sternberg Astron. Inst., HP - Haute-Provence Observatory.

Observer(s):

ASV — S.V. Antipin, GEV — E.V. Glushkova, GNA — N.A. Gorynya, MDE — D.E. Mkrtychian, MJC — J.-C. Mermilliod, RAS — A.S. Rastorgouev, SNN — N.N. Samus, SME — M.E. Sachkov, SMG — M.G. Smekhov, vES — S. van Eck.

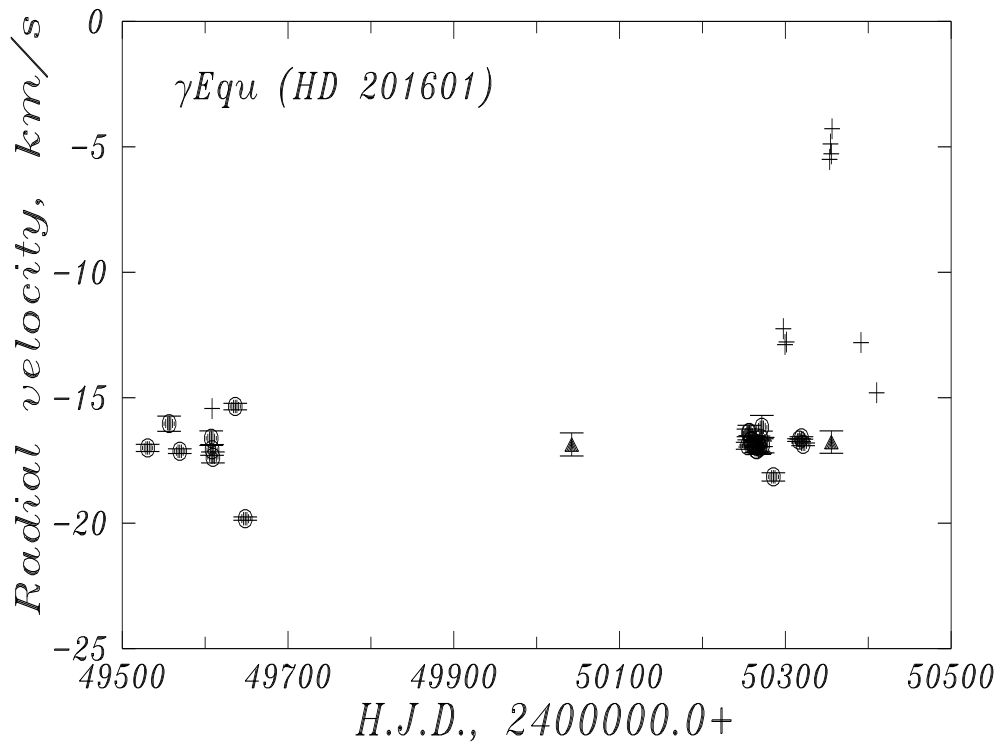


Figure 1. The 1994-1996 radial velocities of γ Equ: full dots — RVS data, triangles — CORAVEL data, crosses — Scholz et al. (1997) data

Figure 1 shows the mean radial velocities of γ Equ versus the Julian Date in 1994–1996, obtained with RVS (full dots), CORAVEL (triangles), and by S97 (crosses). As can be seen, our numerous cross-correlation radial velocities (758 estimations) cover the 1994–1996 interval, but do not show any drastic increase during the year 1996, contrary to what S97 reported. For instance, our radial velocity estimate of -16.77 at the epoch HJD 2450355.384 was obtained just one hour before the measurement yielding $V_r = -5.28 \text{ km s}^{-1}$ according to S97 (at HJD 2450355.426), which makes a difference as large as -11.49 km s^{-1} . Whereas our results are in full agreement, not only with our own previous values, but also with all radial velocities published in the literature, those published by S97 are clearly discrepant. Our data show that the radial velocity of γ Equ has remained constant within the errors on long timescales at a value which, during the 1994-1996 interval, amounted to $-16.83 \pm 0.038 \text{ km s}^{-1}$.

We can summarize the results of our note as follows:

- We obtained 758 new, homogeneous and precise radial velocities of γ Equ in 1994–1996 using cross-correlation scanners.
- The mean radial velocities for individual nights of 1994–1996 are constant on long timescales within the errors and average to $-16.83 \pm 0.038 \text{ km s}^{-1}$. This value is close to the average radial velocity for the last 70 years.
- Our numerous radial-velocity measurements of γ Equ, the epochs of which largely overlap those of S97, do not show any significant increase of radial velocity at the time of the year 1996 when such a change occurred according to S97. We conclude that there is as yet no evidence for a binary companion to γ Equ.

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