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Detection of white dwarf spin period variability in the intermediate polar V2306 Cygni

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ABSTRACT

Magnetic **cataclysmic variables** are close binaries which consist of a compact object - a white dwarf, and a red dwarf filling its Roche Lobe. Such systems are physical laboratories that enable study of the influence of magnetic field on flows of matter. They often exhibit spin-up or spin-down of the white dwarf, some systems exhibit more complex behaviour of the spin period change.

We monitor changes of the spin periods of white dwarfs in a sample of close binary systems to study interaction of the magnetic field and accretion processes as well as evolution of intermediate polars.

Within the framework of our intermediate polar monitoring program, we obtained photometric CCD observation at several observatories. Two-period trigonometric polynomial fit was used for determination of extrema timings. The (O-C) analysis was performed to study the systems orbital and spin periods variability.

Using data taken during 9 years of observations of the magnetic cataclysmic variable V2306 Cygni (formerly known as 1WGA J1958.2+3232), we detected the spin period variability which shows a spin-up of the white dwarf with a characteristic time of $(53 \pm 5) \cdot 10^4$ years. The value of the spin period was 733.33976 seconds with the formal accuracy of 0.00015 seconds. We derived an improved value of the orbital period of the system to be 4.371523 ± 0.000009 hours.

Key words: stars: individual: V2306 Cyg – stars: novae, cataclysmic variables – stars: binaries: close – stars: magnetic fields

1 TABLES FOR ONLINE VERSION

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Table 1. List of orbital minima timings

BJD	±	ϕ	Telescope	AAVSO
2455484.68162	0.00283	0.52		MEV
2455484.70542	0.00203	0.65		GFB
2455487.59681	0.00333	0.52		JJI
2455492.34261	0.00164	0.58		GFB
2455502.17763	0.00195	0.57		GFB
2455808.88716	0.00743	0.34		SRIC
2455809.81523	0.00967	0.44		SRIC
2456086.68173	0.00761	0.38		UJHA
2456118.93406	0.00474	0.44	ZC600	
2456120.93614	0.00331	0.43	ZC600	
2456501.78868	0.00635	0.23	ZC600	
2456501.99019	0.00563	0.34	ZC600	
2456524.37774	0.00659	0.24	AZT-8	
2456524.38762	0.00779	0.30	AZT-8	
2456524.38884	0.00443	0.30	AZT-8	
2456797.59193	0.00558	0.13	Zeiss50	
2456797.60104	0.00481	0.18	Zeiss50	
2456820.17584	0.00394	0.11	ZC600	
2456820.17719	0.00504	0.12	ZC600	
2456829.08129	0.00294	0.00	ZC600	
2456830.75172	0.00534	0.17	ZC600	
2456844.24303	0.00218	0.24		UJHA
2456856.05609	0.00375	0.09		CMJA
2456873.91762	0.00216	0.15		BDG
2457172.26790	0.00695	0.03	Zeiss50	
2457182.64891	0.00390	0.02	ZC600	
2457203.42871	0.00469	0.10	ZC600	
2457214.71194	0.00823	0.04	ZC600	
2457252.06467	0.00240	0.10		GFB
2457292.73976	0.00523	-0.10		BDG
2457308.70379	0.00212	0.04		CDK
2457570.25518	0.00331	-0.10	Zeiss50	
2457570.27337	0.00275	0.00	Zeiss50	
2457578.82224	0.00608	-0.07		UJHA
2457578.83814	0.00306	0.02		GFB
2457580.46332	0.00547	-0.06	Zeiss50	
2457581.56105	0.00246	-0.03		GFB
2457582.29429	0.00319	-0.01		UJHA
2457585.22263	0.00235	0.07		GFB
2457589.38994	0.00235	-0.05		CMJA
2457589.75133	0.00217	-0.07		JJI
2457591.76133	0.00320	-0.04		GFB
2457592.31207	0.00142	-0.01		JJI
2457596.29837	0.00223	-0.13		GFB
2457615.82203	0.00345	0.05		COO
2457929.49930	0.00389	0.08	ZC600	
2457936.57879	0.00313	-0.06	ZC600	
2457947.87532	0.00219	-0.04		JJI
2457950.42435	0.00265	-0.05	ZC600	
2457960.78127	0.00267	-0.19	ZC600	
2458279.40343	0.00502	-0.02	ZC600	
2458279.40442	0.00474	-0.01	ZC600	
2458302.82729	0.00653	-0.43	ZC600	
2458303.54204	0.00874	-0.50	ZC600	
2458329.77603	0.01527	-0.48	ZC600	
2458329.80477	0.01115	-0.32	ZC600	

Table 2. List of spin maxima timings

BJD	±	ϕ	Telescope	AAVSO
2455484.66649	0.00078	-4.08		GFB
2455484.69090	0.00059	-4.20		MEV
2455487.67892	0.00085	-4.16		JJI
2455492.43158	0.00063	-4.20		GFB
2455502.14319	0.00048	-3.99		GFB
2455808.80712	0.00064	-3.15		SRIC
2455809.79910	0.00036	-3.28		SRIC
2456086.77074	0.00241	-2.75		UJHA
2456118.93131	0.00051	-2.63	ZC600	
2456120.99438	0.00063	-2.56	ZC600	
2456501.87680	0.00063	-1.37	ZC600	
2456501.99973	0.00038	-1.89	ZC600	
2456524.38993	0.00087	-0.90	AZT-8	
2456524.39090	0.01335	-1.78	AZT-8	
2456524.39373	0.00026	-1.45	AZT-8	
2456797.55274	0.00093	-1.13	Zeiss50	
2456797.56599	0.00067	-0.57	Zeiss50	
2456820.13322	0.00081	-0.72	ZC600	
2456820.21546	0.00074	-1.03	ZC600	
2456829.08684	0.00043	-0.81	ZC600	
2456830.78282	0.00049	-0.99	ZC600	
2456844.27055	0.00047	-0.88		UJHA
2456855.99153	0.00039	-0.93		CMJA
2456873.87615	0.00054	-0.78		BDG
2457172.21083	0.00067	-0.28	Zeiss50	
2457182.58443	0.00056	-0.08	ZC600	
2457194.48378	0.00038	-0.11	ZC600	
2457203.43024	0.00019	-0.04	ZC600	
2457214.67636	0.00014	-0.04		GFB
2457252.09813	0.00035	-0.04		GFB
2457292.71253	0.00109	0.11		BDG
2457308.78784	0.00025	0.08		CDK
2457570.18845	0.00118	0.04	Zeiss50	
2457570.23442	0.00030	0.46	Zeiss50	
2457578.81585	0.00020	0.52		GFB
2457578.84137	0.00129	0.52		UJHA
2457580.39937	0.00116	1.08	Zeiss50	
2457581.59122	0.00021	0.51		GFB
2457582.26009	0.00070	0.31		UJHA
2457585.24104	0.00012	0.53		GFB
2457589.43843	0.00050	0.06		CMJA
2457589.80571	0.00056	0.33		JJI
2457591.68311	0.00025	0.52		GFB
2457592.40417	0.00015	0.48		JJI
2457596.25763	0.00025	0.49		GFB
2457615.80426	0.00027	0.45		COO
2457929.48448	0.00026	0.95	ZC600	
2457936.59798	0.00050	1.05	ZC600	
2457947.84358	0.00009	1.00		JJI
2457950.46628	0.00012	1.00	ZC600	
2457960.71192	0.00021	1.13	ZC600	
2457980.86125	0.00022	1.11		JJI
2458279.48424	0.00131	1.57	ZC600	
2458279.48478	0.00029	1.63	ZC600	
2458302.91867	0.00042	1.59	ZC600	
2458303.52966	0.00116	1.58	ZC600	
2458329.76085	0.00090	2.11	ZC600	
2458329.84336	0.00065	1.83	ZC600	