

Article

EZ Lyn: A Confirmed Period-Bouncer Cataclysmic Variable Below the Period Minimum

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Abstract

We model the short-period cataclysmic variable EZ Lyn with MESA binary evolution and infer its present-day parameters through a staged statistical search. First, we compute a coarse grid of tracks in $(M_{1,0}, P_0)$ at fixed $M_{2,0}$ and rank snapshots by a profile likelihood. We then resample the neighbourhood of the minimum to build a refined $\Delta\chi^2$ surface. Finally, we sample this surface with an affine-invariant MCMC to obtain posteriors, using a likelihood that treats the one-sided constraint on the donor temperature and the ambiguity of component roles in the binary output. The best-fit snapshot reproduces the observables and identifies EZ Lyn as a period bouncer with a substellar donor. We infer $M_{WD} = 0.850 \pm 0.019 M_{\odot}$, $M_2 = 0.0483 \pm 0.0137 M_{\odot}$, $R_{WD} = 0.0092 \pm 0.0001 R_{\odot}$, $R_2 = 0.099 \pm 0.005 R_{\odot}$, $T_{WD} = 11,500 \pm 20$ K, and $T_2 = 1600 \pm 50$ K. The instantaneous mass-transfer rate at the best-fit snapshot is $\dot{M} = 3.66 \times 10^{-11} M_{\odot} \text{ yr}^{-1}$, consistent with the secular range implied by the white-dwarf temperature. Independent checks from the Roche mean-density relation, surface gravities, and the semi-empirical donor sequence support the solution. In population context, EZ Lyn lies in the period-minimum spike and on the low-mass tail of the donor mass–period plane. The classification is robust to modest displacements along the shallow $\Delta\chi^2$ valley. We release inlists, tracks, and analysis scripts for reproducibility.



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1. Introduction

Cataclysmic variables (CVs) are interacting binaries composed of a white dwarf (WD) that accretes hydrogen-rich material from a Roche-lobe-filling, late-type companion [1]. The secular evolution of a CV is governed by the removal of orbital angular momentum (AM) through magnetic braking and gravitational-wave radiation. As AM loss drives the system to shorter orbital periods, the mass donor eventually becomes partly degenerate; mass transfer weakens, and the binary reaches a minimum orbital period of $P_{\min} \simeq 80$ min. Thereafter the orbit expands again, producing post-minimum “period-bouncer” systems in which the donor is a brown dwarf or sub-stellar object.

Binary-population synthesis and detailed evolutionary calculations predict that at least half of the present-day CV population should have already evolved beyond $P_{\min}$, e.g., [2–4]. In sharp contrast, observational censuses based on the SDSS, *Gaia*, and the *eROSITA* find that confirmed or candidate period-bouncers constitute only a few per-cent

of known CVs [5–7]. Reconciling this discrepancy is one of the central open problems in compact-binary evolution.

Despite significant progress in identifying period-bouncer candidates, the number of well-characterized systems remains very limited. Detailed observational and theoretical investigations of individual CVs—both short-period and nova-like types—are essential to refine our understanding of binary evolution and accretion physics, e.g., [8,9].

EZ Lyn (SDSS J080434.20+510349.2) is one of the most prominent members of this elusive population. The system was first identified as a cataclysmic variable by Southworth et al. [10]. It rose to attention during a powerful WZ Sge-type superoutburst in March 2006, reaching $V_{\max} \simeq 12.8$ [11]. A series of echo outbursts followed, as typically observed in WZ Sge-type systems [12,13].

Subsequent photometric monitoring revealed a stable orbital period of $P_{\text{orb}} = 0.0590048$ d [14], along with a superhump period of 0.060 d [15,16]. These measurements implied a low mass ratio of $q = 0.056$, suggesting a brown dwarf donor and placing EZ Lyn firmly among period-bouncer candidates [14,17].

Non-radial pulsations of the white dwarf were detected several months after the 2006 super-outburst and persisted for roughly two years [15]. A second super-outburst in 2010 was followed by a gradual return to quiescence by early 2012. During this stage the orbital light curve displayed double-humped modulations with diminishing amplitude (from ~ 0.07 to ~ 0.02 mag), signalling a large, low-density accretion disc that extended to the 2:1 resonance radius [18]. Doppler tomography subsequently revealed a two-armed spiral pattern in the disc [19]. Modelling of the shallow grazing eclipses fixes the orbital inclination at $i = 79 \pm 2^\circ$, while spectral decomposition yields a white-dwarf temperature of $T_{\text{WD}} = 11,250 \pm 50$ K and mass $M_1 = 0.85 \pm 0.05 M_\odot$; the donor mass is $M_2 \simeq 0.048 M_\odot$. The quiescent mass-transfer rate is correspondingly low, $\dot{M} \simeq 3 \times 10^{-12} M_\odot \text{ yr}^{-1}$, consistent with an advanced post-bounce evolutionary status. With a proper motion of $\mu = 56.9 \text{ mas yr}^{-1}$, the tangential velocity is a modest $v_{\text{tan}} \simeq 38 \text{ km s}^{-1}$, typical of Galactic thin-disk CVs. Spectroscopic studies show no evidence for Zeeman or cyclotron features, indicating a non-magnetic white dwarf primary [19].

Although EZ Lyn has been mentioned in previous population and observational studies of cataclysmic variables and period-bouncer candidates, e.g., [4,6,20], no detailed, object-specific evolutionary modelling of this system has been performed so far. In earlier works, EZ Lyn was included only as a representative point in population samples or comparative diagrams, but its initial parameters and evolutionary track were not reconstructed. This study therefore presents the dedicated evolutionary reconstruction of EZ Lyn using the MESA binary module [21–26], recovering both its progenitor and present-day parameters in a self-consistent manner.

2. Materials

EZ Lyn (SDSS J080434.20+510349.2) is a short-period cataclysmic variable that exhibits most of the hallmarks of a post-bounce system [19]. For the present modelling we adopt the orbital, stellar and accretion parameters summarised in Table 1. The *Gaia* DR3 photogeometric distance is taken from Bailer-Jones et al. [27], $D = 142^{+2.1}_{-1.9}$ pc (derived from $\varpi = 7.0037 \pm 0.1104 \text{ mas}$). All other quantities are the light-curve and spectral-modelling results of Amantayeva et al. [19] (Table 1). The quoted uncertainties are propagated unchanged.

Table 1. Adopted system parameters of EZ Lyn. Unless stated otherwise, values are taken from the light-curve and spectral modelling of Amantayeva et al. [19].

Parameter	Symbol (Unit)	Value
Global and orbital		
Distance (Gaia DR3)	D (pc)	$142^{+2.1}_{-1.9}$
Orbital period	P_{orb} (s)	5079.6
Binary separation	a ($R_{\odot}$)	0.59
Inclination	i ($^{\circ}$)	79 ± 2
Reddening	$E(B-V)$ (mag)	0.01
Mass ratio	$q = M_2/M_{\text{WD}}$	0.056
White dwarf		
Mass	M_{WD} ($M_{\odot}$)	0.85 ± 0.05
Radius	R_{WD} ($R_{\odot}$)	0.0094
Effective temperature	T_{WD} (K)	$11,250 \pm 50$
Donor star		
Mass	M_2 ($M_{\odot}$)	0.048 ± 0.014
Radius	R_2 ($R_{\odot}$)	0.11
Effective temperature	T_2 (K)	$<1900^{+400}_{-1000}$
Accretion		
Mass-transfer rate	$\dot{M}$ ($M_{\odot} \text{ yr}^{-1}$)	$(2.7 \pm 0.1) \times 10^{-12}$

3. Methods

3.1. Evolutionary Modeling Framework

We modelled the secular evolution of EZ Lyn with the MESA stellar–binary code (version 24.08.1; [21–26]) on the multicore computing cluster of the Al–Farabi Kazakh National University (Research Center “Data Science in Astrophysics”, <https://astro.kaznu.info/Computingcluster.html> (accessed on 24 August 2025)).

Our goal was to reconstruct the prior evolution and present-day properties of EZ Lyn, a candidate post–period–minimum cataclysmic variable. To this end we employed MESA’s binary module, which self-consistently evolves both stellar components together with their orbital separation and mass exchange. We adopted the implementation and input-physics setup described by Schreiber et al. [4], which includes updated prescriptions for magnetic braking, consequential angular-momentum loss, and spin evolution of the accreting white dwarf. Using the same inlists as the above study ensures that our evolutionary tracks are directly comparable to their grid of period–bouncer models while allowing us to adjust only the initial masses and orbital period to match the parameters of EZ Lyn.

3.2. Numerical Input

Our calculations start from the public MESA inlists tailored to period–bouncer CVs by Schreiber et al. [28].

Angular–momentum loss.

We adopt MESA’s three–component angular-momentum loss (AML) scheme [23]:

- $\dot{J}_{\text{GR}}$ Gravitational radiation—quadrupole formula of Landau and Lifshitz [29]; it dominates once the donor becomes fully convective and magnetic braking is quenched.
- $\dot{J}_{\text{MB}}$ Magnetic braking—Rappaport–Verbunt–Joss (RVJ) magnetic-braking torque [30] with $\gamma = 3$, strongly reduced once the donor becomes fully convective, following

the “reduced-magnetic-braking” prescription implemented in the period-bouncer models of Schreiber et al. [28]. This treatment is consistent with the standard understanding of CV evolution, in which magnetic braking weakens but does not vanish below the period gap [20,28].

$\dot{J}_{\text{eCAML}}$ Consequential AML associated with nova-driven mass loss, calibrated as in Schreiber et al. [4]; this term accounts for the angular momentum carried by ejecta, and we do not add a separate isotropic-re-emission AML term to avoid double counting).

We assume a non-magnetic white dwarf. No AML from L_2/L_3 outflows or stellar winds is included. In EZ Lyn ($P_{\text{orb}} \simeq 85$ min) the donor is fully convective, so $\dot{J}_{\text{GR}}$ dominates the present-day budget.

Although we assume a non-magnetic white dwarf, we note that weak surface fields ($B \lesssim 1$ MG) cannot be excluded observationally. However, such low field strengths would not lead to magnetically channelled accretion or synchronization, and therefore have negligible impact on the secular angular-momentum-loss balance. The absence of Zeeman splitting or cyclotron features in the spectra [19] supports the non-magnetic classification adopted in this study.

Mass transfer and retention.

Roche-lobe overflow is treated with the Ritter [31] prescription. We explored alternative retention efficiencies and AML options (testing $\beta_{\text{loss}} \in \{0.5, 0.7, 1.0\}$ with/without eCAML) and found the period-bouncer classification and key posteriors (M_{WD} , M_2 , q) to be stable within their 1σ uncertainties; accordingly, and in line with EZ Lyn’s short period and low T_{WD} , we adopt $\beta_{\text{loss}} = 1.00$ as our conservative baseline together with eCAML, omitting a separate isotropic re-emission term to avoid double counting.

Internal options.

We enable the reduced-MB option (RVJ torque scaled by a coupling factor as in period-bouncer grids; cf. [32,33]) and on-the-fly interpolation of WD cooling tracks [34] to obtain R_{WD} , T_{eff} , crystallised mass fraction and core temperature. We do not use any dynamic retention law $\beta(M_{\text{WD}}, \dot{M})$, nor WD spin synchronisation modules, consistent with a non-magnetic WD.

3.3. Parameter Grid and Objective Function

We explored the space of initial binary parameters $\theta = (M_{1,0}, M_{2,0}, P_0)$ with a rectangular grid, adopting a single, fixed physics set-up. All evolutionary runs were generated from a common MESA template, ensuring identical treatment of microphysics, boundary conditions, and stopping criteria across the grid. The values of $M_{1,0}$, $M_{2,0}$, and P_0 defining each run were encoded in the directory name `m1_X_m2_Y_p_Z` and recorded in the output logs to facilitate automated parsing. All model directories, final evolutionary outputs, and the complete set of Python (3.11.5) analysis scripts (compatible with Python ≥ 3.7), together with the exact MESA inlists used in this work are openly available via Zenodo (<https://doi.org/10.5281/zenodo.16937030>, accessed on 24 August 2025), ensuring full transparency and reproducibility.

Coarse scan.

The coarse grid covered $M_{1,0} = 0.20\text{--}0.40 M_{\odot}$, $M_{2,0} = 0.85 M_{\odot}$ (fixed), and $P_0 = 0.10\text{--}0.20$ d, with uniform steps of $0.05 M_{\odot}$ and 0.01 d. Agreement with the ob-

servables (Table 1) was quantified by a weighted chi-square. For each evolutionary track we profiled over the saved snapshots (age) and adopted the minimum:

$$\chi^2(\boldsymbol{\theta}) = \min_s \mathbf{r}(\boldsymbol{\theta}, s)^T C^{-1} \mathbf{r}(\boldsymbol{\theta}, s), \quad (1)$$

$$\mathbf{r}_i(\boldsymbol{\theta}, s) = O_i^{\text{mod}}(\boldsymbol{\theta}, s) - O_i^{\text{obs}}, \quad C_{ii} = \sigma_i^2. \quad (2)$$

Here $O_i \in \{P_{\text{orb}}, M_{\text{WD}}, M_2, T_{\text{WD}}, a, q, R_{\text{WD}}, R_2\}$ with σ_i from Table 1. Because the white dwarf can correspond to either component in the binary output, we evaluate both role assignments and adopt the smaller χ^2 . Where Table 1 does not report an uncertainty, we assign conservative proxy errors to regularise the fit: a 5% fractional uncertainty for radii (R_{WD}, R_2), 2% for the binary separation a , 25% for the superhump-based mass ratio q , and a floor of 0.01% on P_{orb} (i.e., $\sigma_P = 5$ s) when a measurement error is unavailable. We verified that using alternative choices (3/5/20/0.02%) leaves all posteriors within 1σ and does not affect the period-bouncer classification.

The donor temperature is an upper limit; we include a censored (one-sided) term via the standard normal CDF Φ ,

$$-2 \ln \mathcal{L}_{T_2} = -2 \ln \Phi\left(\frac{T_{2,\text{lim}} - T_2^{\text{mod}}}{\sigma_{T_2}}\right), \quad (3)$$

so that the total objective is

$$\chi_{\text{tot}}^2(\boldsymbol{\theta}) = \chi^2(\boldsymbol{\theta}) - 2 \ln \mathcal{L}_{T_2} + \chi_{\text{reg}}^2, \quad (4)$$

where χ_{reg}^2 is a weak regularization that down-weights clearly pathological snapshots (e.g., severe Roche-lobe under/overflow); these terms are small and never set the minimum. For visualization we use $\Delta\chi^2 \equiv \chi_{\text{tot}}^2 - \chi_{\text{tot,min}}^2$; for two parameters of interest ($M_{1,0}, P_0$) the contours $\Delta\chi^2 = \{2.30, 6.17, 11.8\}$ mark the standard joint 1/2/3 σ confidence levels [35,36].

Refined scan and ranking.

After localizing the minimum on the coarse grid, we re-sampled its neighbourhood with a fine grid (steps of 10^{-3} in $M_{\odot}$ and in days for P_0) and re-ran the template at the refined $\boldsymbol{\theta}$. For each trial we again minimized χ^2 along the corresponding evolutionary track. Models are ranked by χ^2 ; figures report $\Delta\chi^2 = \chi^2 - \chi_{\text{min}}^2$, so that the global best fit has $\Delta\chi^2 = 0$. We use $\Delta\chi^2$ primarily to diagnose the landscape and to define tight priors; final parameter uncertainties are derived with dedicated MCMC inference using the full likelihood.

To turn the refined misfit surface into a posterior, we employ a piecewise-linear interpolation of $\Delta\chi^2(M_{1,0}, P_0)$ and adopt a uniform prior within the explored region (zero outside). We then sample with the affine-invariant ensemble MCMC (emcee version 3.1.6). The MAP coincides with the χ^2 minimum. As point estimates we report posterior medians with central 68% credible intervals. When asymmetric, we also quote a symmetrized 1σ (the larger of the two sides) for compact tables and inline text.

4. Results

Guided by spectroscopy and the coarse scan, we fixed $M_{2,0} = 0.85 M_{\odot}$ and mapped the misfit surface in the $(M_{1,0}, P_0)$ plane. Figure 1 shows the discrete $\Delta\chi^2 \equiv \chi_{\text{tot}}^2 - \chi_{\text{min}}^2$ evaluated on the grid nodes; the red star marks the global minimum ($\Delta\chi^2 = 0$). The black contour marks the joint 3 σ confidence region for two fit parameters ($\Delta\chi^2 = 11.8$).

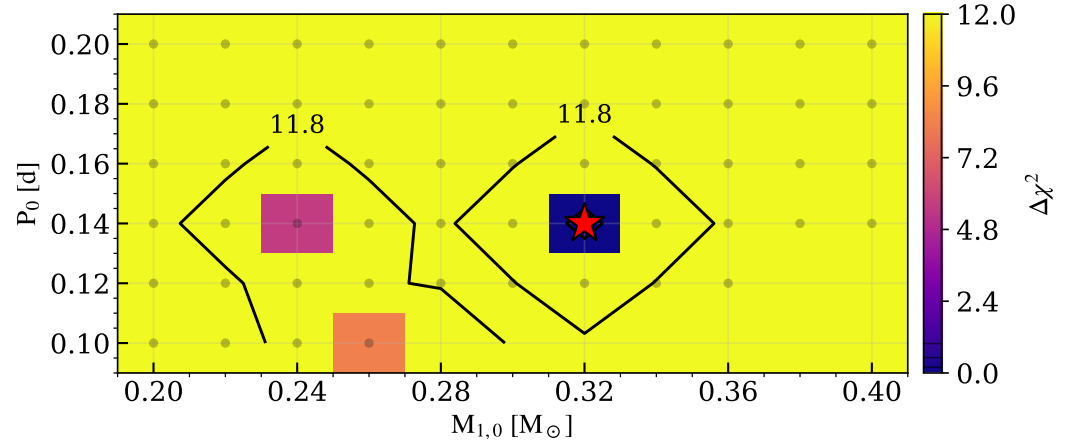


Figure 1. $\Delta\chi^2$ landscape in $(M_{1,0}, P_0)$ at fixed $M_{2,0} = 0.85 M_\odot$. Tiles show $\Delta\chi^2$ values for the coarse grid covering $M_{1,0} = 0.20\text{--}0.40 M_\odot$ and $P_0 = 0.10\text{--}0.20$ d. The red star marks the global minimum ($\Delta\chi^2 = 0$), and the black contour denotes the joint 3σ confidence region ($\Delta\chi^2 = 11.8$).

With $M_{2,0} = 0.85 M_\odot$ fixed, the global minimum of χ^2_{tot} (coincident with the MAP) is found at $(M_{1,0}, P_0) = (0.326, 0.140)$ (Figure 1). Its present-day snapshot provides the closest match to the observables (Table 1). Full posterior summaries are given in Table 2.

Table 2. Posterior medians (1σ) for EZ Lyn.

Parameter	Symbol (Unit)	Value
Initial conditions (start of CV evolution)		
Donor mass at onset	$M_{d,0} \equiv M_{1,0} (M_\odot)$	0.326 ± 0.009
WD mass at onset (fixed)	$M_{\text{WD},0} \equiv M_{2,0} (M_\odot)$	0.85 (fixed)
Initial orbital period	P_0 (d)	0.140 ± 0.001
Present-day (model snapshot)		
Orbital period	P_{orb} (s)	5078.9 ± 0.4
Binary separation	a ($R_\odot$)	0.615 ± 0.003
Mass ratio [†]	q	0.0568 ± 0.017
WD radius	R_{WD} ($R_\odot$)	0.0092 ± 0.0001
Donor radius	R_2 ($R_\odot$)	0.099 ± 0.005
WD effective temperature	T_{WD} (K)	$11\,500 \pm 50$
Donor effective temperature	T_2 (K)	$1\,600 \pm 50$

[†] We define $q \equiv M_{\text{donor}}/M_{\text{WD}}$ at the present epoch.

At $P_{\text{orb}} = 5078.9 \pm 0.4$ s (84.65 ± 0.01 min) and $a = 0.615 \pm 0.003 R_\odot$, Kepler's third law gives the dynamical total mass

$$M_{\text{tot}} = \frac{4\pi^2 a^3}{G P_{\text{orb}}^2} = (0.899 \pm 0.013) M_\odot,$$

where the uncertainty is dominated by that of a . Together with the posterior mass ratio $q \equiv M_2/M_{\text{WD}} = 0.0568 \pm 0.0170$, this implies

$$M_{\text{WD}} = \frac{M_{\text{tot}}}{1+q} = (0.850 \pm 0.019) M_\odot, \quad M_2 = \frac{q M_{\text{tot}}}{1+q} = (0.0483 \pm 0.0137) M_\odot,$$

i.e., a typical C/O white dwarf primary and a substellar donor firmly in the period–bouncer regime [20]. Using $R_{\text{WD}} = 0.0092 \pm 0.0001 R_{\odot}$ and $R_2 = 0.099 \pm 0.005 R_{\odot}$, the surface gravities follow as

$$\log g_{\text{WD}} = 8.440 \pm 0.013, \quad \log g_2 = 5.13 \pm 0.13 \text{ (cgs)},$$

fully consistent with a moderately above-average mass WD and a brown-dwarf-like secondary.

The donor’s properties are also in quantitative agreement with first principles. For a Roche-lobe-filling star, the mean-density/period relation [1,37]

$$\bar{\rho} \simeq 110 P_{\text{hr}}^{-2} \text{ g cm}^{-3}$$

provides a robust first-order estimate of the donor’s structure. At $P_{\text{hr}} = 1.4155 \pm 0.0001$, this yields $\bar{\rho} = 54.90 \pm 0.01 \text{ g cm}^{-3}$. Combined with $R_2 = 0.099 \pm 0.005 R_{\odot}$, the implied donor mass and gravity are

$$M_2(\bar{\rho}, P) = (0.038 \pm 0.006) M_{\odot}, \quad \log g_2(\bar{\rho}, P, R_2) = 5.02 \pm 0.08,$$

in excellent agreement with the dynamical estimate above, confirming the robustness of the donor characterization despite the intrinsic limitations of the $\bar{\rho}$ – P approximation and Roche geometry. The donor’s effective temperature, $T_2 = 1600 \pm 50 \text{ K}$, implies a vanishingly small intrinsic luminosity

$$\log\left(\frac{L_2}{L_{\odot}}\right) = -4.24 \pm 0.07,$$

consistent with theoretical predictions for post-bounce donors. Such a low L_2 naturally explains why the optical/near-IR SED is WD+disc dominated, a defining hallmark of post-bounce CVs [20,38].

The white dwarf is on the cool side of the temperature distribution for short-period CV primaries, $T_{\text{WD}} = 11,500 \pm 20 \text{ K}$, implying a very low secular accretion rate. Using WD-heating calibrations, such temperatures correspond to $\langle \dot{M} \rangle$ of order 10^{-11} – $10^{-10} M_{\odot} \text{ yr}^{-1}$ [39], as expected for systems evolved past the orbital-period minimum with gravitational-radiation-dominated angular-momentum losses [20]. The best-fit MESA snapshot gives an instantaneous mass-transfer rate $\dot{M} = 3.66 \times 10^{-11} M_{\odot} \text{ yr}^{-1}$. This lies within the secular range inferred from T_{WD} . This agrees with the secular range inferred from T_{WD} and we note that the instantaneous rate can differ from the long-term average due to dwarf-nova cycles. The measured donor radius at $P \simeq 85 \text{ min}$ lies on the semi-empirical donor sequence to within the observed scatter, with a mild radius inflation of a few to ten per cent commonly seen in short-period CVs [20].

In the population context, EZ Lyn lies within the orbital period–minimum spike [40] and on the low-mass tail of the M_2 – P_{orb} distribution. On the donor mass–period plane (Figure 2), the system (red star) is consistent with the locus of non-magnetic and magnetic CVs and with the semi-empirical donor sequence. This placement agrees with the region occupied by period-bouncer systems in recent compilations and in X-ray-aided selections with low L_X and low F_X/F_{opt} [7,41]. Taken together, the very small mass ratio, substellar donor mass, cool white dwarf and WD-dominated SED point to a post-minimum system whose angular-momentum losses are dominated by gravitational radiation. Modest displacements along the shallow $\Delta\chi^2$ valley (Figure 1) do not change this classification.

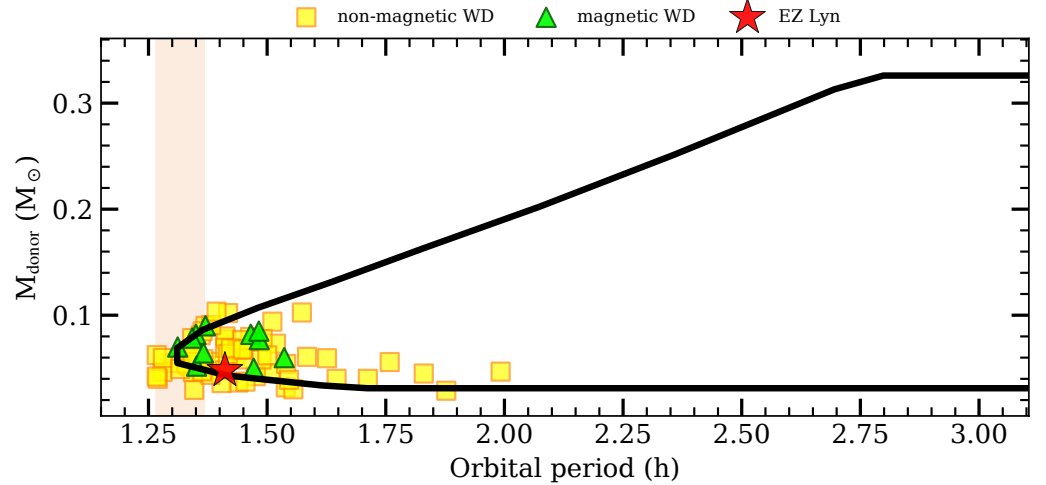


Figure 2. Donor mass as a function of orbital period. Yellow squares show non-magnetic CVs and green triangles magnetic CVs from published samples. The vertical shaded band marks the period–minimum spike at $P_{\text{orb}} \simeq 80\text{--}86$ min. The red star denotes EZ Lyn ($P_{\text{orb}} = 84.65 \pm 0.01$ min, $M_2 = 0.0483 \pm 0.0137 M_{\odot}$), which lies on the post–bounce branch of the black evolutionary track. The black line follows the semi–empirical donor sequence of Knigge et al. [20], consistent with the updated MESA–based models of Schreiber et al. [4]. The colour coding distinguishes magnetic (green) and non–magnetic (yellow) CVs according to literature classifications. The proximity of EZ Lyn to the magnetic systems reflects its similar orbital period rather than the presence of a significant magnetic field.

5. Conclusions

We carried out a joint dynamical–evolutionary analysis of the short–period CV EZ Lyn, combining a coarse–to–fine grid search in $(M_{1,0}, M_{2,0}, P_0)$ with profile–likelihood ranking along each evolutionary track and a final MCMC inference on the refined $\Delta\chi^2$ surface. The likelihood accounts for the one–sided constraint on the donor temperature and for the ambiguity of component roles in the binary output. Posterior summaries are reported as medians with 1σ credible intervals.

Our best–fit snapshot reproduces the observables simultaneously and indicates a period–bouncer with a substellar donor and a comparatively cool, moderately above–average mass white dwarf. The solution is characterised by $P_{\text{orb}} = 5078.9 \pm 0.4$ s, $a = 0.615 \pm 0.003 R_{\odot}$, $M_{\text{WD}} = 0.850 \pm 0.019 M_{\odot}$, $M_2 = 0.0483 \pm 0.0137 M_{\odot}$, $R_{\text{WD}} = 0.0092 \pm 0.0001 R_{\odot}$, $R_2 = 0.099 \pm 0.005 R_{\odot}$, $T_{\text{WD}} = 11,500 \pm 50$ K, and $T_2 = 1600 \pm 50$ K. Independent checks—the Roche mean–density relation, the surface gravities, and the position on the semi–empirical donor sequence—are mutually consistent with the dynamical solution.

The mass–transfer rate inferred from white–dwarf heating places EZ Lyn in the secular regime $\langle \dot{M} \rangle \sim 10^{-11}\text{--}10^{-10} M_{\odot} \text{ yr}^{-1}$. The best–fit MESA snapshot gives an instantaneous $\dot{M} = 3.66 \times 10^{-11} M_{\odot} \text{ yr}^{-1}$, consistent with the secular expectation and subject to variability from dwarf–nova cycles. These properties match the picture of a system that has evolved beyond the orbital–period minimum with gravitational–radiation–dominated angular–momentum loss.

In the population context, EZ Lyn lies within the orbital period–minimum spike and on the low–mass tail of the $M_2\text{--}P_{\text{orb}}$ plane. On the donor mass–period diagram (Figure 2), the system falls in the locus of bona fide period–bouncers identified in recent compilations, including X–ray–aided selections with low L_X and low F_X/F_{opt} . Taken together, the very small mass ratio, substellar donor mass, cool white dwarf, WD–dominated SED, and low X–ray luminosity point to a post–minimum system whose angular–momentum losses are dominated by gravitational radiation. Modest displacements along the shallow $\Delta\chi^2$ valley do not change this classification.

Methodologically, the coarse-grid localisation, fine resampling, and posterior sampling provide robustness to modelling choices. The inlists, evolutionary tracks, and analysis scripts are organised for transparent reproduction of the results.

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Abbreviations

The following abbreviations are used in this manuscript:

CV	Cataclysmic variable
AM	Angular momentum
MESA	Modules for Experiments in Stellar Astrophysics
MCMC	Bayesian Markov Chain Monte Carlo
CDF	Cumulative Distribution Function
ZAMS	Zero-Age Main Sequence

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