# Magnetic Orbital Decay of Solar Type Binaries: Their Gyrochronology

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## Abstract

This study is the final installment of the previously CRS-funded projects, involving an observational study of the apparent age of the universe as indicated by gyrochronology. It involves estimating ages due to magnetic orbital decay of solar type binaries. The scenario used is in a time dilation scenario applying the RATE results (accelerated radiometric aging). Three *CRSQ* papers have resulted from this study. It was also presented twice at summer Creation Research Society meetings. Additionally, it has been presented at secular meetings of the International Astronomical Union general assembly (IAUGA) and was well received by individual astronomers. In the 2018 IAUGA in Vienna Austria, we reported in a poster paper a compendium of 200 binaries. We conclude this study here by presenting recently analyzed binaries to the previous study, publishing the full group of binaries directing these results through the *Creation Research Society Quarterly*. These give strong evidence that the age of universe even in a time dilated scenario is grossly exaggerated and amounts to only 0.3% of the accepted age of the universe to the secular astronomer. Here, an age is computed for each binary, $\Delta t$, based on the difference in the current orbital period and the proposed initial period, $\Delta P$ and the rate of orbital decay, $dP/dt$, $\Delta t = -\Delta P/(dP/dt)$. The result is that the evolution of solar type binaries, from formation to the present configuration, average more than two magnitudes faster than theory suggests. Further implications are explored.


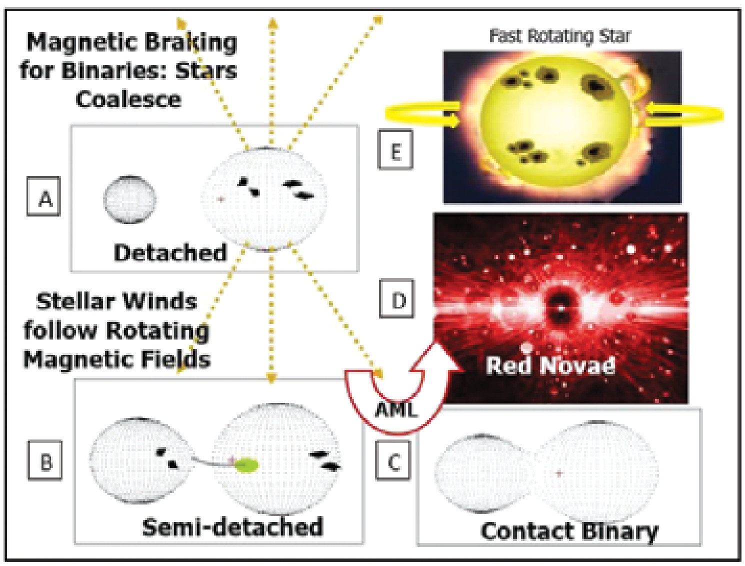


Figure 1. Depiction of a binary star made up of two solar-type stars undergoing magnetic braking which results in angular momentum loss (AML). (A) Plasmas leave along north and south magnetic field (dipole) lines cause the magnetically active binary (detached spotted binary in the upper left-hand corner) to lose angular momentum and steadily fill their Roche lobe and move to a (B) semidetached and then a (C) contact binary configuration. (D) The binary becomes unstable and a Luminous Red Novae (LRNe) event erupts finally resulting in a (E) fast-rotating single star.

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## Introduction

This study is the final installment of the previously CRS-funded projects, which included the papers, "The Apparent Age of the Time-Dilated Universe I: Gyrochronology, Angular Momentum Loss In Close Solar Type Binaries" (Samec-1 = Samec and Figg, 2012), "The Apparent Age of the Time Dilated Universe II: Gyrochronology, Magnetic Orbital Decay of Close Solar Type Binaries and Errata" (Samec-2 = Samec, 2016a), and *Magnetic Orbital Decay of Solar Type Binaries and Creation Implications, 2018* (Samec-3 = Samec, 2018a) which involved the CRS undergraduate research initiative, allowing undergraduate mentors and their research students to request research grants from the Society Research Committee (see section VI.). The first paper made a calculation correction to the original paper and increased the number of binaries included in the study to 124 binaries. This time a simpler kinematic approach [instead of a complicated angular momentum approach (See Samec-1, 2012)] is taken to extend the number of systems surveyed. An estimate of the age of the time-dilated universe was made. The second study included system analyses in which students performed the analysis of eleven eclipsing binaries. The average of the ages of these came out to be $3.6\times10^7$ years. Otherwise, we first reported an initial statistical study was begun with a poster session at the 2015 International Astronomical Union General Assembly (IAUGA)—a compendium of more than 75 solar type binaries was presented--each with a clearly decreasing orbital period as indicated by magnetic braking. Later in the 2018 IAUGA in Vienna, Austria, we reported in a poster paper a compendium of 200 binaries, *Magnetic Orbital Decay Of Solar Type Binaries, Their Gyrochronology And Red Novae*. We conclude this study here by presenting new recently analyzed binaries to the previous study, publishing the full group of binaries. In an article in *Publications of the Astronomical Society of Japan*, Tian et al. (2009) noted that the rate of decay of orbits is "1–2 orders of magnitude faster" than expected in binary star evolution (e.g., Guinan and Bradstreet, 1987). We find here that this is nearer to 2–3 orders, but their general observation is correct, i.e., binaries are decaying. at a rapid and easily observable rate. Thus, binary evolution occurs in real time—easily perceptible by human observers during their lifetimes and on the order of decades. This all has strong young-Earth creation implications.

## Magnetic Braking

W U Ma (solar type) binaries are believed to be undergoing steady but slow angular momentum ($\sum m\vec{r} \times \vec{v}$)[1] losses. This is due to *magnetic braking* as stellar winds blow radially away on stiff bipolar magnetic field lines. This torques the binary similar to that occurring to a spinning speed skater slowly spreading his/her arms. The skater's angular rotation slows as the radial distance of the hands/arms increase. But we also know that as the skater brings her arms in, the rotation speeds back up due to conservation of angular momentum. But in the case of stars, plasma (charged mass particles) never return but completely leave the star at about 15 times the radius of the star, called the Alfvén radius. So as stellar winds leave the star, the star also loses mass and angular momentum—it spins down. This is called angular momentum loss (AML). Solar type binaries are magnetic in nature. They have sunspots and a host of magnetic phenomena including facula, plages (bright spots), sun (dark) spots, prominences, flares, coronal mass ejections and solar winds (here, we say stellar winds). The Sun is undergoing AML. In the case of a single star, much like the speed skater extending his/her arms, is slowing its rotation. This is magnetic braking. In the case of solar type binaries which obey Kepler's laws ($r^3 \propto P^2$, where P is the orbital period). They slowly coalesce (decreasing r) and speed up their rotation (decreasing P) as they undergo AML.

Solar-type binaries are believed to begin their existence as well-detached fast-spinning stars in groups that undergo gravitational interactions which leave them as binaries with several day periods. Since they are highly magnetic in nature, due to their convective envelopes and fast rotation, they undergo magnetic braking as plasma winds stream away from the stars on stiff rotating dipole fields. This action torques the binary, eventually bringing the components into contact (contact or W UMa binaries, see Figure 1). During the contact stage, the atmospheres of both stars are shared, not only nearly equalizing the surface temperatures of the two stars but causing mass transfer between the stars. The secondary component may decrease in mass as it is absorbed by the primary, more massive, component. Heavy, dark-spot activity on the primary star can act to mask the initial surface temperature actually making it appear as the cooler component. In this case, the binary is called a W-Type W UMa binary. Later, when the primary component returns to appear as the hotter component, it is called an A-type W UMa binary (primary component, is hotter) and are believed to be among the most ancient of stars. They continue to coalesce and finally merge and undergo a cataclysmic event called a *red nova* (see Samec-2, 2016a), the aftermath of which is a single, earlier spectral type star (usually F or A); see Samec-3, 2018a.

## Approach

A simple but effective method was taken in this project. In this methodology, we use the following equation to make our age calculations:

1 For a single particle orbiting in a circular motion about a center, L (angular momentum) = mvr, where m is the mass of the particle, v is its orbital speed and r is the radius of orbit.

$$\Delta t = \frac{-\Delta P}{\dot{P}} \tag{1}$$

Here the ΔP is the change of period of the binary. ΔP is equal to the present orbital period less the initial period. $\dot{P} = \frac{dP}{dt}$ is the rate of change of period in the binary. The elapsed time interval or age of the binary is the change in period divided by the negative rate of change since the rate is negative. Only the actual period and the assumed initial period and rate of period change were needed. The method only assumes that the chosen systems have a continuous, quadratically decreasing period. ΔP is the difference in the present orbital period of the binary minus its initial period. The quantity, $\dot{P}$ is the rate of change in the period, $\frac{dP}{dt}$, in Equation (1). I undertook a survey of the literature and internet sites including the American Association of Variable Stars (AAVSO) O-C files which was created and maintained by Dr. Bob Nelson.[2] I also included additional binaries from 34 years of my personal observations. The binary star community is indebted to Dr. Nelson's continued work in handling thousands of period studies of eclipsing binary stars. Of importance was Pietrukowicz et al. (2017). I was able to cover some 202 binaries with orbital periods present ranging in P = 0.21 days to 9.3 days. We have added more systems recently analyzed to this group. The additional analyzed binaries are summarized in this paper.

## 2018–2020 Analyses

In our 2018 submitted and accepted paper, *Magnetic Orbital Decay of Solar Type Binaries and Creation Implications*, *2018*, (Samec-3 of this study = 2018a) we summarized 11 more solar type binaries that we analyzed and published with the aid of undergraduate college students as a part of a funded CRS project during 2015–2018. That brought our total up to 93 eclipsing binaries. During the intermediate time interval, we were adding several more analyzed systems and gathered many more from the recent literature. The systems analyzed by this author included NSVS 103152 (V616 Cam), NSVS 10541123, V385 Cam, AE Cas, NS Cam and SZ Scl. We summarize the results of their analyses here.

## NSVS 103152 (V616 Cam)

NSVS 103152 (V616 Cam) is a F5V±2 type (T~ 6500K) eclipsing binary. It was observed on March 5, 6, 9, and 30, 2017, at Dark Sky Observatory in North Carolina with the 0.81-m reflector of Appalachian State University. It is a totally eclipsing binary with a period of 0.52835d. A total eclipse of

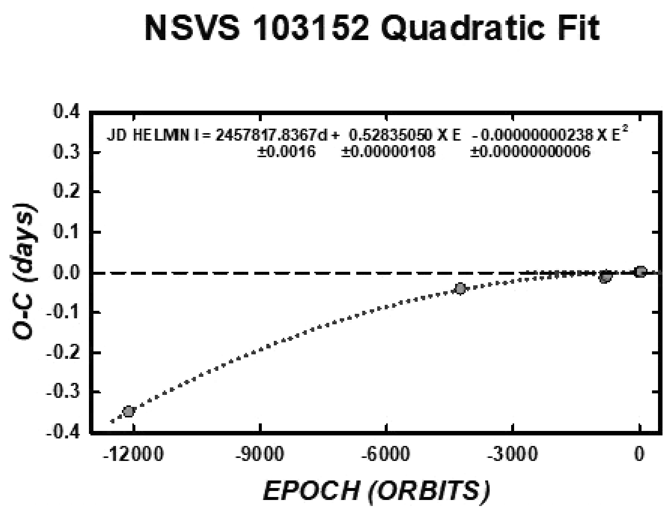


**Figure 2. The period study of 17.5 years indicates continuous period decrease.**

38 minutes occurs at phase 0.5. Five times of minimum light were determined from our present observations, which include three primary eclipses and two secondary eclipses. It is likely a detached near-contact binary and has spots. The spectral type is ~F5 ± 2V. This yields a temperature of 6500 ± 250K.

The period study covers a time interval of some 17.5 years and shows a period that is decreasing. A plot of the quadratic residuals (Observed-Calculated, or O-C's) is given in Figure 6. The quadratic fit carried a precision of 27 sigma although the study consists of only 11 times of minimum light. This system was given as a poster paper at the American Astronomical Society, AAS Meeting #233 (Samec, 2019b) and was published in the *Journal of the American Association of Variable Star Observers* (Samec, 2019c).

## NSVS 10541123

NSVS 10541123 (TYC 1488-0693-1) is an ~F2 type (T~ 6750K) eclipsing binary. It was observed in April and May 2015 at Dark Sky Observatory in North Carolina with the 0.81-m reflector of Appalachian State University. Six times of minimum light were determined from our present observations, which include two primary eclipses and four secondary eclipses. A $BVR_cI_c$ simultaneous Wilson-Devinney (W-D) Program solution indicates that the system has a mass ratio ($q=M_2/M_1$) of ~0.58, and a component temperature difference of 2350 K. The large ΔT in the components verify that the binary is not in contact. A Binary Maker fitted hot spot was maintained in the WD Synthetic Light Curve Computations. It remained on

2 http://www.aavso.org/bob-nelsons-o-c-files

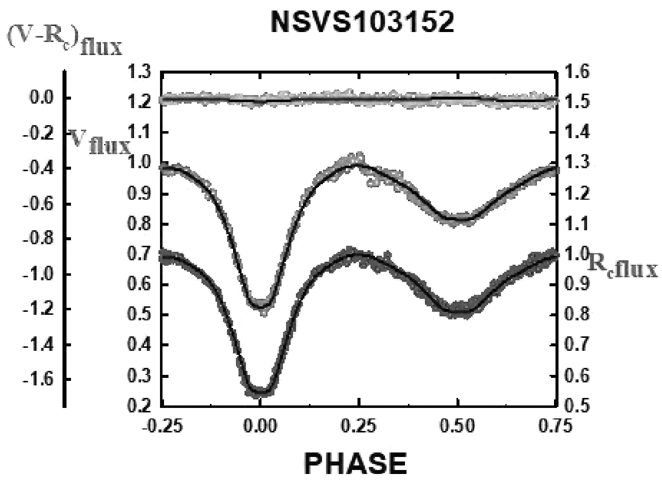


Figure 3. V, $R_c$ Normalized Fluxes and the V-R color curves overlaid by our solution of NSVS 103152 (V1616 Cam).

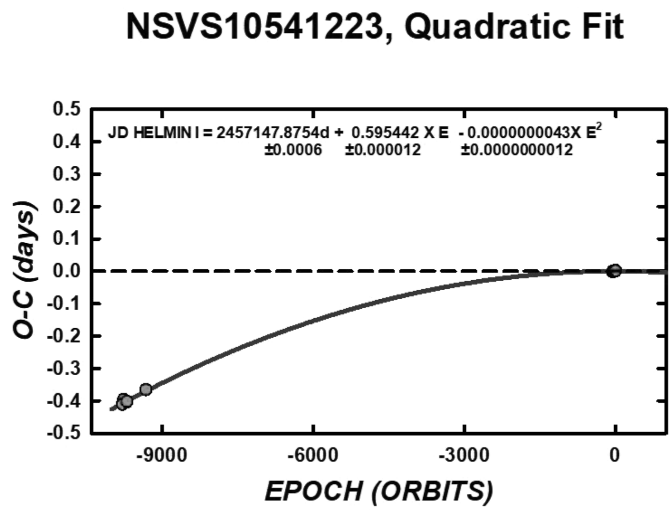


Figure 5. Residuals from quadratic term, NSVS 10541223 (TYC 1488-0693-1).

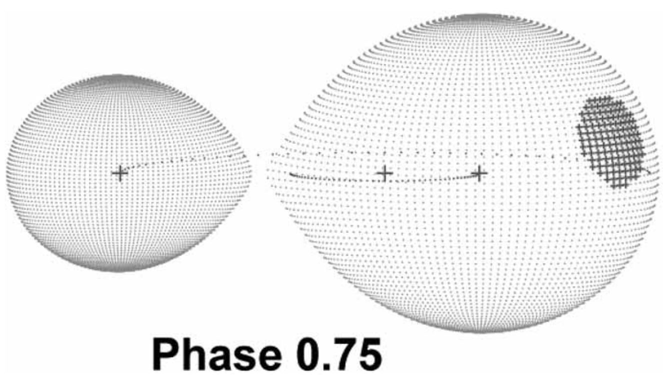


Figure 4. Geometrical Representation at phase 0.75 of NSV103152 or TYC 1488-0693-1.

the larger component at the equator on the correct (following) side for a stream spot directed from the secondary component (as dictated by the Coriolis effect). This could indicate that the components are near filling their respective Roche Lobes. The fill-outs are nearly identical, 96% for the primary component and 95% for the secondary component. The inclination is ~79° which is not enough for the system to undergo a total eclipse.

Improved linear and quadratic ephemerides were calculated from these times of minimum light which gave a rapid period change of dP/dt= -5.2(1.5)×$10^{-06}$ d/yr. The rapid period decrease may indicate that the binary is undergoing magnetic braking and is approaching a contact configuration due to the angular momentum loss.

The spot on the primary component is at the physical position that a stream spot would be expected, so it is possible that a weak plasma stream is being emitted from the secondary component with the secondary component as the gainer. The inclination is 79° which allows only 2% of the light of the system to be contributed by the secondary component at phase 0.5. The iterated hot spot region has a 9° radius and a mean T-factor of 1.05 (T~7100K). The mass ratio and the component temperatures indicate that the secondary is somewhat oversized so that interactions may have occurred in the past.

This system was published in the *Journal of the American Association of Variable Star Observers* (Samec et al., 2018d).

## V385 Camelopardalis

V385 Cam is a G7±2 type (T~ 5500K) eclipsing binary. It was observed on December 15, 16, 17, and 18, 2017, at Dark Sky Observatory in North Carolina with the 0.81-m reflector of Appalachian State University. Three times of minimum light were determined from our present observations, which include two primary eclipses and one secondary eclipse. Eight times of low light were calculated using least squares fits to archived data from the Sky Patrol All-Sky Automated Survey for Supernovae (ASAS-SN, hereafter, ASAS, https://asas-sn.osu.edu/).

The following quadratic ephemeris was determined from the available times of minimum light:

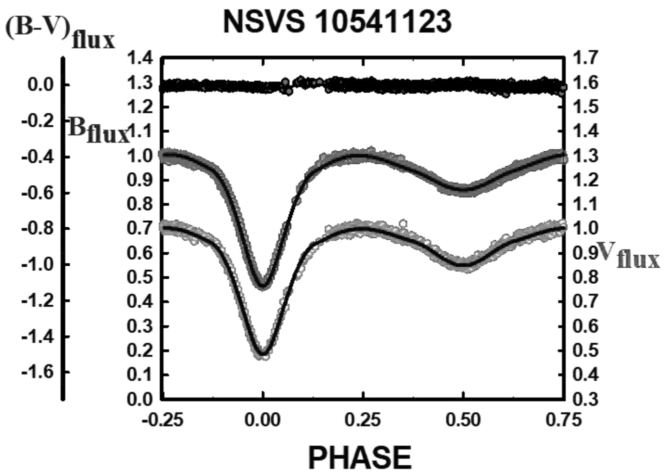


Figure 6. Solution overlaying B, V normalized flux light curves or TYC 1488-0693-1.

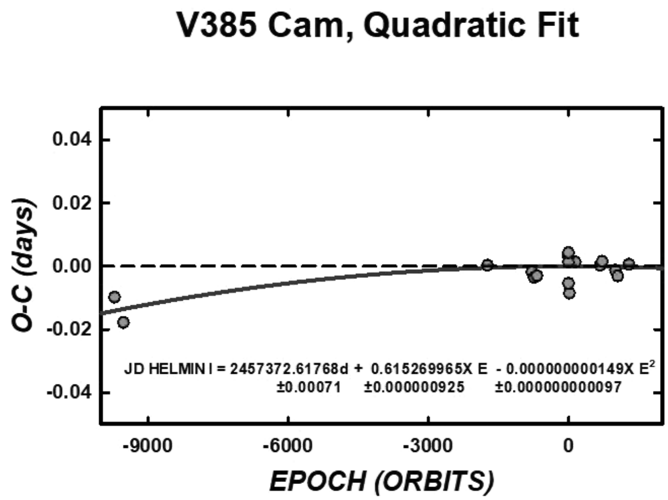


Figure 8. Residuals from quadratic term, V385 Cam.

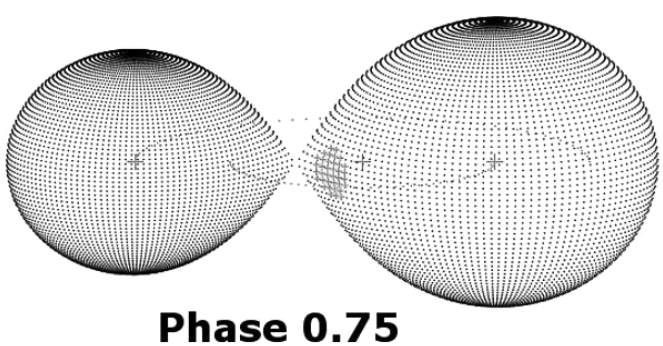


Figure 7. Geometrical representation at phase 0.75 of NSVS 10541123.

JD Hel Min I=2451 57372.61838 ±0.00063d

+ 0.61527012 ±0.00000077 X E

-0.00000000014± 0.00000000008 X $E^2$

The weak period decrease may indicate AML and/or that the mass is flowing from the secondary Lagrangian point to the primary component. $BVR_cI_c$ simultaneous 2015 Wilson-Devinney Program (W-D) solutions gives a mode 5 classical Algol solution (secondary component filling its Roche Lobe, primary underfilling). The semidetached solution gives a primary component with a 95% fill-out. The solution gives a mass ratio of 0.288±0.001, and a component temperature difference of ~1300 K. The large ΔT in the components verify that the binary is not yet in contact. A Binary Maker fitted dark spot did not persist in the WD Synthetic Light Curve Computations even though there is a definite asymmetry at phase ~0.75. The inclination is ~ 81.7 ±0.2°, resulting in a total eclipse (secondary component) of 16.3 minutes in duration. The systems distance is 854 (±13) pc as determined from GAIA DR2.

This was published in the *The American Association of Variable Stars Observers Journal* (Samec et al., 2019a).

## AE Cassiopeiae

AE Cas was observed some 40 years ago by Srivastava and Kandpal (1984) and was analyzed by a Fourier technique. This study represented the first modern synthetic analysis of light curves using the 2016 version of the Wilson-Devinney Program. It was observed on October 3,4, and 23, 2016, at Dark Sky Observatory in North Carolina with the 0.81-m reflector of Appalachian State University and the 0.9-m reflector at KPNO remotely through the SARA consortia. V, $R_c$, $I_c$ observations were taken. Five times of minimum light were determined from our present observations, which include three primary eclipses and two secondary eclipses.

In addition, eight observations at minima were introduced as low-weighted times of low light taken from archived ASAS data and 74 times of minimum light from the literature, some of which were from visual observations. The quadratic residual plot is given in Figure 20. This study covers an interval of

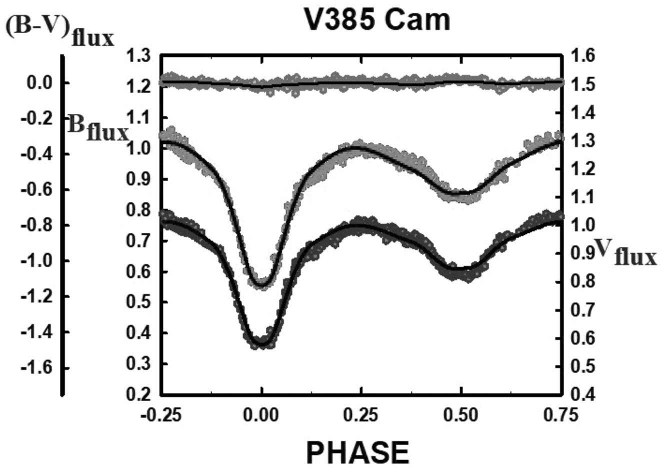


Figure 9. Solution overlaying B, V normalized flux light curves

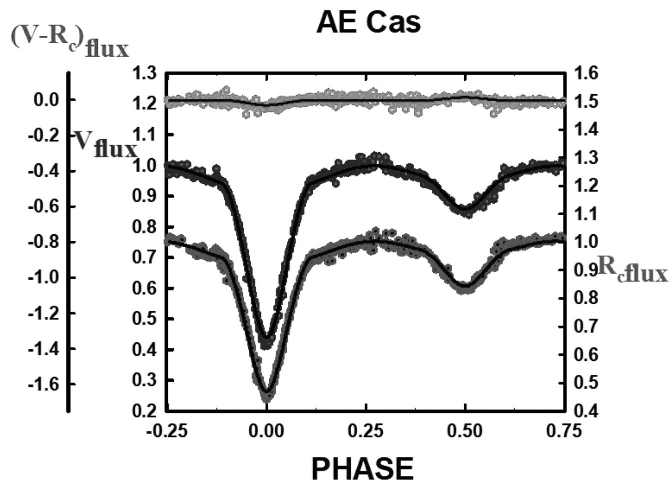


Figure 11. Solution overlaying B, V normalized flux light curves.

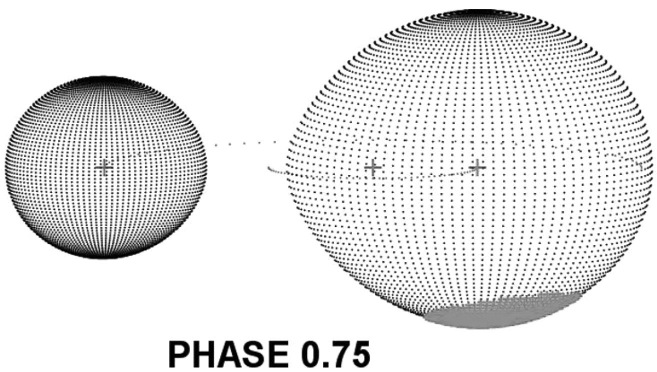


Figure 10. Geometrical representation at phase 0.75 of V385 Cam.

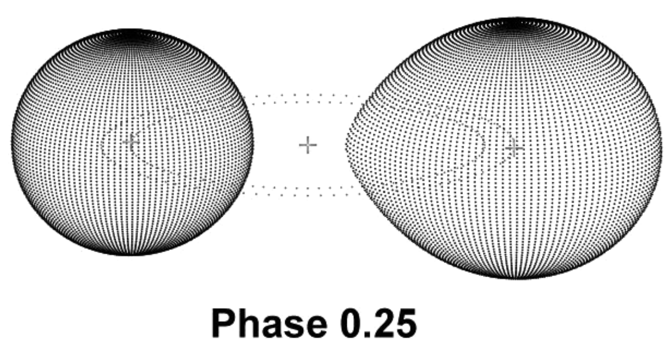


Figure 12. Geometrical representation at phase 0.25 of AE Cas.

some 89 years. The following quadratic ephemerides were determined from all available times of minimum light:

$$\text{JD Hel Min I}=2457684.75610\pm0.00085\text{d} + 0.75911881\pm0.00000014 \times E - 0.000000000047\pm 0.000000000003 \times E^2$$

The period decrease (see Figure 20) may indicate that the binary is undergoing magnetic braking and is approaching its contact configuration. Alternately, the near contact secondary component may be streaming matter onto the primary, more massive component.

A $VR_cI_c$ simultaneous Wilson-Devinney Program (W-D) solution indicates that the system has a mass ratio somewhat less than unity (q=0.856±0.001), and a component temperature difference of ~2060 K. A q-search was performed and the mass ratio minimized at the above q-value. The large ΔT in the components verifies that the binary is not yet in contact. No spots were needed for the solution, so if the stream exists it is weak as verified by the decreasing period. The fill-out of our model is 83.2% for the primary component (smaller radius) and 99.1% for the secondary component. The inclination is

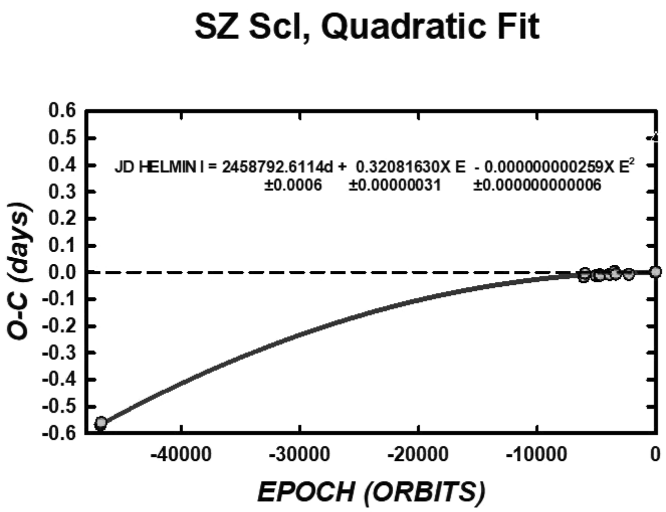


**Figure 13. A plot of the quadratic term overlying the linear residuals of Equation 3. Note there is a gap in the observations from -46000 to -7000 orbits.**

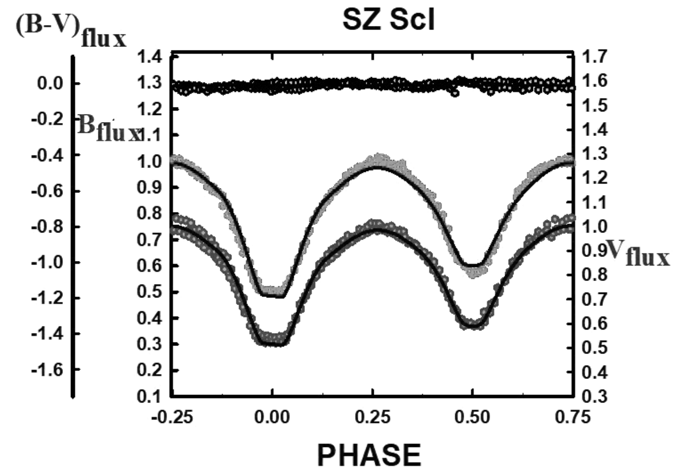


**Figure 14. *B*,*V* and *B*-*V* normalized flux overlaid by the WD solution.**

~76°, not enough for the system to undergo a total eclipse. The light curve in V is more than one magnitude in amplitude. The B,V and B-V plot of the the solution is given in Figure 11. The geometrical representation is given in Figure 12.

## SZ Sculptoris

SZ Sculptoris (GSC 6990–0597), a solar type (T ~ 5040K), shallow-contact, eclipsing binary. It was observed on October 5 and 6 and November 7, 2019, in remote mode with the Cerro Tololo InterAmerican Observatory, 0.6-m SARA South reflector by R. Samec. The amplitude of the light curves were 0.74, 0.67, 0.65 and 0.61 mags in *BVRI*, respectively. Six times of minimum light were calculated from three primary eclipses and secondary eclipses with our present observations. Eight times of low light were also taken from ASAS observations. Two additional timings were taken from the BBSAG bulletin #39 and from APASS (the AAVSO Photometric All-Sky Survey) observations. From this 41-year-interval orbital period study, it was found that the period is decreasing.

$$\text{JD Hel Min I} = 2458792.6114(6)\text{d} + 0.32081630(31) \text{ X E} -0.000000000259(6)\times E^2$$

This may be due to angular momentum loss (AML) resulting from rotating ion streams leaving along stiff magnetic

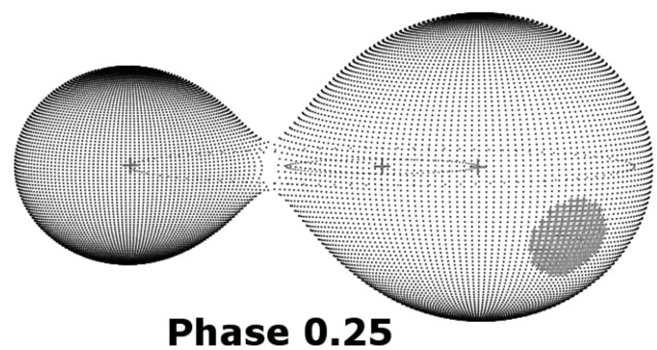


**Figure 15. Geometrical representation of the solution for SZ Scl at phase 0.25.**

bipolar field lines from the system. The quadratic residuals are given in Figure 13. A linear ephemeris was also calculated. A *BVRI* Bessel filtered Wilson-Devinney Program (W-D) solution gives a mass ratio, $m_1/m_2 = 0.3800 \pm 0.0007$), a large component temperature difference of 350 K and a contact fill-out of only 11%. Thus, the system is in poor thermal contact. A near equatorial spot (colatitude of 112.5 ± 0.5°), radius of 15.04 ± 0.45° and T-factor of 0.84 ± 0.01 was calculated. The B,V and B-V color curves are given as Figure 14. The system is an unusual shallow-contact A-type W UMa binary, albeit, the amplitudes

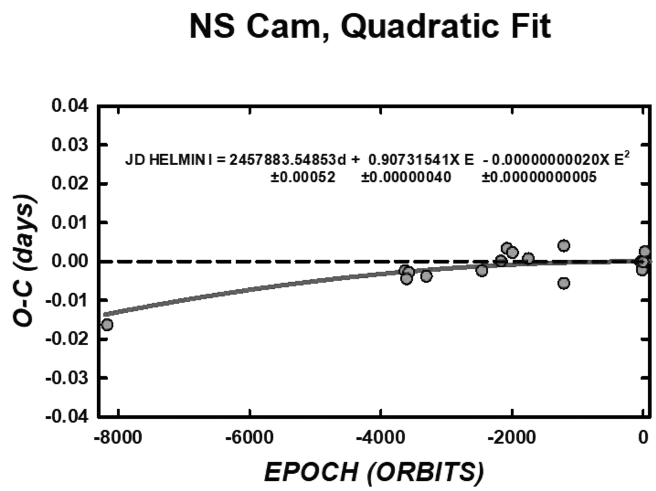


Figure 16. The linear residuals from quadratic equation (Equation 2) overlaying a plot of the quadratic term versus the orbital epoch in the period study of NS Cam.

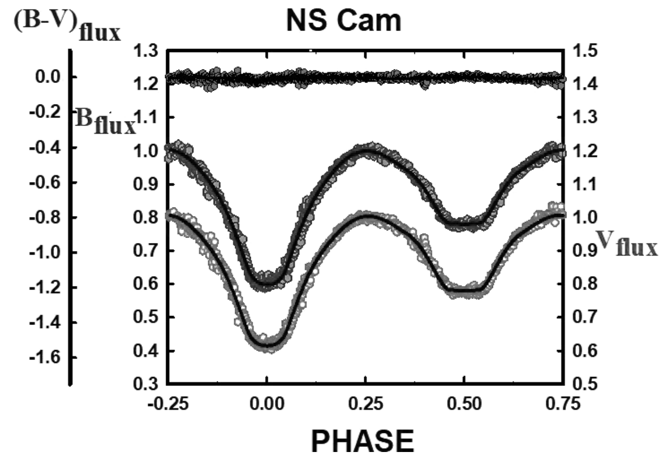


Figure 17. B, V normalized fluxes and B-V and R-I color curves overlaid by our solution curves of NS Cam.

of the primary and secondary eclipse are equal within the errors. An eclipse duration of ~21 minutes was determined for the secondary eclipse and the light curve solution. The geometrical representation at phase 0.25 is given in Figure 15.

## NS Camelopardalis

CCD, $BVR_cI_c$ light curves of NS Cam were taken on January 1, 20, 21, 22, 23, February 4, 22, and 23, March 1, and April 7, 2020, at the Dark Sky Observatory, North Carolina, with the 0.81-m reflector of Appalachian State University by D. Caton. The initial study (light curves, classification, ephemeris etc.) of NS Cam (NSV 3771, GSC 4373 0708) was given by Khruslov and Tula of the SKYdot team (IBVS 5699). They classified it as an EB system with a maximum magnitude of 12.9 and minima of 13.5 and 13.2 for the primary and secondary eclipses. The period was 0.90733d.

Five times of minimum light were determined from our present observations, which include three primary eclipse and two secondary eclipses. We selected 4 times of low light from parabola fits of ASAS observations. From these we determined a quadratic ephemeris. The residuals are given in Figure 16.

$$\text{JD Hel MinI} = 2458883.54853 \pm 0.00052\text{d} + 0.90731541 \pm 0.00000040 \times E - 0.00000000020 \pm 0.00000000005 \times E^2 \quad (1)$$

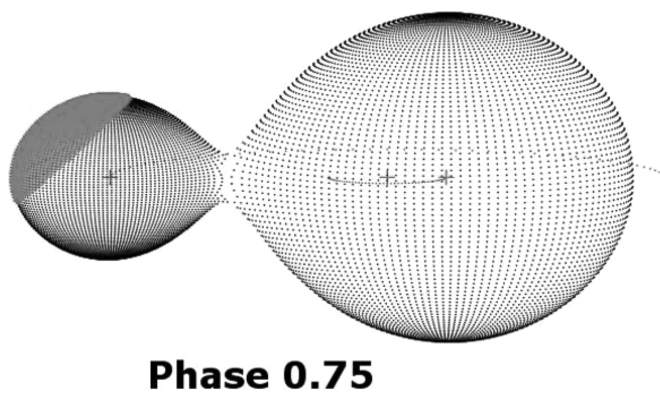


Figure 18. Geometrical representation of the surface of the binary at phase 0.75 for NS Cam with spot.

Thus, from our 20.3-year study, the period is found to be decreasing. Since the spectral types are ~F7V and ~G4V, this is probably due to magnetic braking. A Wilson-Devinney analyses reveals that the system is a W UMa shallow contact binary. The component temperature difference is 566K. The mass ratio is also somewhat extreme, $M_2/M_1=0.2130\pm0.0001$. The total eclipses make this a firm determination. The geometric representation of the solution is given in Figure 18. Its Roche Lobe fill-out is 15%. The dark spot was at midlatitude (co-latititude = 48°), but overlaps the pole with a large radius of ~60° and a T-factor of only ~0.67. The binary inclination is high, 83.5±0.2°, resulting in total eclipses. As a result, the primary minimum has a time of constant light with an eclipse duration of 104 minutes. The B, V and B-V color curves with the solution overlaid are given in Figure 17.

## Results

Figure 19 shows the typical theoretical thinking for magnetic braking of close binary (Guinan and Bradstreet, 1988). The observed rate of angular momentum loss has a much greater effect on the ages of short period binaries than proposed by the binary star community. We have recently been studying pre-contact W UMa binaries—that is, solar type stars—which exist in detached (separated) binary orbits with periods up to ~10 days. Thus, our study extends to longer periods than usual accorded to close binaries. Due to the inclusion of these longer period binaries, we have extended our range of initial periods to 20 days. In our final results (See Samec-2 = 2016a), we assumed 5 days as the birth period for binaries of period 0.2–0.5 days. Further, we assumed an initial period of 8 days for periods of 0.5–0.8 days, 10 days for 0.8–1.5 day periods 15 and 20 days for periods from 2.0–9.3 days. Our final results begin in Table 1. The over-all average age of our extended sample is about 40 million years. This is only 0.3 % (0.003) of the evolutionary age of the universe (13.8 Gyr). Figure 20 shows example results: O-C figure showing evolution of the orbit of AE Cas that is decaying over the 89-year-period study (Samec et. al, 2019d).

In the example given by Guinan and Bradstreet (1988), shown in Figure 19, using their magnetic braking equations, the scenario of a present contact binary with a 0.315-day period is calculated. The sample calculation shows the decrease in the orbits over time of 5 different initial periods $P_0$ from 1 day to 5 days. It is of interest here that they state that systems having periods $P_0 > 6$d may not experience this braking effect as main sequence stars since the tidal effects are small due to their relatively large separations. They cut off their initial period at 5d. We note that all of the stars except for two studied here have periods less than 5d. Here, selected systems were limited to those appearing to be undergoing magnetic braking. Thus, my unwitting selection may lend credibility to their prediction. As shown in the figure, the time to reach contact depends strongly on the initial period. Their calculations yield an age of 17 Gyr for an initial period of 5 days and 30 Myr for $P_0 = 1$d. In our sample, using binaries with periods from 0.30 to 0.32 days, we find, from observational rates of decay, that the time to attain contact ranges from 5 to 260 Myr, averaging 42 Myr, nearer to the prediction for initial 1 d periods. Our result for this transition (braking from a 5-day period to 0.32 days) is far short of 17 (now 13.8) Gyr. In fact, it is only

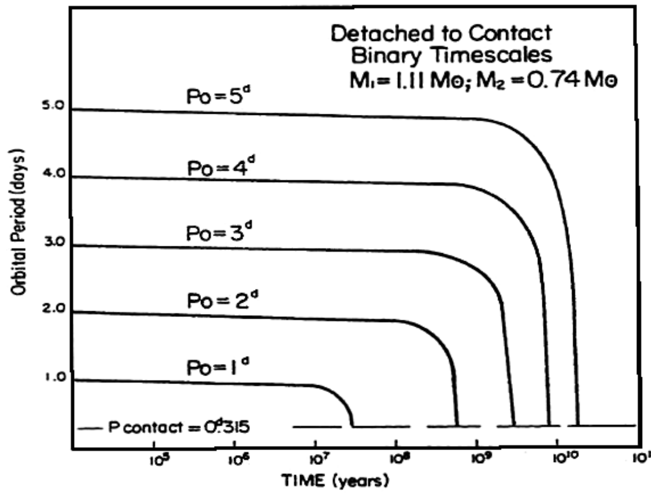


**Figure 19. Typical theoretical thinking for magnetic breaking of close binary: The time need to brake from a, 1–5 d period binary to a 0.315 period binary with 1.11 and 0.74 solar masses for the primary component and the secondary component, respectively (Guinan and Bradstreet, 1988).**

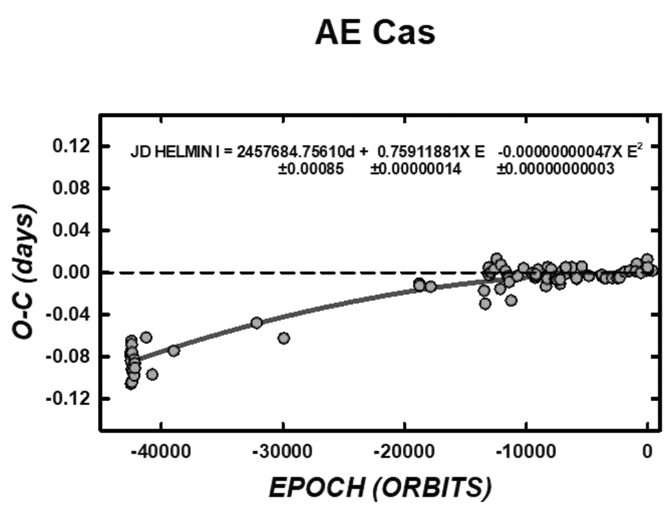


**Figure 20. Example Results: O-C figure showing evolution of the orbit of AE Cas that is decaying over the 89-year-period study. Since this system is of solar type, we concluded in our paper that the period is decreasing and angular momentum loss is occurring. We include AE Cas in our calculation of the age of such binaries. This was published in *The Astronomical Journal* (Samec et. al, 2019d).**

**Table I. Additional Eclipsing Binary Systems.** (Not all #s are in numerical order; some numbers are also missing.)

| Number | System | Ref | dp/dE (d/E) | dP/dt (d/yr) | period (d) | Est. Spec. Type |
|---|---|---|---|---|---|---|
| 1 | 279326 | 55 | -1.03E-10 | -3.29E-07 | 0.227733 | K9V |
| 2 | V1107 Cas | 64 | -5.69E-11 | -1.52E-07 | 0.273411 | K1V |
| 3 | 187430 | 55 | -1.20E-10 | -3.18E-07 | 0.275312 | K9V |
| 4 | RW Dor | 48 | 0.00E+00 | -9.27E-09 | 0.285463 | K2V |
| 5 | 238356 | 55 | -5.89E-10 | -1.47E-06 | 0.292658 | K6V |
| 6 | 294795 | 55 | -1.95E-10 | -4.84E-07 | 0.293658 | K0V |
| 7 | 238356 | 55 | -5.89E-10 | -1.47E-06 | 0.292658 | K6V |
| 8 | 294795 | 55 | -1.95E-10 | -4.84E-07 | 0.293658 | K0V |
| 29 | IK Boo | 53 | -1.36E-10 | -3.28E-07 | 0.303118 | G2V |
| 10 | 190636 | 55 | -8.19E-10 | -1.96E-06 | 0.305221 | K9V |
| 11 | 215121 | 55 | -2.32E-10 | -5.51E-07 | 0.3078.42 | K7V |
| 36 | ASAS J083241+2332.4 | 62 | -3.77E-10 | -8.85E-07 | 0.311321 | F5V |
| 13 | V1187 Her | 63 | -1.4E-10 | -3.34E-07 | 0.310763 | F7V |
| 14 | 149279 | 55 | -8.75E-10 | -2.03E-06 | 0.314728 | K9V |
| 83 | SZ Scl | - | -2.59E-10 | -5.90E-07 | 0.3208163 | K2V |
| 15 | V474 Cam | 42 | -4.2E-10 | -9.4E-07 | 0.328207 | K0V |
| 16 | V658 Lyr | 41 | -1.3E-10 | -3E-07 | 0.330258 | G2V |
| 17 | V1007 Cas | 40 | -8.1E-11 | -1.8E-07 | 0.332008 | |
| 18 | 181083 | 55 | -4.9E-10 | -1E-06 | 0.349391 | K6V |
| 19 | 218785 | 55 | -1.2E-09 | -2.5E-06 | 0.353455 | K9V |
| 20 | 2172596 | 55 | -1.5E-10 | -3.1E-07 | 0.354705 | K6V |
| 21 | 162594 | 55 | -3E-10 | -6.2E-07 | 0.356191 | K3V |
| 22 | QW Gem | 50 | -1.3E-10 | -2.6E-07 | 0.358123 | F8V |
| 23 | 233821 | 55 | -7.8E-10 | -1.6E-06 | 0.35992 | K2V |
| 24 | 246693 | 55 | -3.5E-10 | -7E-07 | 0.363524 | G0V |
| 25 | 347999 | 55 | -2.2E-09 | -4.3E-06 | 0.365383 | K3V |
| 26 | MT Cam | 64 | -4.6E-11 | -9.2E-08 | 0.366139 | G8V |
| 27 | 130708 | 55 | -1E-09 | -2.1E-06 | 0.366826 | K9V |
| 28 | GSC 3108-0057 | 28 | -1.9E-10 | -3.8E-07 | 0.368751 | G6V |
| 29 | Omega Cen V150 | 46 | -9.5E-11 | -1.9E-07 | 0.369 | F7V |
| 30 | 168012 | 55 | -1.9E-10 | -3.8E-07 | 0.371039 | K9V |
| 31 | 241306 | 55 | -3.6E-10 | -7.1E-07 | 0.371268 | K3V |
| 32 | NSVS 5066754 | 65 | -2.4E-08 | -4.7E-05 | 0.37478 | G5V |
| 33 | 339765 | 55 | -6.1E-09 | -1.2E-05 | 0.37784 | K6V |
| 34 | 351804 | 55 | -1.1E-09 | -2.1E-06 | 0.38542 | K6 |
| 35 | 320382 | 55 | -1.4E-09 | -2.6E-06 | 0.388373 | K7V |
| 36 | 207879 | 55 | -3E-10 | -5.5E-07 | 0.393082 | K6V |
| 37 | 119460 | 55 | -1.3E-09 | -2.5E-06 | 0.394387 | K6V |

**Table I (cont.)**

| Number | System | Ref | dp/dE (d/E) | dP/dt (d/yr) | period (d) | Est. Spec. Type |
|---|---|---|---|---|---|---|
| 38 | 229500 | 55 | -9.3E-10 | -1.7E-06 | 0.398365 | K5V |
| 39 | 192437 | 55 | -8.8E-10 | -1.6E-06 | 0.402313 | K9V |
| 40 | 243151 | 55 | -2.4E-09 | -4.4E-06 | 0.403628 | K5V |
| 41 | 217990 | 55 | -6.4E-10 | -1.1E-06 | 0.412545 | K9V |
| 42 | MR Com | 57 | -3E-10 | -5.3E-07 | 0.412744 | F7V |
| 43 | V1695 Aql | 66 | -9.8E-10 | -1.7E-06 | 0.412816 | G8V |
| 44 | 212252 | 55 | -2.2E-09 | -3.9E-06 | 0.41325 | K9V |
| 45 | V573 Peg | 67 | -2.7E-10 | -4.8E-07 | 0.417449 | G7V |
| 46 | 225278 | 55 | -4.1E-10 | -7.2E-07 | 0.417923 | K6V |
| 47 | GQ Cnc | 68 | -2.9E-11 | -5E-08 | 0.422208 | K0V |
| 48 | 181311 | 55 | -8.3E-10 | -1.4E-06 | 0.422617 | K6V |
| 49 | 195664 | 55 | -2.7E-09 | -4.6E-06 | 0.4369 | K5V |
| 50 | 198303 | 55 | -2.3E-10 | -3.8E-07 | 0.438734 | K2V |
| 51 | FF Vul | 69 | -6E-11 | -9.8E-08 | 0.444976 | F4V |
| 52 | NSVS 10083189 | 70 | -4.9E-10 | -7.9E-07 | 0.452189 | F8V |
| 53 | 114280 | 55 | -6.2E-10 | -1E-06 | 0.453031 | K5V |
| 55 | 183004 | 55 | -1.3E-09 | -2E-06 | 0.467429 | K3V |
| 56 | V532 Mon | 52 | -1.1E-10 | -1.7E-07 | 0.466976 | F5V |
| 57 | 183004 | 55 | -1.3E-09 | -2E-06 | 0.467429 | K3V |
| 58 | 184767 | 55 | -5.6E-10 | -8.6E-07 | 0.473305 | M1V |
| 59 | 106230 | 55 | -5.9E-10 | -8.9E-07 | 0.489019 | K3V |
| 60 | 163655 | 55 | -1.1E-09 | -1.6E-06 | 0.492482 | K9V |
| 61 | 201682 | 55 | -1.3E-09 | -1.9E-06 | 0.497314 | K9V |
| 62 | 168049 | 55 | -1.9E-09 | -2.7E-06 | 0.506522 | K7V |
| 64 | NSVS 103152 | 64 | -2.4E-09 | -3.3E-06 | 0.528378 | F5V |
| 65 | 192939 | 55 | -3.2E-09 | -4.4E-06 | 0.531934 | K9V |
| 66 | 287671 | 55 | -1.4E-09 | -1.9E-06 | 0.532926 | K2V |
| 67 | 182438 | 55 | -8.3E-10 | -1.1E-06 | 0.549392 | K9V |
| 68 | 159116 | 55 | -1.4E-09 | -1.7E-06 | 0.587393 | K2V |
| 69 | 176119 | 55 | -1.2E-09 | -1.4E-06 | 0.594569 | K7V |
| 70 | TYC 1488-693-1 | 63 | -4.3E-09 | -5.2E-06 | 0.595442 | F2V |
| 72 | V385 Cam | 65 | -1.5E-10 | -1.8E-07 | 0.615271 | G7.5V |
| 73 | 172659 | 55 | -5E-09 | -5.9E-06 | 0.626226 | K5V |
| 74 | AE Cas | 66 | -4.8E-11 | -4.6E-08 | 0.759121 | F7V |
| 75 | V1073 Cyg | 45 | -1.04E-10 | -9.7E-08 | 0.78585 | F2V |

**Table I (cont.)**

| Number | System | Ref | dp/dE (d/E) | dP/dt (d/yr) | period (d) | Est. Spec. Type |
|---|---|---|---|---|---|---|
| 76 | 175354 | 55 | -1.2E-08 | -1.1E-05 | 0.840163 | K7V |
| 84 | N Cam | - | -2.00E-10 | -1.61E-07 | 0.90781541 | F7V |
| 77 | 220028 | 55 | -7.6E-09 | -6E-06 | 0.920792 | K4V |
| 78 | 154749 | 55 | -1.3E-08 | -1E-05 | 0.932247 | M1V |
| 79 | 344477 | 55 | -2.1E-08 | -1.5E-05 | 1.032195 | K5V |
| 80 | 176377 | 55 | -2.4E-08 | -1.4E-05 | 1.245946 | K9V |
| 81 | 299145 | 55 | -2.9E-08 | -1.7E-05 | 1.252603 | K5V |
| 82 | 170070 | 55 | -2.2E-08 | -1.2E-05 | 1.401907 | K9V |

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55. Pitrukowicz et al., 2017
57. Qian et al., 2003
62. Sriram et al., 2016b
63. Samec et al., 2018a
64. Samec et al., 2019b
65. Samec et al., 2019a
66. Samec et al., 2019d
67. Samec et al., 2018c
69. Samec et al., 2016b
70. Samec et al., 2018d

**Table 2. Average values from Samec-1 and 2 (2012, 2016a), including this paper.**

| | $P_0$ 5d (initial) | $P_0$ 8d (initial) | $P_0$ 10d (initial) | $P_0$ 15d (initial) | $P_0$ 20d (initial) | Average |
|---|---|---|---|---|---|---|
| AGE (Years) | 4.12E+07 | 6.05E+07 | 4.74E+07 | 1.97E+07 | 2.22E+07 | 3.82E+07 |
| Maximum | 7.15E+08 | 2.86E+08 | 2.18E+08 | 1.02E+08 | 1.45E+08 | 7.15E+08 |
| Minimum | 1.33E+01 | 2.20E+05 | 5.09E+05 | 6.28E+04 | 8.86E+04 | 5.09E+05 |
| % age of Universe | 0.3 | 0.4 | 0.3 | 0.1 | 0.2 | 0.3 |

0.4% of the current estimated age of the universe, (some 2–3 orders of magnitude)!

Binary evolution is taking place at a rate of ~300 times that predicted by theory! Using the 5-day limiting period of Guinan and Bradstreet, our sample decreases to 133 binaries and the age of this group is about 40 million years. This is only 0.3% (0.003) of the present estimate of the evolutionary age of the universe (13.8 Gyr). So, our results remain at same order of magnitude.

## Creation Implications

This paper gives physical confirmation of the youthful age, in a creationary sense, of the universe in a time-dilation scenario. We have determined the age of solar type binaries from a large sample which comprise the most abundant of the binaries in the universe (probably 90%) and about 50% of all stars. A scheme was developed which estimated the age of such binaries and thus apparent age of the time-dilated universe. The average age result is on the order of ~38.2 million years as the apparent age of the time-dilated universe. Although this seems large for a creation-based paper, it is much, much smaller than the proposed age of W UMa binaries of some 5–10 billion years. The age is about 1/200th of their theoretical age! The 5-day initial period binaries (including 135 eclipsing solar type binaries) have an average age of $4.12 \times 10^7$ years or 0.3% of the age of the universe proposed by secular astronomers, 13.8 Gyr. I reiterate the statement given in Samec-2 (2016a) as a footnote here with the present results.[3] This shows that even in a time-dilated view of the cosmos that the universe "evolves" at a much higher rate than the evolutionist imagines. As I have noted before, someone called to our attention at a recent meeting much of this prehistory took place during Creation Week following the creation of the first stars on Day 4. So, the time-dilation events postulated by Humphreys (1994, 2005, 2008) fall into the category of a Creation Week event. Regardless, the aging phenomena did actually take place in a scientific-historical sense and it is not due to an apparent, ex nihilo, created history. The events we see truly took place and are objects of legitimate scientific inquiry that the Lord has allowed His children to study. I firmly believe as stated in Exodus 20:11, "*For in six days the LORD made heaven and earth, the sea, and all that in them is, and rested the seventh day*:" and Isaiah 45:12, "*I have made the earth, and created man upon it: I, even my hands, have stretched out the heavens, and all their host have I commanded.*"

3 Although this does not equal the oft-cited age of 6000–10,000 years in creation literature, I remind the reader that this value is the *apparent age* of a time-dilated universe. The Earth and, I believe, the entire Solar System remains in the range of ages last mentioned. And only some ~100 million years (not 13.8 billion!) years of *apparent* history is exhibited at least in the nearby (<2 kiloparsec's, or about 6000 LY) cosmos—and probably for the "deep" universe as well. I also believe that some celestial bodies were created so that they defy being dated by evolutionary time schemes, such as our Sun.

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