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Times of maximum of KZ Hya from OACS -UNAH

Tiempos de máxima luz de KZ Hya desde el OAC-UNAH

M. MEZA[1,†], A. PINEDA[2,†], C. ARGUETA[1,†], Y. MENDOZA[2,†], M.C. PEREIRA[1,†], W. FUENTES[3,†], M. INTERIANO[2,†]

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ABSTRACT

A pulsating variable star is one whose brightness changes periodically due to the expansion and contraction of the surface layers of the star. Several times of maximum light can be obtained in brief observations of SX Phoenicis variable stars due to their short periods of pulsation ($P \sim 1.0 - 1.75$ h). We report three new times of maximum light of SX Phoenicis star KZ Hya obtained from photometric observations made on the night of April 5-6, 2019 from the Observatorio Astronómico Centroamericano de Suyapa (OACS) of the Universidad Nacional Autónoma de Honduras.

RESUMEN

Una estrella variable pulsante es una cuyo brillo cambia periódicamente debido a la expansión y contracción de las capas superficiales de la estrella. Las estrellas variables SX Phoenicis tienen periodos de pulsación cortos ($P \sim 1.0 - 1.75$ h) por lo que se pueden obtener varios tiempos de máximo en observaciones cortas. Se reportan tres tiempos de máximo para la estrella SX Phoenicis KZ Hya, obtenidos a partir de observaciones fotométricas hechas en la noche del 5-6 de abril de 2019 desde el Observatorio Astronómico Centroamericano de Suyapa (OACS) de la UNAH.

KEYWORDS

Variable stars, SX Phe, HD 94033, Time of maximum.

PALABRAS CLAVES

Estrellas variables, SX Phe, HD 94033, Tiempo de máximo.

[1]Facultad de Ciencias Espaciales, Universidad Nacional Autónoma de Honduras.

[2]Escuela de Física, Facultad de Ciencias, Universidad Nacional Autónoma de Honduras.

[3]Departamento de Física, Universidad Nacional Autónoma de Honduras en el Valle de Sula.

[†]Grupo de Investigación en Estrellas Pulsantes - UNAH. unah.giep@gmail.com

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I | INTRODUCTION

KZ Hya (HD 94033, V = $9.^m498 - 10.^m243$)) is a SX Phoenicis variable star (Rodríguez, E. & Breger, M., 2001). SX Phe stars have a similar variable behavior to high amplitude delta Scuti stars (HADS); however, SX Phe stars are old, population II stars (metal-poor) while HADS are young, population I stars (metal-rich). For this reason, SX Phe stars were proposed as a separate class of variable stars by (Frolov & Irkaev, 1984). Most of these stars are members of globular clusters but some of them are found in galactic disks (Aerts, Christensen-Dalsgaard, & Kurtz, 2010).

KZ Hya is a population II star with Fe/H= -2.40 and Z= 0.0001. Its mass is $0.97M_{\odot}$ and its effective temperature is 7640 K (Jiang, 2008). It was discovered in a study of high proper motion stars by (Przybylski & Bessell, 1979) and 25 times of maximum were determined in subsequent observations. They found that this star moves at a high velocity around the center of the Milky Way Galaxy in a very eccentric and retrograde orbit. The last studies of KZ Hya were made by (Peña et al., 2018), who found 19 new times of maximum, a variation of its spectral class between A5V and A8V, and a stable period of pulsation of 0.059510382 d, among other physical parameters. We present photometric observations made from the OACS-UNAH on section II and the subsequent determination of times of maximum light on section III, which is the main objective of this work. The latter was possible through differential photometry and fifth order polynomial fitting (Sterken, 2005).

II | OBSERVATIONS

The observations of the variable star KZ Hya were made on the night of April 5-6, 2019. A Meade Schmidt-Cassegrain $LX200 - ACF8'' \ f/10$ telescope was used along with a CCD ST-402 camera with a field of view of $11.8' \times 7.9'$. We also used a G filter from the RGB filter system. These observations took place on the Observatorio Astronómico Centroamericano de Suyapa of UNAH (Latitude: $14°05' 11.04''$ N, Longitude: $87°09' 33.84''$ W) in Tegucigalpa. We chose HD 93998 (G = 9.9830 mag - RGB system) as our reference star for the differential photometry. Twenty-three stacks of sixty photographs each were taken with a 10 second exposure time for each photograph. The data reduction was done with AstroImageJ (Collins, Kielkopf, Stassun, & Hessman, 2017).

III | DETERMINATION OF THE TIMES OF MAXIMUM

From Figure 1, three times of maximum light are evident. These were determined from three polynomial fits, illustrated in Figure 2, which were obtained using the least squares regression method. A fifth order polynomial fit was adjusted to each time of maximum light, these are:

$$\begin{aligned}
P_1(x) =& 3829478.77515489x^5 - 137984367.257548x^4 + 1761421653.07987x^3 \\
& - 8309379989.66683x^2 - 1766559479.61853x + 84078516043.9237 \\
P_2(x) =& 15342027.2906929x^5 - 555891183.866165x^4 + 7136273256.99145x^3 \\
& - 33865262916.9878x^2 - 7091576249.9818x + 345879551622.624 \\
P_3(x) =& 6421783.7990124x^5 - 234217522.642847x^4 + 3026702661.57637x^3 \\
& - 14460100691.7672x^2 - 3023388052.59832x + 149538403248.6194
\end{aligned}$$

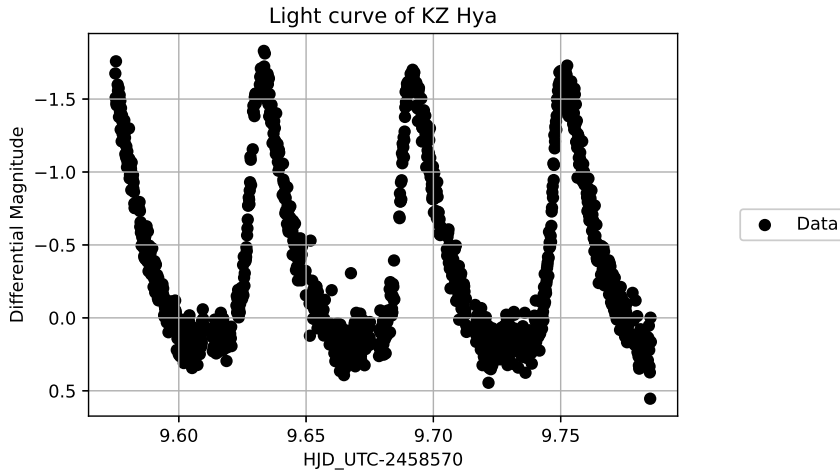

Figure 1: Obtained light curve. The vertical axis shows the differential magnitude, which is the difference in apparent magnitude between the target star and the comparison star. The heliocentric Julian date is shown on the horizontal axis.

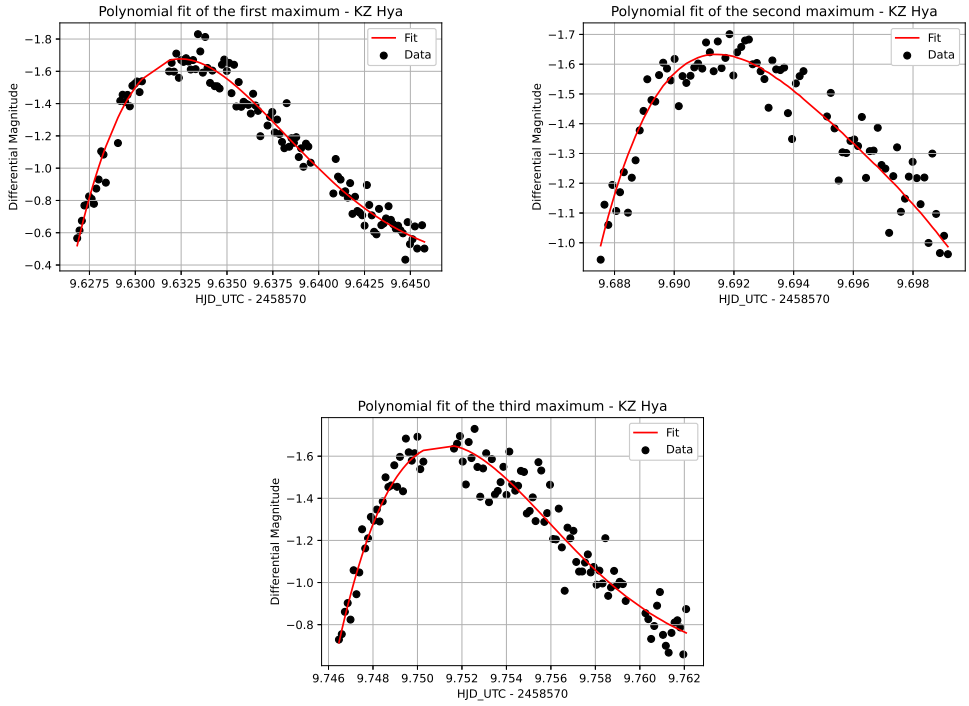

Figure 2: Polynomial fits of the three times of maximum light.

i	**HJD-UTC**	P_i : R^2
1	2458579.6325	0.96
2	2458579.6914	0.92
3	2458579.7512	0.93

Table 1: Times of maximum light of KZ Hya. R^2 is a statistical measure of how close the data are to the fitted regression curve.

Finally, the determined times of maximum light are reported in Table 1 along with the R^2 values of their respective polynomial fit.

IV | CONCLUSIONS

Three new times of maximum light of KZ Hya were determined through differential photometry and polynomial regressions with high R^2 values. With this work, we seek to encourage research in the astrophysics field in Honduras, as well as to show the potential of similar projects that can be done from the OACS. We expect to extend this work on to the determination of physical parameters of the variable star KZ Hya, including a precise period of pulsation from its available times of maximum.

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