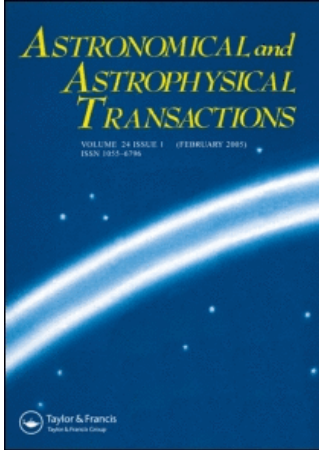


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S. YU. Gorda <sup>a</sup>, YU. YU. Balega <sup>b</sup>, E. A. Pluzhnik <sup>c</sup>; Z. U. Shkhagosheva <sup>b</sup>

<sup>a</sup> Astronomical Observatory, Ural State University, Ekaterinburg, Russia

<sup>b</sup> Special Astrophysical Observatory, Russian Academy of Sciences, Zelenchukskaya, Karachaevo-Cherkesia, Russia

<sup>c</sup> Subaru Telescope, National Astronomical Observatory of Japan, Tokyo, Japan

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## Visual orbit of the third body on the eclipsing binary SZ Cam

S. YU. GORDA\*†, YU. YU. BALEGA‡, E. A. PLUZHNIK§ and Z. U. SHKHAGOSHEVA‡

†Astronomical Observatory, Ural State University, 51 Lenin Avenue, Ekaterinburg 620083, Russia

‡Special Astrophysical Observatory, Russian Academy of Sciences, Nizhnij Arkhyz,  
Zelenchukskaya, Karachaevo-Cherkesia 369167, Russia

§Subaru Telescope, National Astronomical Observatory of Japan, 2-21-1 Osawa,  
Mitaka, Tokyo 181-8588, Japan

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On the basis of new speckle interferometric and photometric observations of the eclipsing binary SZ Cam, executed on the 6 m telescope at the Special Astrophysical Observatory, Russian Academy of Sciences, and the 0.5 m telescope of the Astronomical Observatory, Ural State University, and data added from the literature, a complete set of parameters for the apparent relative orbit of the third body are determined for the first time. The mass of the third body,  $M_3 = 23.4 M_\odot$ , and the distance to SZ Cam,  $d = 1125$  pc, are estimated. The duality of the third body is confirmed. The assumption is stated that SZ Cam is probably not a member of the open star cluster NGC 1502, on which centre it is projected.

*Keywords:* Eclipsing binary systems; Double stars; Speckle interferometry; Stellar photometry

The presence of the third body in the eclipsing binary SZ Cam was established by Mayer *et al.* [1] on the basis of spectral data. Using the results of the speckle interferometric research on SZ Cam, which exist only for that moment (carried out by Mason (and later published in [2]), who found a visual companion at the angular distance of  $0''.071$  from SZ Cam), and photometric data, Mayer *et al.* [1] have calculated four versions for the visual orbits of the third body for two values of the period (50.7 years and 60.1 years) and two values of the inclination angle ( $i = 60^\circ$  and  $i = 90^\circ$ ) [3].

In 2002 we carried out observations of SZ Cam using a digital speckle interferometer [4], mounted in the primary focus of the 6 m telescope at the Special Astrophysical Observatory, Russian Academy of Sciences. For the epoch  $T_2 = 2002.2485$ , new values of the separation of the close visual companion,  $\rho = 0''.076 \pm 0''.001$ , and the position angle,  $\theta = 295^\circ.6 \pm 0^\circ.5$ , were calculated. These values differ from those obtained earlier for the epoch  $T_1 = 1994.7035$  ( $\rho = 0''.071$  and  $\theta = 300^\circ.6$ , respectively) [2]. This can be considered as confirmation of the orbital motion of the close visual companion, which is identified with the third body in the SZ Cam system.

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\*Corresponding author. Email: Stanislav.Gorda@usu.ru

Table 1. The parameters of the third body's visual orbit.

Third body							SZ Cam		
$P_{\text{orb}}$ (years)	$T_0$	$e$	$a$	$i$	$\Omega$	$\omega$	$a' \sin i$ (au)	$P_{\text{SZ}}$ (days)	$\text{JD}_{\odot} I_{\text{min}}$
53.5	1980.437	0.78	0''.047	72°.9	302°.0	26°.3	22.81	2.698 4688	2426 286.7644

In order to define the complete set of parameters of the visual orbits of the third body we used speckle interferometric data and data on the moments minima of SZ Cam from the literature, complemented by unpublished data obtained by Gorda in 1996–2005. First, on the basis of the curve of the change in the period of SZ Cam ( $O-C$ ), the following parameters of the orbit were found:  $P_{\text{orb}}$ ,  $\omega$ ,  $e$  and  $T_0$ . Then the speckle interferometric data were used to determine the parameters for the visual orbit of the third body ( $i$ ,  $\Omega$  and  $a$ ). The values of the parameters for the visual relative orbit of the third body as well as the true period  $P_{\text{SZ}}$  of SZ Cam and the projection  $a' \sin i$  on the plane of view of the major semiaxis of its orbit are given in table 1.

Evaluation of the mass function of the 'third body–SZ Cam' system and the total mass of SZ Cam ( $M_{12} = 28.5 M_{\odot}$  [5]) allowed us to determine the following estimate for the mass of the third body:  $M_3 = 23.4 M_{\odot}$ . The high value of the mass of the third body confirms the conclusion made by Lorenz *et al.* [3] about its duality.

An estimate of the distance to SZ Cam,  $d = A/a = 1125$  pc, was obtained together with the value of the major semiaxis of the relative orbit of the third body,  $A = 52.9$  au, calculated on the basis of  $M_{12}$ ,  $M_3$  and  $a'$ .

The obtained estimate of the distance to SZ Cam exceeds by 30% the value of the distance to the open star cluster NGC 1502, which is equal to 880 pc [6]. Taking into account that the maximum radii of the open clusters do not exceed 10–15 pc [7] we conclude that the eclipsing binary system SZ Cam is probably not a member of the open star cluster NGC 1502, on which centre it is projected.

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