PERIOD STUDY OF AX DRACONIS

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Abstract. A new period (P = 0.5681643) for AX Draconis, based on all available times of minima, has been given. O-C diagrams for the star, based on various periods, have been given. A sinusoidal variation is apparent in figures, which is suggestive of the possible presence of a third body, having a period of more than 80 years.

1. Introduction

The earliest observations of the eclipsing binary system AX Draconis (= AX Dra = BV 40) are attributed to the work of Kippenhahn (1955), who located the star and suspected its variability. Strohmeier and Knigge (1961) carried out photographic observations and presented a photographic light curve, and twelve times of minima. They suggested a period of 0.5681644. Their light curve is suggestive of the fact that the system is of Algol-type.

Numbers of visual minima are given by BBSAG observers. First photoelectric epoch was presented by Faulkner (1986), who gave the period of the system as 0.5681616. Later, Di-sheng et al. (1989) carried out photometry of AX Dra in detail and presented the photometric light curve, light elements, spectral types as F1 and K3, and gave a period of 0.56816240. They suggested that the system is of β Lyr-type. None of the period studies given above are complete, and can not be supposed to be the last ventures.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Author</th>
<th>Epoch and period</th>
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<tbody>
<tr>
<td>1</td>
<td>Strohmeier and Knigge(1961)</td>
<td>J.D. 2426767.675  + 0.5681644 E</td>
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<tr>
<td>2</td>
<td>Brancewicz and Dworak(1980)</td>
<td>J.D. 2446172.7202  + 0.5681616 E</td>
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<tr>
<td>3</td>
<td>Faulkner(1986)</td>
<td>J.D. 2446522.1423  + 0.56816240 E</td>
</tr>
<tr>
<td>4</td>
<td>Di-sheng et al.(1989)</td>
<td>J.D. 2426767.659  + 0.5681643 E</td>
</tr>
<tr>
<td>5</td>
<td>Srivastava (present work, based on all available minima)</td>
<td>J.D. 2446172.7202  + 0.5681660 E</td>
</tr>
<tr>
<td>6</td>
<td>Srivastava (present work, based on only pe minima)</td>
<td>J.D. 2446172.7202  + 0.5681660 E</td>
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2. Epoch, Period and New Period

Epochs and periods of AX Dra, determined by various authors, are given in Table I. The table shows some variation in the period of the system. Strohmeier and Knigge (1961) considered only 12 photographic minima and gave an epoch and a period. Faulkner (1986) considered only 7 minima including 1 photoelectric minimum, and 6 visual minima. Di-sheng et al. (1989) considered only 11 minima, including 3 photoelectric and 8 visual minima. All these investigators have not considered all the minima available in the literature at the time of their studies of the system AX Dra, as such their period studies were incomplete.

We have searched out the whole literature and, in all, 33 minima have been collected from the literature, out of which 15 are visual, 13 photographic and 5 photoelectric. All these minima are primary and no secondary minimum is available to us.

Using the initial epoch and period, a new period has been derived, based on all minima, from the method of least squares, which comes out to be $0^d5681643 \pm 0^d0000001$. A photoelectric period has been derived, using only 5 photoelectric minima available to us, employing the photoelectric epoch, $\text{Pri. Min.} = \text{J.D. 2446172.7202}$, given by Faulkner (1986). The period comes out to be $0^d5681660 \pm 0^d0000001$.

3. O-C Diagrams and Period Variation

The period studies given by Strohmeier and Knigge (1961), Faulkner (1986) and Di-sheng et al. (1989) have been reviewed and found that these have been far from satisfactory, as being incomplete, not considering all times of minima available in the literature. All available times of minima, numbering 33, obtained in the time interval 1932 to 1986, have been listed in Table II. Four O-C diagrams (Figs. 1 to 4) have been drawn from the O-C values based on the following ephemerides:

1. Primary Minimum = J.D. 2426767.659 + $0^d5681644 \text{ E}$, (Strohmeier and Knigge, 1961);
2. Primary Minimum = J.D. 2426767.659 + $0^d5681643 \text{ E}$, (Srivastava, present work, based on all available times of minima);
3. Primary Minimum = J.D. 2426767.659 + $0^d56816240 \text{ E}$, (Di-sheng et al., 1989);
4. Primary Minimum = J.D. 2426767.659 + $0^d5681616 \text{ E}$, (Faulkner, 1986, based on pe min only).

Comparing the four O-C diagrams (Figs. 1 to 4), it is apparent that:

1. The period appears to be little over estimated in first O-C diagram (Fig. 1);
2. The period appears to be quite satisfactory as the O-C values balance them equally around $\text{O-C} = 0^d000$ in second O-C diagram (Fig. 2);
3. The period appears to be under estimated in third O-C diagram (Fig. 3);
4. The period appears to be under estimated in fourth O-C diagram (Fig. 4).