NSV 03005: A PROBABLE LONG-PERIOD ECLIPSING BINARY

NSV 03005 (BD +17° 1281, HD 258878, SAO 095781) is an 8th-magnitude star, spectral type F2II, at RA $6^h 28^m 47.7^s$ Dec $17° 07' 8.2"$ (1950). It was listed as a possible variable by Hill and Schilt (1952), but the New Catalogue of Suspected Variable Stars (Kholopov et al. 1982) classifies variability as doubtful or erroneous.

One of us, Kaiser, is conducting a photographic nova search by the PROBLICOM method (Mayer 1977) using 35mm Ektachrome 400 color slide film. While blinking slides taken on 21 March 1988 UT, he noted a marked decrease in the brightness of NSV 03005 compared to images on three earlier dates. On 23 March, Baldwin established a provisional visual comparison star sequence, and he and Kaiser began visual observations while photography continued. On 28 March, Williams began photoelectric observations with a 28-cm Schmidt-Cassegrain and Optec SSP-3 photometer. In addition to observing NSV 03005, he determined V and B magnitudes for the comparison star sequence (Table I) by differential measures linked to the Johnson standard star Gamma Geminorum, +1.92 V, +0.00 B-V (Astronomical Almanac 1988).

The observations of NSV 03005 are listed in Table II. The visual and color-film estimates have been interpolated from the observers' provisional step values to the V magnitude scale given in Table I. The light curve (Figure 2) strongly resembles what would be expected for an eclipsing variable.

The observations are not adequate to indicate whether there is a constant interval at minimum. However, reflecting the ascending branch
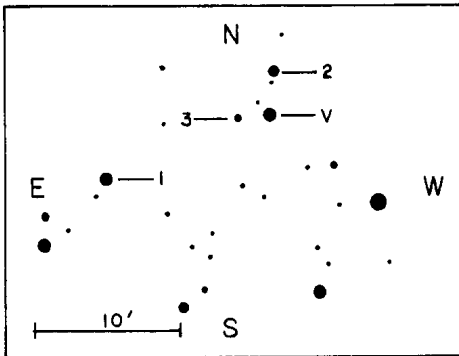
Figure 1. Finder chart for NSV 03005. Coordinates and magnitudes are listed in Table I.

TABLE I.

| Star (Fig. 1) | RA (1950) | DEC (1950) | V | B |
|---|---|---|---|---|
| 1 = SAO 095810 | $6^h$ $29^m$ $47.4^s$ | $+17°$ $03'$ $59.2"$ | $+7.92$ $\pm0.01$ | $+8.42$ $\pm0.01$ |
| 2 = SAO 095777 | $6^h$ $28^m$ $43.7^s$ | $+17°$ $10'$ $29.5"$ | $8.96$ $\pm0.02$ | $9.32$ $\pm0.02$ |
| 3 - - - - | $6^h$ $29^m$ $02^s$ | $+17°$ $08'$ $05"$ | $9.90$ $\pm0.06$ | $10.51$ $\pm0.15$ |
| V = SAO 095781 | $6^h$ $28^m$ $47.7^s$ | $+17°$ $07'$ $08.2"$ | $8.24*\pm0.02$ | $8.96*\pm0.03$ |

* At post-eclipse maximum.

to fit the single observation on the descending branch sets a limit to any such total phase, which could not be much longer than 1 day, and also suggests that the faintest observations are very close to minimum light. The rise to the level of constant maximum required 6-7 days, indicating that the duration of eclipse is 12-14 days. With reasonable allowances for the possible error of the single observation on the descending branch, we estimate mid-eclipse at JD 2447243.4 $\pm0.5$.

If NSV 03005 is indeed an eclipsing binary, it has exceptional characteristics. The F2II primary is luminous enough to have a cooler, fainter giant companion, though two giants in a binary system would be unusual. Except for Beta Lyrae-type stars, only ten of the 881 eclipsing binaries listed in the Cracow Supplement (S.A.C. 1988) have longer durations of eclipse, and only one of those ten has an amplitude greater than $1^m.5$.
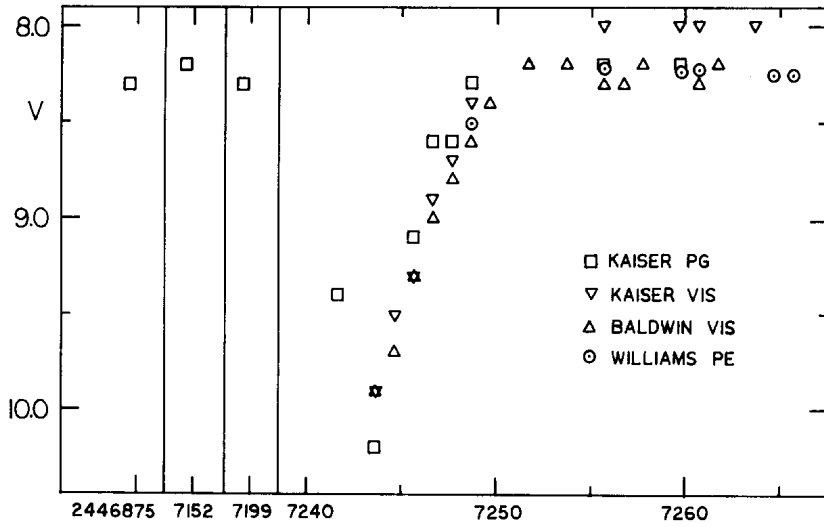
Figure 2. NSV 03005, light curve plotted from observations in Table II.

TABLE II.

| HJD 2440000+ | K (pg) | K (vis) | B (vis) | W (pe) | * |
|---|---|---|---|---|---|
| 6874.6 | +8.3 | | | | |
| 7151.7 | 8.2 | | | | |
| 7198.6 | 8.3 | | | | |
| 7241.6 | 9.4 | | | | |
| 7243.6 | 10.2 | +9.9 | +9.9 | | |
| 7244.6 | - | 9.5 | 9.7 | | |
| 7245.6 | 9.2 | 9.3 | 9.3 | | |
| 7246.6 | 8.6 | 8.9 | 9.0 | | |
| 7247.6 | 8.6 | 8.7 | 8.8 | | |
| 7248.563 | - | - | - | +8.51 V | +0.03 |
| .6 | 8.3 | 8.4 | 8.6 | - | |
| 7249.6 | - | - | 8.4 | - | |
| 7251.6 | - | - | 8.2 | - | |
| 7253.6 | - | - | 8.2 | - | |
| 7255.570 | - | - | - | 8.22 V | +0.01 |
| .6 | 8.2 | 8.0 | 8.3 | - | |
| 7256.6 | - | - | 8.3 | - | |
| 7257.6 | - | - | 8.2 | - | |
| 7259.6 | 8.2 | 8.0 | - | - | |
| .602 | - | - | - | 8.24 V | +0.02 |
| 7260.593 | - | - | - | 8.23 V | ∓0.02 |
| .6 | - | 8.0 | 8.3 | - | |
| 7261.6 | - | - | 8.2 | - | |
| 7263.6 | - | 8.0 | - | - | |
| 7264.571 | - | - | - | 8.26 V | +0.01 |
| 7265.566 | - | - | - | 8.26 V | ∓0.02 |

* Comparison star = SAO 095810 (Table I).

For an 8th magnitude star with an amplitude of $1^m_{\cdot}8$ to escape earlier discovery, observable eclipses must be very infrequent. Hill and Schilt (1952) do not give the epoch at which variability was suspected, so this reference does not help to identify a possible second minimum. A search of archival plate collections, or radial velocity measures over a sufficient time interval, could provide additional information needed to determine the period. One possibility is a period slightly less than $365^d(n)$, with (n) being a whole integer, so that eclipses have occurred near solar conjunction for many years.

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