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**IW And IS A Z Cam-TYPE DWARF NOVA**

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IW And (S 10792) is a blue variable discovered by Meinunger (1975). Meinunger (1980) studied the object spectroscopically and described that the object seems to be a unique object: in spite of broad absorption lines of  $H\beta$ ,  $H\gamma$  and  $H\delta$  resembling those of an O or early B dwarf or subdwarf, the spectrum was found to be featureless around  $H\alpha$ . Meinunger (1980) further stated that a couple of doubtful emission lines at the limit of detectability seem to be present. From 330 observations for the period JD 2440802–46706, Meinunger and Andronov (1987) found that 72% of the observations are in the inactive state (15.1–15.3) of the star. The object infrequently showed maximum brightness (18% of time, 13.7–15.0 mag) and minimum brightness (10% of time, 15.4–17.3 mag). Meinunger and Andronov (1987) stated that such behavior is significantly different from those of dwarf novae or polars. More recently, Liu et al. (1999) obtained a higher quality spectrum, and detected  $H\alpha$  emission line with broad absorption troughs. Although Liu et al. (1999) classified the object as a confirmed cataclysmic variable, the exact nature of the object has not been evident owing to the lack of dense photometric observations.

We observed IW And on 55 nights between 2001 December 6 and 2002 March 25. The observations were done using an unfiltered ST-7E camera (system close to  $R_c$ ) attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analysed using the Java<sup>TM</sup>-based PSF photometry package developed by one of the authors (TK). The differential magnitudes of the variable were measured against GSC 2811.1573 (Tycho-2  $V$ -magnitude 12.05,  $B - V = 0^m11$ ), whose long-term constancy was confirmed to 0.10 mag by comparison with GSC 2811.2117 (Tycho-2  $V$ -magnitude 11.57,  $B - V = 0^m69$ ). The log of observations is summarized in Table 1.

The resultant light curve is shown in Fig. 1. The light curve clearly shows oscillations at the beginning of the observation. After that, the object entered a standstill. The behavior is quite characteristic to a Z Cam-type dwarf nova entering a standstill (Szkody and Mattei 1984; Honeycutt et al. 1998; Oppenheimer et al. 1998; Kato 2001). There was even a small hint of small-amplitude oscillations during the early part of the standstill which are quite analogous to those of Z Cam (Kato 2001) and HX Peg (Honeycutt et al. 1998). The last observation may indicate that the object was caught during an outburst from the standstill. The present observations establish that IW And is a previously

Table 1. Nightly averaged magnitudes of IW And

| Mid-JD <sup>a</sup> | Mean mag <sup>b</sup> | Error <sup>c</sup> | N <sup>d</sup> | Mid-JD <sup>a</sup> | Mean mag <sup>b</sup> | Error <sup>c</sup> | N <sup>d</sup> |
|---------------------|-----------------------|--------------------|----------------|---------------------|-----------------------|--------------------|----------------|
| 52250.1090          | 2.224                 | 0.005              | 31             | 52305.8840          | 2.794                 | 0.014              | 31             |
| 52250.9993          | 1.973                 | 0.006              | 31             | 52306.8847          | 2.721                 | 0.017              | 31             |
| 52252.1208          | 1.967                 | 0.007              | 31             | 52309.9958          | 2.675                 | 0.037              | 10             |
| 52255.1118          | 2.215                 | 0.017              | 31             | 52311.8993          | 2.846                 | 0.024              | 31             |
| 52255.9875          | 2.325                 | 0.043              | 12             | 52312.8972          | 2.786                 | 0.030              | 31             |
| 52257.0632          | 2.688                 | 0.044              | 31             | 52316.9007          | 2.675                 | 0.010              | 31             |
| 52257.9840          | 3.293                 | 0.013              | 31             | 52317.8951          | 2.713                 | 0.019              | 31             |
| 52259.9757          | 4.398                 | 0.048              | 31             | 52318.8986          | 2.639                 | 0.017              | 31             |
| 52260.9667          | 4.686                 | 0.067              | 31             | 52319.8931          | 2.591                 | 0.031              | 31             |
| 52261.9993          | 4.908                 | 0.094              | 31             | 52320.9243          | 2.647                 | 0.012              | 31             |
| 52262.9660          | 4.415                 | 0.034              | 31             | 52323.9382          | 2.887                 | 0.179              | 5              |
| 52266.9660          | 3.366                 | 0.022              | 31             | 52325.9062          | 2.738                 | 0.014              | 31             |
| 52267.9562          | 4.186                 | 0.043              | 31             | 52327.9569          | 2.659                 | 0.039              | 31             |
| 52270.9486          | 5.017                 | 0.119              | 31             | 52329.9188          | 2.866                 | 0.013              | 31             |
| 52276.9639          | 2.753                 | 0.021              | 29             | 52330.9021          | 2.852                 | 0.032              | 31             |
| 52277.9076          | 2.985                 | 0.010              | 31             | 52336.9167          | 2.802                 | 0.028              | 31             |
| 52279.0493          | 3.347                 | 0.159              | 6              | 52337.9062          | 2.732                 | 0.044              | 26             |
| 52282.9604          | 2.589                 | 0.011              | 31             | 52341.9042          | 2.718                 | 0.036              | 18             |
| 52286.9056          | 2.741                 | 0.012              | 31             | 52342.9590          | 2.817                 | 0.041              | 12             |
| 52291.9104          | 2.852                 | 0.042              | 31             | 52344.9076          | 2.875                 | 0.046              | 31             |
| 52293.8875          | 2.753                 | 0.012              | 31             | 52345.9132          | 2.770                 | 0.041              | 31             |
| 52296.8764          | 2.641                 | 0.013              | 31             | 52346.9090          | 2.672                 | 0.036              | 31             |
| 52297.8875          | 2.704                 | 0.027              | 31             | 52348.9111          | 2.800                 | 0.087              | 19             |
| 52298.8861          | 2.748                 | 0.017              | 31             | 52351.9181          | 2.728                 | 0.031              | 31             |
| 52301.9292          | 2.767                 | 0.026              | 31             | 52352.9146          | 2.619                 | 0.051              | 31             |
| 52302.9847          | 2.769                 | 0.038              | 31             | 52353.9153          | 2.829                 | 0.079              | 20             |
| 52303.8979          | 2.813                 | 0.021              | 31             | 52358.9181          | 2.121                 | 0.030              | 22             |
| 52304.9639          | 2.858                 | 0.024              | 31             |                     |                       |                    |                |

<sup>a</sup> JD−2400000.

<sup>b</sup> Relative magnitude to GSC 2811.1573.

<sup>c</sup> Standard error of nightly average.

<sup>d</sup> Number of frames.

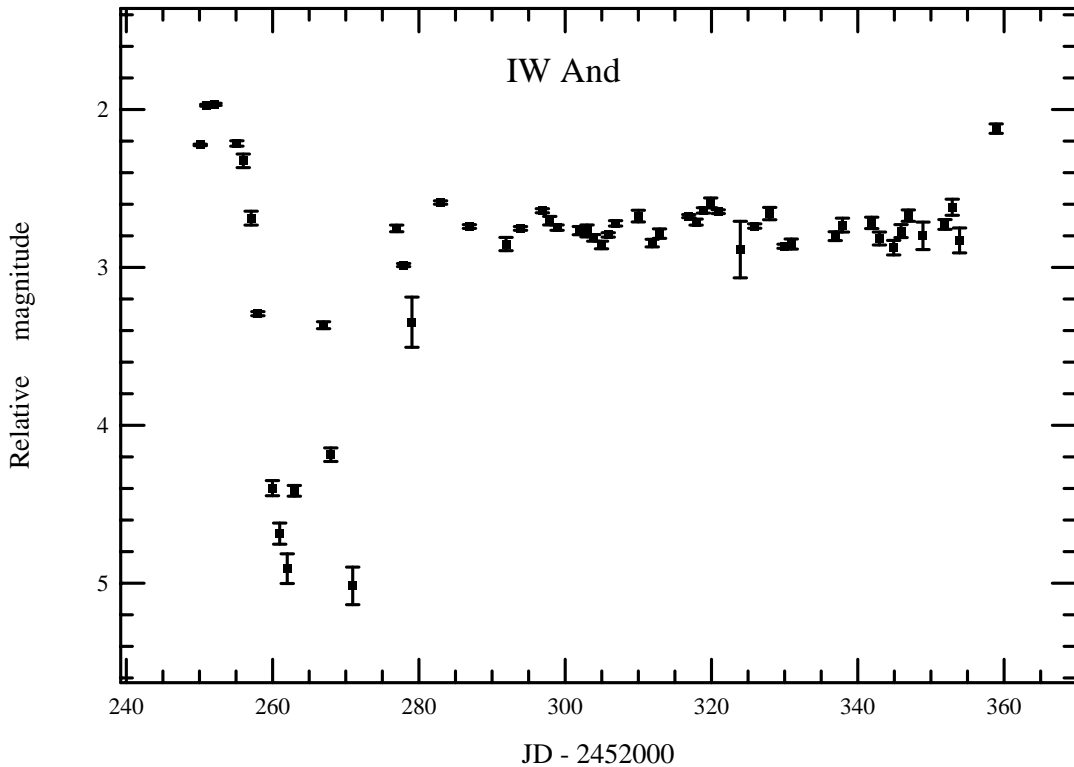


Figure 1. Light curve of IW And

unrecognized Z Cam-type dwarf nova. The “inactive” state described in Meinunger and Andronov (1987) must have been standstills.

Although determination of the actual duty cycle of standstills would require further continuous observations, we regard the 72% of observations being inactive state mentioned in Meinunger and Andronov (1987) to mean the percentage of the duty cycle of standstills in this star. Among Z Cam stars, the duty cycle (nearly 72%) of standstills is exceptionally high. Although Z Cam stars have long been understood as intermediate systems between dwarf novae and novalike (NL) systems (e.g. Meyer, Meyer-Hofmeister (1983)) in the framework of the disk-instability model (see Osaki (1996) for a review), there has been a wide gap between Z Cam stars and NL systems. IW And may be the first object to fill this gap. Since such an object is expected to provide strong observational constraints to the mechanism of Z Cam stars (Meyer and Meyer-Hofmeister 1983; Honeycutt et al. 1998; Buat-Ménard et al. 2001), further continuous observations to precisely determine the pattern of outbursts and standstills, and spectroscopic observations to determine system parameters (orbital period, component masses etc.) are strongly encouraged.

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