NSV 11749: Slow Nova or FU Ori Variable?

David B. Williams
P.O. Box 58, Whitestown, IN 46075

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Abstract Observations of NSV 11749 from Harvard photographic plates reveal that in 1899 this variable began to brighten gradually to 12th magnitude (blue), remained at maximum for four years, then gradually declined to 17th magnitude or fainter. The light curve alone is insufficient to determine whether this variable is a very slow nova, an FU Ori star, or possibly a unique type. Further photometry and especially spectroscopy are needed to classify this unusual variable.

1. Introduction

While determining accurate identifications for the many variables discovered by W. J. Luyten during the Bruce Proper Motion Survey in the 1930s (Williams 2000a), I have also continued to investigate some of the brighter Luyten discoveries on the Harvard patrol plates. This has revealed several interesting variables, such as the previously unrecognized dwarf nova V383 Vel (Williams 2000b).

The newest of these discoveries is NSV 11749, which Luyten marked as one of eleven variables in Bruce Region 994 (central Aquila) on a pair of plates exposed in 1903 and 1934. The variable was bright on the earlier plate and faint on the later plate. Luyten estimated the photoblue (ptg) magnitudes at approximately 13.5 and 17.

Based on this large magnitude difference, I assumed that NSV 11749 would prove to be another of the many Mira variables that crowd Luyten's discovery list. However, a preliminary examination of patrol plates showed that this variable was visible at about the same magnitude on all plates for several years in the early 1900s and invisible on all later plates.

2. Observations

I therefore observed NSV 11749 on all the useful Harvard plates, which cover much of the interval from 1888 to 1988. Comparison star magnitudes were adopted from the *USNO A2.0 Catalogue*. These magnitudes are only approximate and do not agree in every case with my estimates of magnitude differences on the Harvard plates. Magnitudes reported here must therefore be considered as only tentative measures of the variable's brightness. An accurate *B* photometric calibration of the field is needed.

Using a *Digital Sky Survey* printout from the POSS-I blue scan, I tentatively identified NSV 11749 with the 17th magnitude star USNO 0900-13949606,

R.A. $19^h\,07^m\,42.3^s$, Dec. +00° 02' 50.5" (2000). However, the Harvard plates on which the variable is clearly visible were exposed with short-focus instruments and do not show fainter surrounding stars. This identification is based on an eye estimate of the position relative to visible surrounding field stars and is not conclusive. Indeed, the variable may be one of several 19th magnitude stars very near this position or may be fainter than the POSS blue limit.

The light curve (Figure 1) is based on 175 plates. The variable is invisible on all the earliest plates, 1888–1896, which only reach 12-13 ptg. A rare deep plate shows the variable fainter than 15.5 ptg on 1897.6. It was first visible, at about 14.0 ptg, on 1899.5 and reached maximum, 12.5 ptg, on 1903.4. The variable remained near maximum for four years, until 1907.6, declined to around 14.5 ptg by 1911.6, and then fell below the limit of the available plates. Four faint images near 17.0 ptg were found between 1934.7 and 1949.5, but the variable was invisible on all other plates, 1912–1988.

It may be worth noting that three "fainter than" observations were recorded between positive estimates during the declining phase of the eruption, which could indicate that the decline was not smooth.

3. Analysis

From this photometric behavior, it is difficult to decide whether NSV 11749 is a slow nova or an FU Ori type variable. During the interval when NSV 11749 was visible on the Harvard plates, it took four years to brighten from 14th to 12th magnitude, remained near maximum for four years, then declined to 14th magnitude in another four years. Its total amplitude is at least 12.5–17.0 ptg but may be greater if the quiescent object is actually fainter than the identified USNO star.

A typical slow nova, HR Del (Nova Del 1967), rose rapidly from 12th to 5th magnitude, remained near maximum for 300 days with variations, and then entered into a long, slow decline back to 12th magnitude.

FU Ori variables are pre-main sequence stars that rise dramatically in brightness over a period of months and then remain bright for many years. FU Ori itself rose from 16.5 to 9.5 magnitude in 60 days and has remained only slightly fainter than maximum for 70 years. V1057 Cyg rose from 15th to 10th magnitude in 430 days, remained near maximum for 1000 days, then slowly declined over several decades to its current 13th magnitude.

4. Conclusions

NSV 11749 brightened too slowly to match the typical behavior of a slow nova, and then declined back to minimum too rapidly and too completely for an FU Ori star. New observations are needed to determine the exact nature of this enigmatic variable. CCD observations can provide comparison star magnitudes, test for small-amplitude variability, and measure color indexes. Spectroscopy can

provide a spectral type and reveal features such as emission lines that can help to classify this variable.

5. Acknowledgements

I am grateful to Gary Billings, who prepared the light curve, and to Harvard College Observatory and plate curator Alison Doane for extensive use of the observatory's enormous and invaluable plate collection. I would also like to express my appreciation for the fact that the late W. J. Luyten, an AAVSO charter member as well as a distinguished astronomer, took the time to mark more than 1,700 variable stars on the plate pairs he compared during his search for high proper-motion stars, even though he lacked the time and funding to investigate these variables.

References

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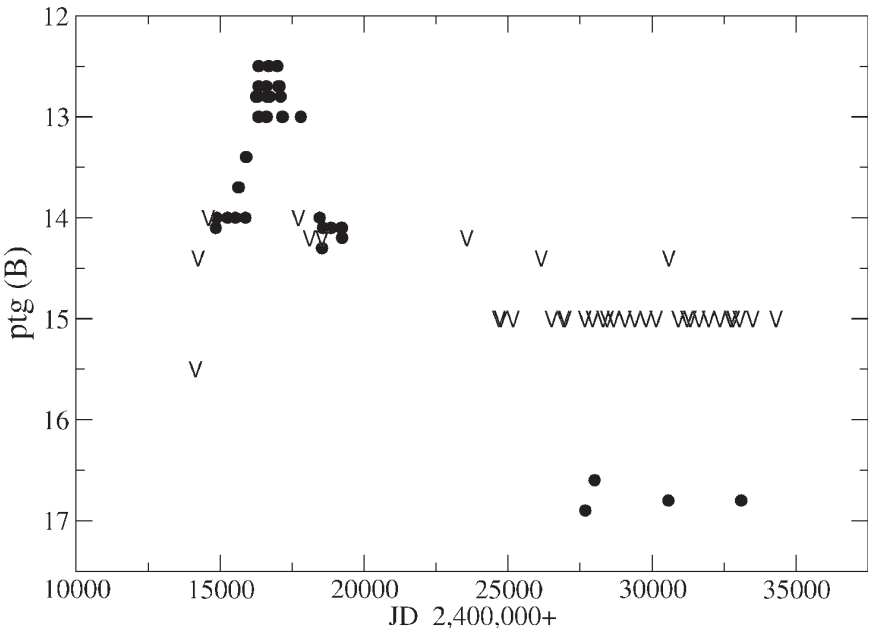

Figure 1. Observations of NSV 11749, 1897–1952. Due to the compressed time scale (5000 days = 13.7 years), duplicate observations separated by a few days have been omitted. The figure does not include the entirely negative observations for 1888–1896 and 1964–1989 (see text for magnitude upper limits). No Harvard plates exist for 1953–1963.