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PHOTOMETRY OF STARS NEAR WZ Sge

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The dwarf nova WZ Sge goes into outburst every few decades, and erupted again during July 2001. This star has been extensively studied during outburst and quiescence. However, few reports that present calibrated magnitudes for nearby stars that can be used as comparison stars have been given. Krzeminski and Kraft (1964, KK) list the *UBV* magnitudes for three nearby stars. Those magnitudes have been adopted by most other researchers.

In addition, WZ Sge has a close, red companion. In the 1960's, this companion was only 7'' west of the variable and made measurement of the variable itself during quiescence quite difficult. The proper motion of WZ Sge (Luyten 1969) has moved the dwarf nova further to the east, increasing the separation of the two stars to the current value of 10''.9. With CCD detectors, this separation is easily resolved if the seeing is relatively good and the pixel scale is such that several pixels fall between the two centroids. However, this pixel scale is not always available for amateur telescopes, and using unfiltered photometry, the light from the close companion starts to dominate once WZ Sge is fainter than about $V = 12$.

We have remeasured the KK comparison stars, along with many other fainter stars, to extend the wavelength range of the calibration to Cousins *R* and *I* and to provide an independent check on the KK published values at *UBV*. We have found some discrepancies and are presenting the new values in a timely fashion ahead of measures of WZ Sge itself in the hopes of providing improved calibration for other observers.

The 1.5-m telescope at CTIO, along with an RCA 31034A photomultiplier tube, 14'' aperture and the same filters as discussed in Landolt (1992) were used to calibrate four bright comparison stars. A large number of standard stars, careful extinction determination, and the application of nonlinear transformation coefficients were used to obtain two measures of each star on three separate nights. These stars, along with WZ Sge and the close companion, are shown in Figure 1. The photometric measures of all comparison stars are given in Table 1, where the error in the last digit(s) is indicated in parenthesis.

The 1.0-m telescope at the USNO, Flagstaff Station was used with a SITe/Tektronix 1024×1024 CCD and *UBVR_cI_c* filters to independently measure the four main comparison stars, along with many fainter stars. Data was taken on four mostly photometric nights. These measures are given in Henden (2001). A fainter extension, but only in *B* and *V* filters, is given in Henden and Honeycutt (1997). In addition, psf-fitting was performed on two nights during the recent outburst to obtain good magnitudes and positions of WZ

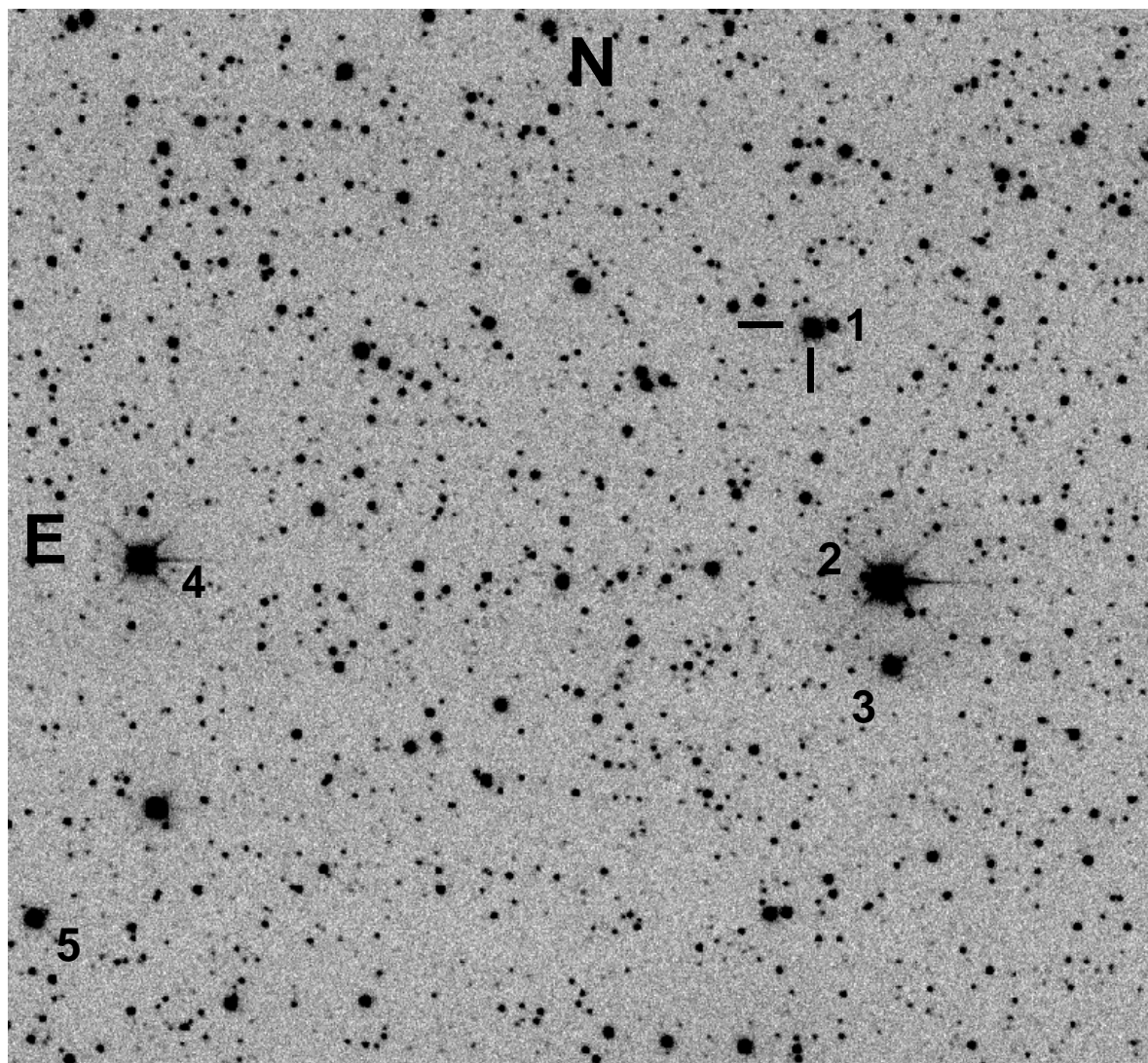


Figure 1. Combined outburst NOFS CCD *V* image of field. The field of view is $10' \times 10'$

Sge and of its close companion. The magnitude and colors of the companion, along with representative magnitude and colors of WZ Sge in outburst, are also given in Table 1. The photometric errors for the companion are largely due to the short exposure times used and the faintness of the companion with respect to WZ Sge at blue wavelengths. The measured positions for all stars are from the CCD images, are relative to USNO-A2.0, and have internal errors of 100 mas.

Table 1: Coordinates and Magnitudes

ID/KK	RA(J2000)	Dec(J2000)	V	$B - V$	$U - B$	$V - R$	$R - I$
WZ Sge	20 ^h 07 ^m 36 ^s .53	+17° 42' 15".2	8.646(5)	-0.078(5)	-0.781(5)	0.016(5)	0.020(5)
1	20 ^h 07 ^m 35 ^s .77	+17° 42' 17".1	13.888(18)	1.514(24)	1.587(68)	0.802(9)	0.687(8)
2/C	20 ^h 07 ^m 33 ^s .74	+17° 40' 00".6	8.737(5)	0.168(4)	0.136(6)	0.075(2)	0.078(3)
3	20 ^h 07 ^m 33 ^s .56	+17° 39' 16".1	11.755(5)	0.192(6)	0.150(5)	0.088(3)	0.113(7)
4/A	20 ^h 08 ^m 01 ^s .45	+17° 40' 11".2	9.686(5)	1.012(2)	0.780(7)	0.531(3)	0.488(4)
5/B	20 ^h 08 ^m 05 ^s .42	+17° 37' 01".7	11.770(3)	0.393(5)	0.207(7)	0.215(3)	0.210(5)

The colors for KK stars A, B, C agree between these new measures and the published values. However, the V magnitude differs in the sense that KK is always fainter than the new magnitudes, ranging from 0^m.02 for star C to 0^m.07 for star B.

As reported by KK, the companion was measured on one night by Olin Eggen on the 5-m Hale telescope. Its measured values were $V = 14.27$, $B - V = 1.49$, $U - B = 1.45$. These values differ considerably from the values shown in Table 1. Either the comparison star is variable, or the method used to separate WZ Sge and its companion with the photoelectric photometer on the 5-m telescope did not split the two stars cleanly.

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