

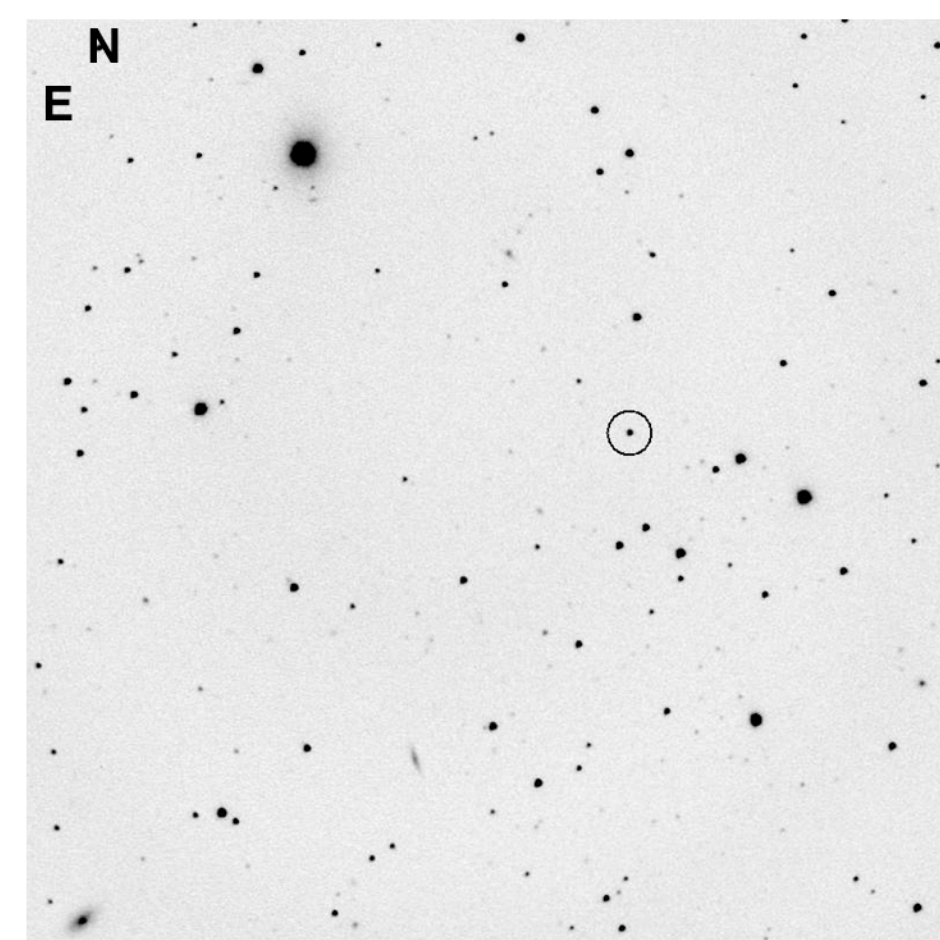
BZ UMa & Var Her 04: Orphan TOADS



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Both BZ UMa and Var Her 04 are cataclysmic variable stars without a home. Neither fit easily into current classification systems so may extend the population distribution of two unique CV types: UGWZ dwarf novae and intermediate polars. New outburst photometry and archival X-Ray data shed some new light on BZ UMa's high energy state and new spectral and IR observations from Spitzer of dust around the newly discovered cataclysmic variable Var Her 04 may help find it a home as well.

BZ UMa



Unfiltered image is by AAVSO observer Bruce Gary (15x15)

Vital statistics:

- * Discovered by Markarian (1968)
- * Orb: 0.0679 days, (Ringwald et al., 1994)
- * $q = 0.20$, (Jurcevic et al., 1994)
- * Secondary: M5.5 +/- 0.5V (Ringwald et al., 1994)
- * Circular DC polarisation: 0.077 +/- 0.17% (null result by Liebert & Stockman, 1980)
- * Cycle: 313d
- * Range: 11.3 - 16V

AAVSO Observations

Intensive CCD campaigns were conducted by the AAVSO for both the 2004 and 2005 outbursts. Data sets were assigned the same zeropoint by separately detrending each data set from each observer on each night. An intensive two-day, multilongitudinal quiescence observing campaign was conducted in April, 2004 in order to look for any short periods formed as a result of beat frequencies between the orbital and spin periods. None were found. Analysis was done using Date Compensated Discrete Fourier Transforms with the CLEANEST algorithm (Foster 1995) and searches for QPOs were done using visual inspection of the power spectrum along with WWZ wavelet analysis (Foster 1996).

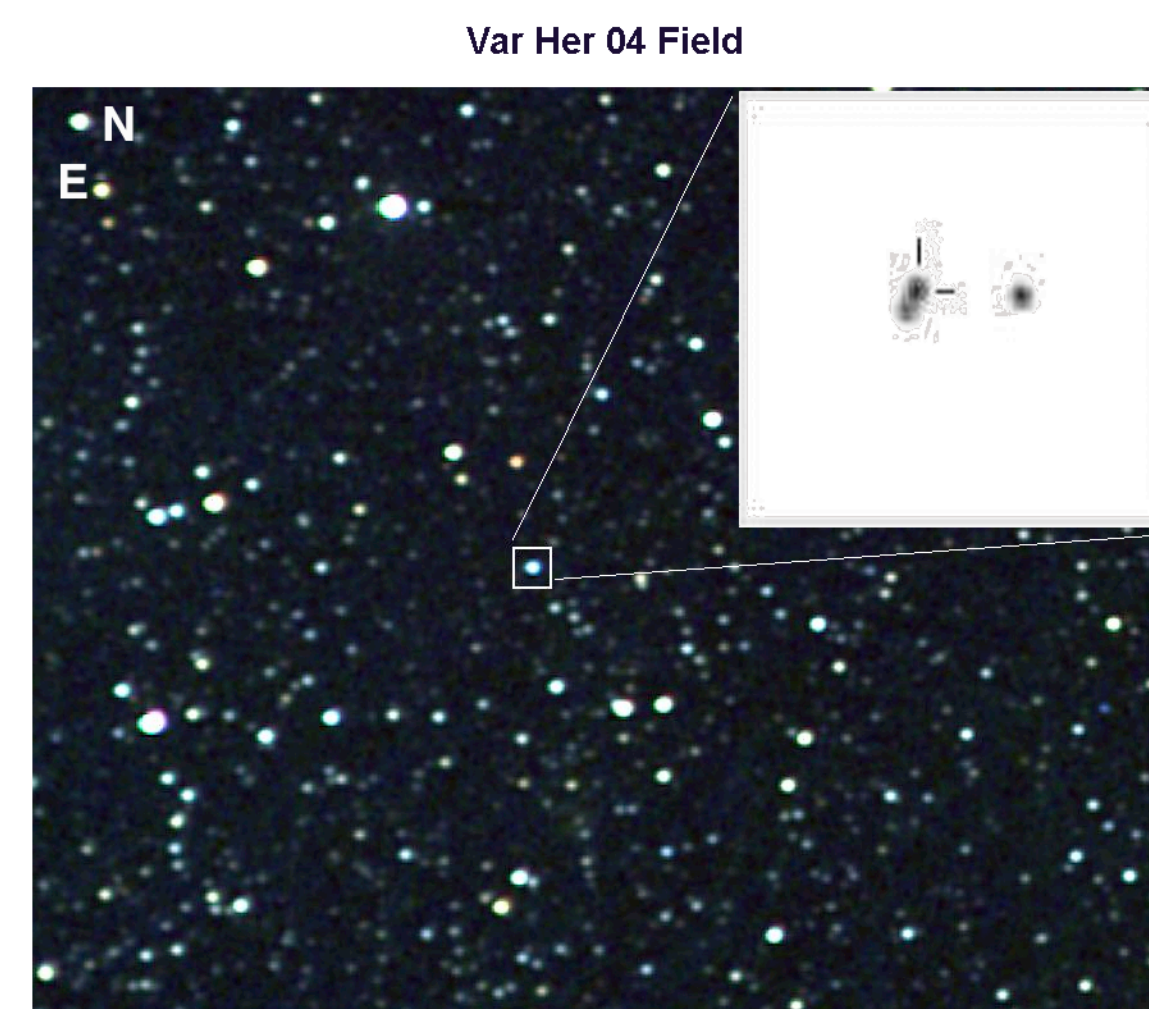
Vital Statistics

- * Discovered by Yuji Nakamura, Kameyama, Mie-ken, Japan on June 13, 632 2004 (UT)
- * Orb = 81.8 minutes
- * Superhump period = 83.2 minutes
- * $q=0.072$ ($M2 \approx 0.05M_{\text{sun}}$)
- * Distance: ~174pc
- * Weak ROSAT X-Ray source: 0.07 ct/s +/- 0.01 (1RXS J183927.1+260409)
- * An unassociated, faint G class field star exists 1" away
- * Not yet assigned a name by GCVS

Var Her 04

What's Cool & Mysterious About Var Her 04

- * One of the shortest period CVs known
- * In typical TOAD systems, the disc should hide the secondary, yet we see features of both in the spectra
- * What does the presence of the Spitzer-detected dust mean?
- * Why is the red secondary so bright (est. $V=16.9; M=12$)
- * Why has the supercycle period increased so much in the last 80 years?



BVR image is by Bruce Gary (17x14"). Closeup is from Price (2004) with the University of Hawaii 2.2m (10x10"). Var Her 04 is separated from companion by 1".

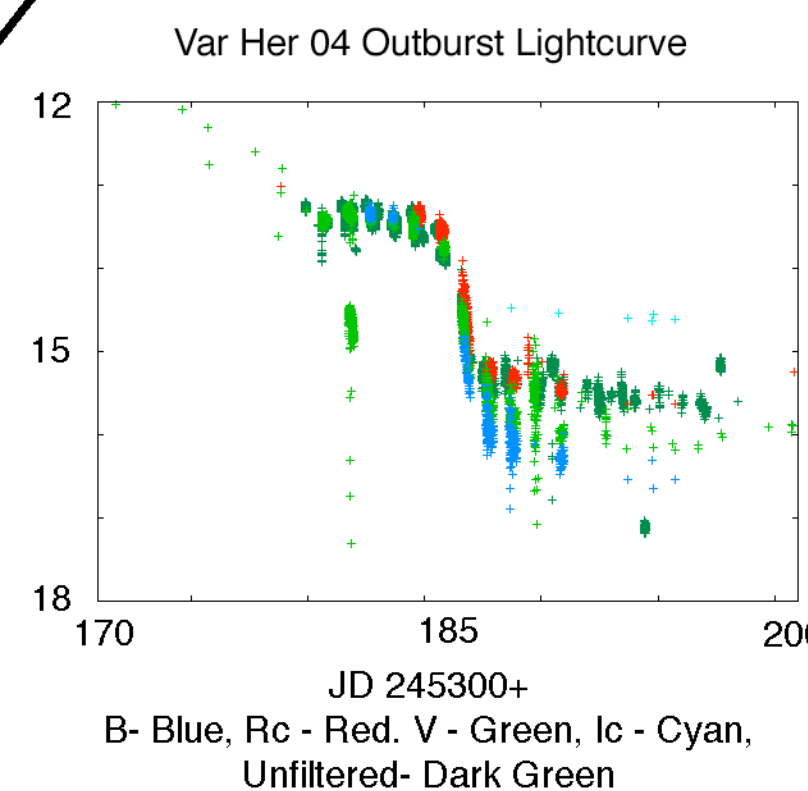
Optical Observations

Var Her 04's outburst mimicked that of a UGWZ except without any echo outbursts. Superhumps were quickly observed and followed through the outburst. The announcement of the nova came a week after its discovery. Thus we cannot test for early orbital humps which are characteristic of UGWZ dwarf novae.

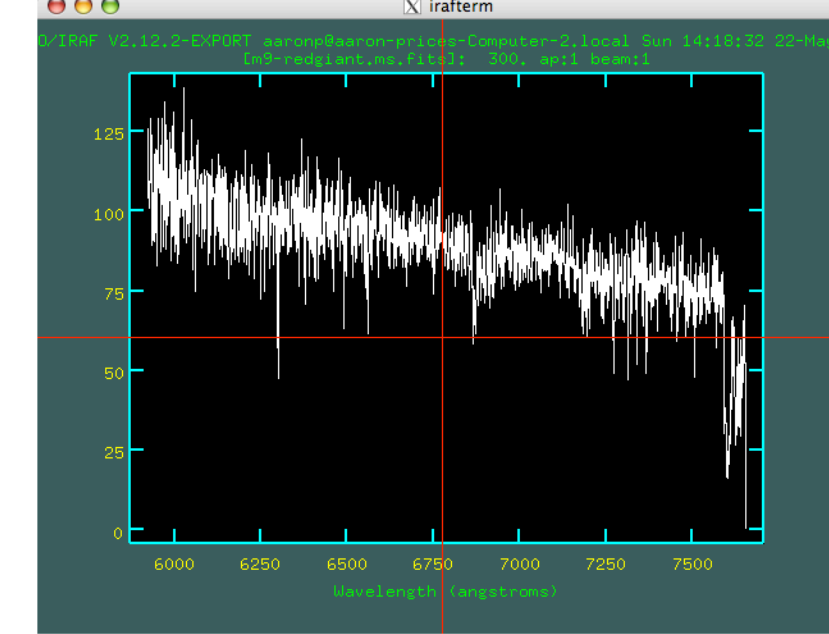
Short quiescent campaigns were conducted in the spring of 2005. These campaigns were designed for simultaneous observations in B and Ic. At the time we thought variation in Ic was from the field companion but in fact it originates from the secondary. A total of 465 Ic observations and 184 B observations were obtained.

Spitzer Observations of Dust

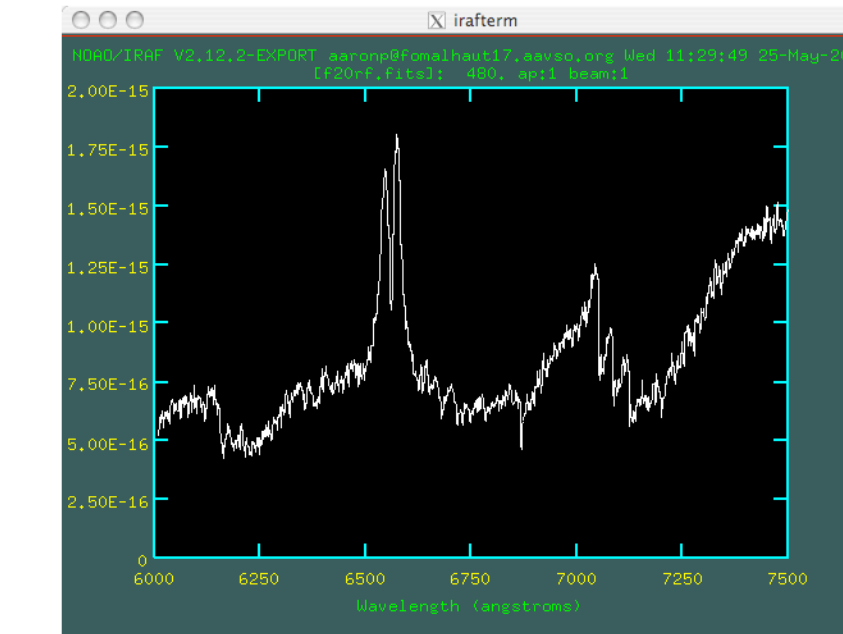
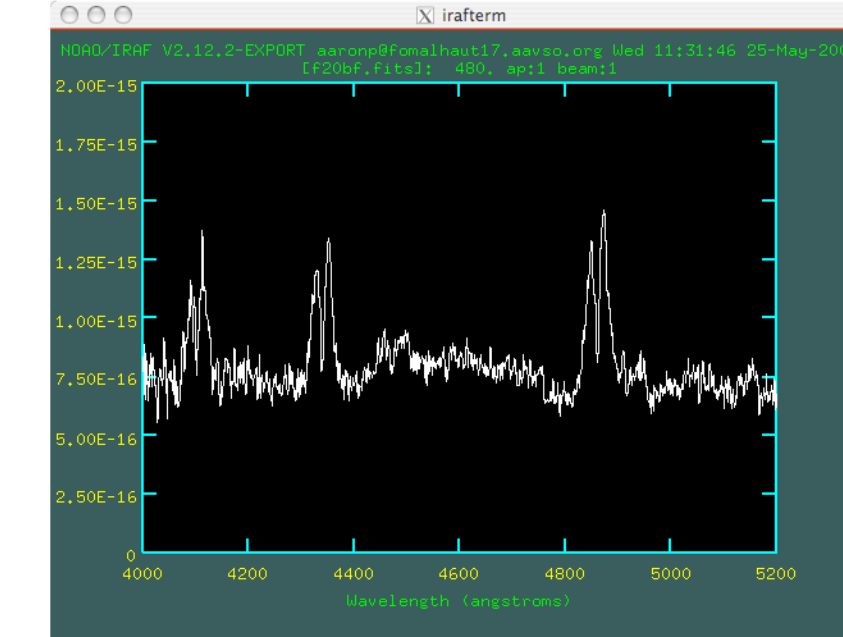
In three observations in late 2004, Ciardi et al. (2005) detected a change in the 24 μ m flux in 1 of 3 MIPS observations and suggested it could be dust formation in the system reminiscent of that generated by classical novae. Their final Spitzer observation, scheduled for April, 2005, was postponed because of a Spitzer safe mode. It would have been very helpful in confirming the change in flux. Ciardi and Howell are working to reschedule this fourth observation for later in 2005. Meanwhile, AAVSO observers will hold vigil on the CV in V and Ic.



JD 2453300+
B- Blue, Rc - Red, V - Green, Ic - Cyan, Unfiltered- Dark Green



Spectra of G companion to Var Her 04



Preliminary Var Her 04 spectra (blue top, red bottom) showing a high inclination, optically-thin CV with some disc emission over a prominent M3 secondary. Observations by Paula Szkody with APO. Quick radial velocity measurements give an orbital period of 80.8 mins. Further reduction and more thorough radial velocity measurements are in progress.

All AAVSO Data For Both Stars Is Available Online At:
<http://www.aavso.org/data/>

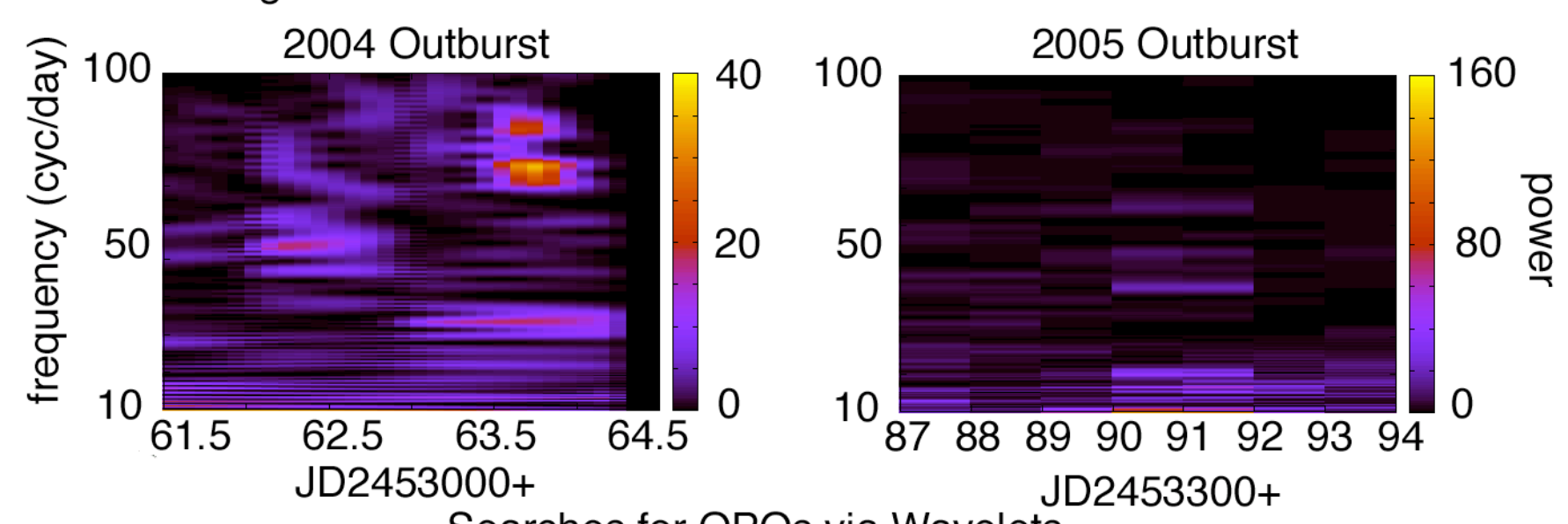
BZ UMa Spectra From the Literature
Balmer emission and N(V)/C(IV) emission flux ratios are unusually strong. (Gansicke 2004) Gansicke et al. suggest the system may be accreting CNO material from a star that has lost its envelope to thermal time-scale mass transfer (TTMT). Similar abnormal N(V)/C(IV) lines have been found in the IP TX Col. Neustroev et al. (2004) have detected five different peaks in the H α emission line. Their related Doppler maps point to spots in the accretion disc far from the hot spot. The broad lines with multiple, shallow peaks suggest a high inclination system with structure in the accretion disc. The presence of Balmer lines along with He I and Ca emission lines suggest the presence of a dominant accretion disc.

BZ UMa as UGSU

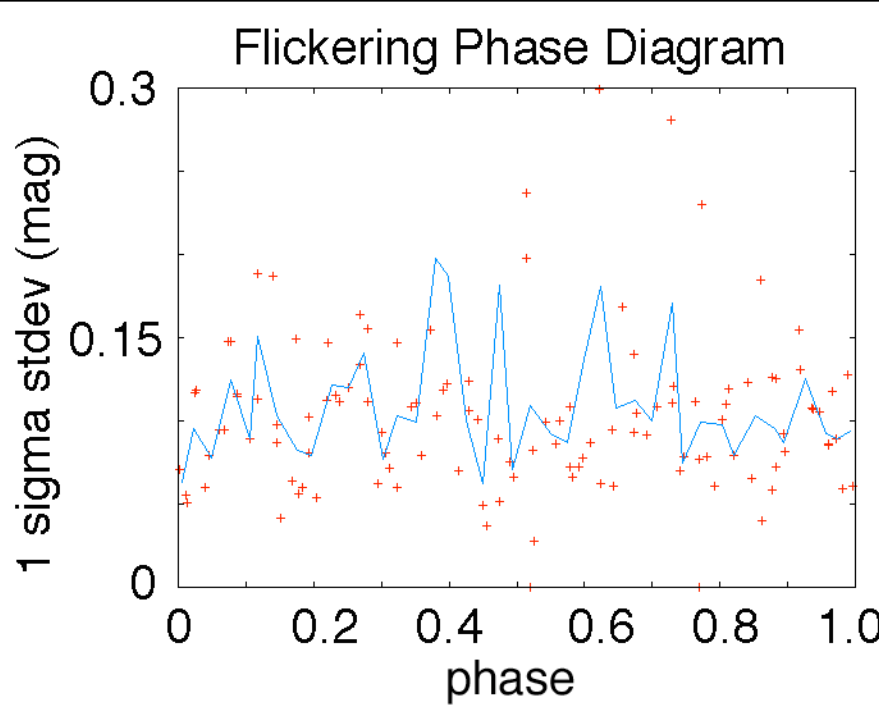
BZ UMa is classified as a UGSU according to the General Catalog of Variable Stars (GCVS). (Samus 2003) It's orbital period, mass ratio, outburst amplitude and recent outburst cycle length all fall into the UGSU category. However, a superoutburst with superhumps has yet to be detected despite good coverage of three outbursts, including intensive multilongitudinal coverage of the last two outbursts in 2004 and 2005. Also, archival visual observations do not detect any outburst between 1976 and 1992. Visual monitoring was consistent during this time and should have detected any outburst of similar brightness and length to the other detected outbursts.

BZ UMa as an Intermediate Polar (IP)

BZ UMa is a bright X-Ray source in the ROSAT catalog (0.41 +/- 0.04 cts/s^-1). In the 1999 outburst Kato detected quasisperiodic oscillations (QPOs) of ~39m. (Kato 1999) AAVSO observations of the February, 2004 outburst uncovered a QPO of around 18 minutes. During a follow up quiescent campaign in April, 2004 a QPO of 39m was detected. No QPOs were detected in the January, 2005 outburst despite having the best CCD coverage of all the campaigns (perhaps earlier detections were aliases caused by incomplete coverage). A rigorous statistical analysis of possible QPO behavior is underway. Peculiarities in the BZ UMa spectra match those of the IP TV Col. However, Liebert & Stockman (1980) measured a mean "DC" circular polarization of around 0.077 +/- 0.17% indicating a null result.



Searches for QPOs via Wavelets



Flickering

The system exhibits significant, high amplitude flaring that is not phased with the orbital period suggesting it is not associated with any particular location on the accretion disc. It also does not diminish during outburst (as expected in UGSUs) and shows up as significant red noise in the power spectra.

HELP NEEDED!

We need X-Ray observations of BZ UMa to detect the white dwarf spin period. Also, simultaneous optical observations and time series spectra could correlate QPOs with changes in the H α emission line peaks. Any ideas, hints or observations will be welcome and earn you lots of favors from the AAVSO. This is a neat system, help us figure it out!

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Some equipment used in this campaign was funded by a grant from the Curry Foundation and analysis done with software developed with support from the AAS Small Research Grant program.

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Archival Data

The blue RH series patrol plates at the Harvard College Observatory Plate Stacks* were inspected for previous outbursts on plates dating from 1929- 1950. Four outbursts were detected and one more possible outburst was detected at the plate limit (Table 1). The All Sky Automated Survey (ASAS-3) does not detect the star during almost nightly observations from March 30.4 2003 to June 6.3 2004 (UT). A search through the orphan files in the NSVS database revealed no detected outbursts from April 5.5 1999 to March 23.5 2000. (Wozniak et al. 2004)

Table 1. Archival Outbursts 1929 - 1950.

Date	Observer
Apr. 21, 1932	
Oct. 17, 1934	
Aug. 6, 1939	
Aug. 3, 1940	
Aug. 2, 1941	

We also would like to thank P. Szkody and M. Templeton for help with the poster and A. Doane for access to the HCO Plate Stacks.

*Plate stack info and online catalog are available at: <http://tdc-www.harvard.edu/plates/>