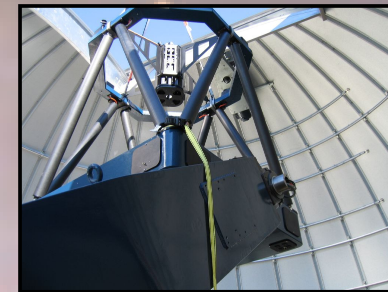
PHOTOMETRIC INVESTIGATION OF ECLIPSING BINARY STAR BX DRACONIS (BX DRA)

Shaukat Goderya & Teresa Sykes

Tarleton State University, Stephenville, Texas

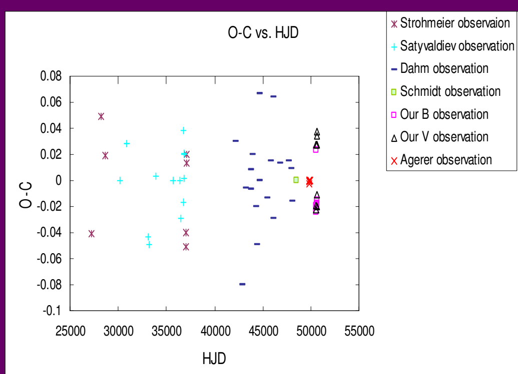


Observations and Period Analysis

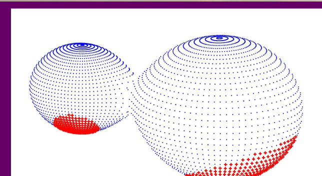
The data for BX Dra was collected Jerry Gunn and Brian Hakes using the Jubilee Observatory near Peoria, and the Mead LX 2000 Hanna City Robotic Telescope and CCD photometer at Hanna City, Illinois. BX Dra was observed with B and V bandpass filters on 9 nights in 1997.

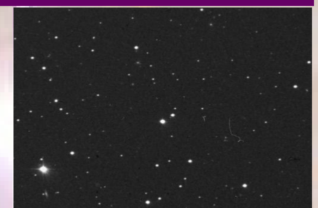
1. Period determination
   a) Published elements (IBVS No. 4266)
      Min (I) = HJD 2449810.5924(±1) + $0^d.57902552 \times E(\pm 6)$
      Min (I) = HJD 2449810.5924(±1) + $0^d.5790282 \times E(\pm 12) + 5.56 \times 10^{-10} \times E^2$
   b) Derived 15 new minima in B and V band-pass.
   c) The revised epoch and period through generalized linear least squares program.
      Min (I) = HJD2449810.4843 (±1) + $0^d.57909704 (\pm 5)E$
   d) O-C for all the available minima and our data is shown below.
   e) Period variation is inconclusive with present data.

Gunn, Jerry B. 1997, Sky & Telescope



BX Draconis


From Binary Maker


From: SMIBAD and ALADIN

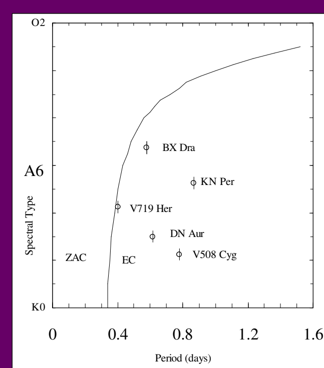
Star	G.S.C No.	B	V	B-V	α (2000)	δ (2000)
BX Dra	4192.0448	10.98	10.80	0.18	16 06 17.4	+62 45 46.1
C1	4192.0540	9.25	8.81	0.44	16 07 08.9	+62 43 19.5
C2	4192.0488	12.30	11.50	0.70	16 07 42.5	+62 49 35.4

Why Study BX Dra?

Bx Dra is one of the poorly studied eclipsing binary system. No photometric solutions can be found in literature.

The period spectral type diagram (Leung & Schneider) can identify zero age contact (ZAC) and evolved contact (EC) systems. Close systems show case A type mass loss (mass loss during core hydrogen burning). Wider systems can have case B type mass loss (mass lose during shell hydrogen burning).

Leung, K. C. & Schneider D. P. 1978, ApJ, 222, 917



Photometric Data Analysis

Light curve modeling was done with the 1993 version of the Wilson-Devinney Model.

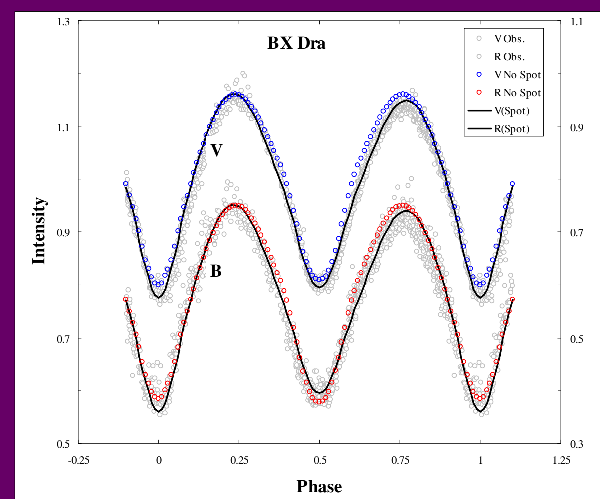
Parameter	No Spot	Dark Spot
$q(m_2/m_1)$	0.2483±0.0025	0.3292±0.0036
$L_1/(L_1+L_2)$ (4000È)	0.7547±0.0517	0.8442±0.0606
$L_1/(L_1+L_2)$ (7000È)	0.7615±0.0472	0.8050±0.0469
i	76°.05±0.44	74°.37±0.24
$\Omega_1=\Omega_2$	2.2895±0.0046	2.4517±0.0049
Ω(in)**	2.3483	2.2595
Ω(out)**	2.1918	2.3256
f(% of overflow)	37.54%	38.15%
$A_1=A^*_2$	0.90	0.90
$x_1=x^*_2$(4000È)	0.8	0.8
$x_1=x^*_2$(7000È)	0.8	0.8
$g_1=g^*_{2*}$	0.90	0.90
T_1K	9200*	9200*
T_2K	9428±0.0045	7782±0.0050
$\Sigma(wr^2)$	0.2119	0.1534

* Not Adjusted ** Theoretical values

	Cool Spot	Cool Spot
Location	Star 1	Star2
Co latitude*	155 °	140 °
Longitude*	180 °	285 °
Angular Radius*	50	30
Temp. Factor*	0.4	0.5

Results

Spot model shows a better fit to the observed light curve. Bx Dra is a WUMa type system with type A (transit during primary eclipse) light curve and possibly mass loss during core hydrogen burning (case A). Luminosity of the system shows that it may be a single line spectroscopic binary.



Ongoing Work

Recent advances in information technology and space based astronomy has lead to a dramatic increase in our ability to acquire astronomical data. Ground based surveys (ROTSE) and space missions (COROT, KEPLER, GAIA etc.) are already underway or being planed to search for terrestrial planets in our galaxy as well as the local neighborhood of galaxies. These programs directly benefit the field of Eclipsing Binary Stars. It is expected, the number of known eclipsing binary stars from various surveys will increase the database from 10,000 to over 8 million. Artificial intelligence based investigative tools will be needed, to mine and harness such an ever increasing database for new information of astrophysical value. A research program has been started to develop an automated tool, to search and identify contact binary stars from various existing survey photometry data. To asses the effectiveness of the tool a small subset of these systems will be selected for detail photometric observations with the 32 inch remotely controlled telescope at Tarleton State University.

Acknowledgement: The funding for this project is provided by Tarleton State University