

# A Spectral and Lightcurve Study of 50+ Blue Stars from the Burrell-Optical –Kepler-Survey (BOKS)

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## ABSTRACT

BOKS used the 0.6m Burrell-Schmidt telescope over a period of 40 nights and identified 54, 687 stars between  $14 < r < 19$  in the Kepler Mission's field of view. Its primary goal was to detect Jupiter-sized and Hot Jupiter (Period = 3 – 9 days) short-period exoplanets within the survey field as well as to compile high precision stellar variability data that the Kepler Mission can use for comparison purposes and to characterize the hundreds of other variable stars within the survey region.

We present the spectral classifications and light curve analysis of a subsample of 50+ blue stars within the BOKS field of view using BOKS lightcurve data and spectra from the Kitt Peak 2.1 meter telescope. The purpose of this study is to identify the variability of and provide characterization for the blue star population within the BOKS field.

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## BOKS AND KEPLER

The Burrell-Optical-Kepler-Survey (BOKS) is a moderate-field (1.65 x 0.825 degrees), moderate-aperture transit-survey with brighter limiting magnitude compared to large aperture transit-surveys such as EXPLORE/OC, but it can see deeper than the small-aperture transit surveys (BEST, HAT, KELT, Super-Wasp).

The full BOKS dataset was obtained using the 0.6 m Burrell-Schmidt telescope over a period of 40 nights, containing 54, 687 stars between  $14 < r < 19$  in the Kepler Mission's field of view (shown relative to Kepler's Field of View in the image below).

Its primary goal is to detect very hot Jupiter-sized (Period = 1 – 3 days) and Hot Jupiter (Period = 3 – 9 days) exoplanets within the survey field as well as other transit surveys, to compile high precision stellar variability data that the Kepler Mission can use for comparison purposes and to characterize the hundreds of other variable stars within the survey region.

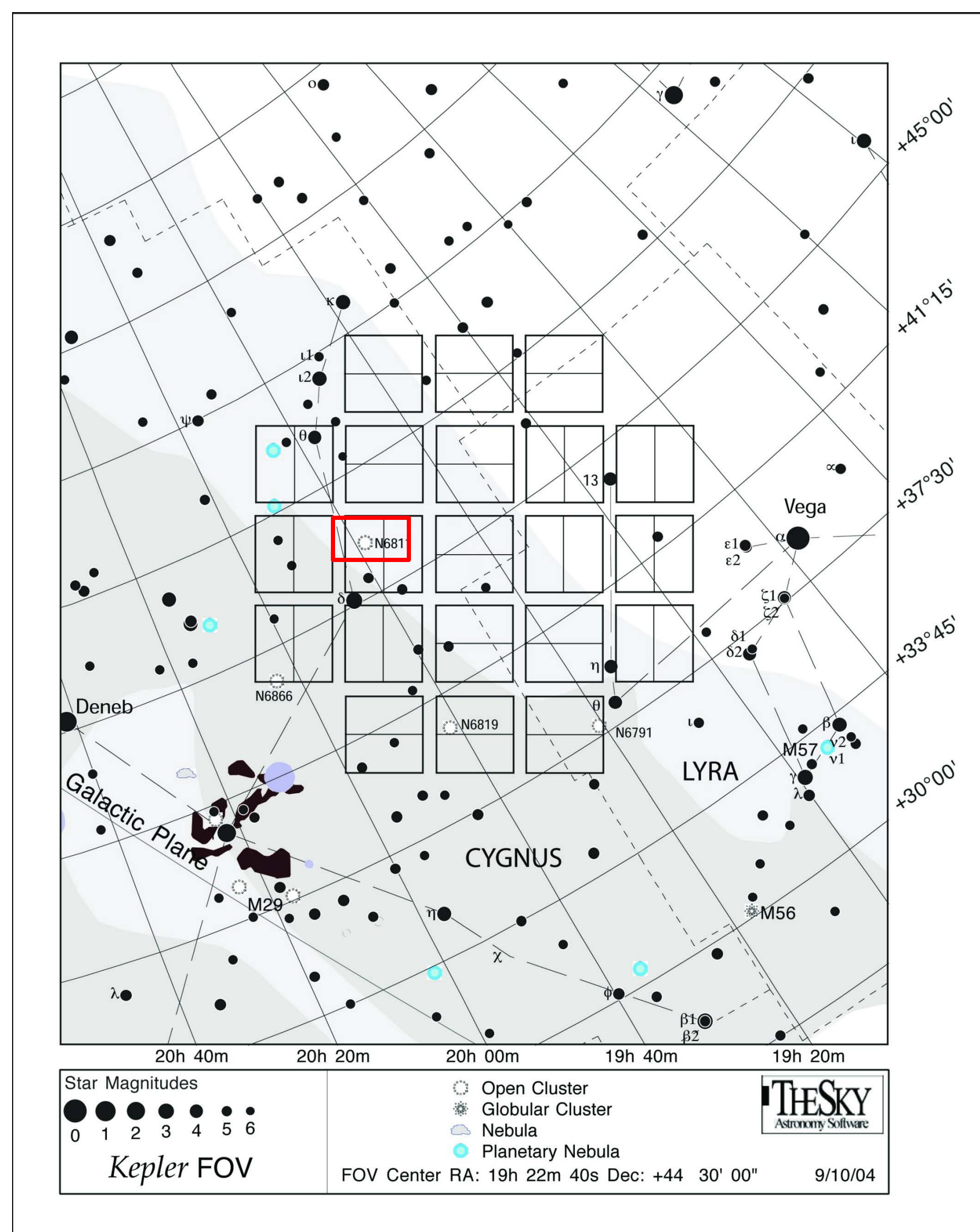


FIGURE 1: The BOKS FOV (red) superimposed on the Kepler FOV [http://keplergo.arc.nasa.gov/images/program/Kepler\\_FOV\\_hiRes.jpg](http://keplergo.arc.nasa.gov/images/program/Kepler_FOV_hiRes.jpg)

## DATA SETS

- To date 54 stellar light curves have been acquired
- This work concentrated on 28 of the 54 stars that had 5 consecutive nights of excellent photometric data. They are shown in red in the table below
- Spectra for 20 of those 54 stars have been acquired and examined
- Only one of the 20 stars with spectra was also in the subset of 28
- In the subset of 28, 5 are considered possible variables – see Results section

TABLE 1

BOKS ID	KIC7 ID	r MAGNITUDE	SPECTRAL TYPE
302 ‡	10024658	10.047	A
2981 ‡	11279061	11.633	A
4433 ‡	9711261	7.646	A
5484 ‡	9711402	13.195	B
9256 ‡	10149310	15.149	-
12119	11670108	18.019	-
13521	11606237	18.023	-
14976	11214502	19.114	-
17311	10088811	10.062	B
17503	9964671	8.336	B
19631 ‡	9964942	13.115	B
20682	11150950	18.889	-
22071	9776399	12.312	A
27413 ‡	11542921	18.792	-
27418	10151476	14.086	B
27425	11411638	17.535	-
28239	11476964	18.512	-
28303	10151590	18.427	-
29275	11608270	19.435	-
29526	11672342	19.061	-
29641	11672362	19.232	-
30071	10151797	10.994	B
31168	11608697	19.525	-
31851	11672728	19.675	-
32170	11478033	19.366	-
32349	11672803	19.502	-
32809	11478354	18.915	-
33151	11672948	16.56	K
33652	11478577	18.709	-
34009	11609352	18.946	-
34856 ‡	9777965	10.973	A
34969	9966723	18.653	-
35354 ‡	9715034	12.459	B
36167 ‡	11544953	16.882	-
36960 ‡	9715226	11.963	-
37344	11545150	19.642	-
38791	9967164	17.854	-
38928	9715416	17.153	-
39040	9841842	16.021	-
38979	11610327	19.555	-
39264 ‡	11545658	10.832	B
41348	9967438	12.491	B
43929	9715959	16.019	B
43917 ‡	10029743	9.797	-
44980	11284119	17.454	-
45533	10153528	17.096	-
46418	11218411	18.462	-
46620	9968057	17.117	-
48270	9968234	14.463	-
48476	9968276	14.512	B
49669	10154022	10.046	B
50114	9968451	14.958	B
50286 ‡	10092606	12.021	A
53856	11285203	17.412	-

TABLE 1 Footnotes:

- RED – These stars (28 total) had five consecutive nights of excellent photometry
- BLACK – Stars with fewer than 5 consecutive nights of excellent photometry and were not considered here
- ‡ - These stars (14 total) were saturated and were not considered here

## RESULTS

Tools Used:

- IRAF (for spectral reduction and analysis)
- GNUC++ (to analyze light curve data)
- GNUPLOT (to plot light curve data)

The preliminary results shown below are those of variable star candidates whose periods are in the process of being determined. To date only one of them, BOK 27418, has both a spectrum and 5 consecutive nights of excellent photometry.

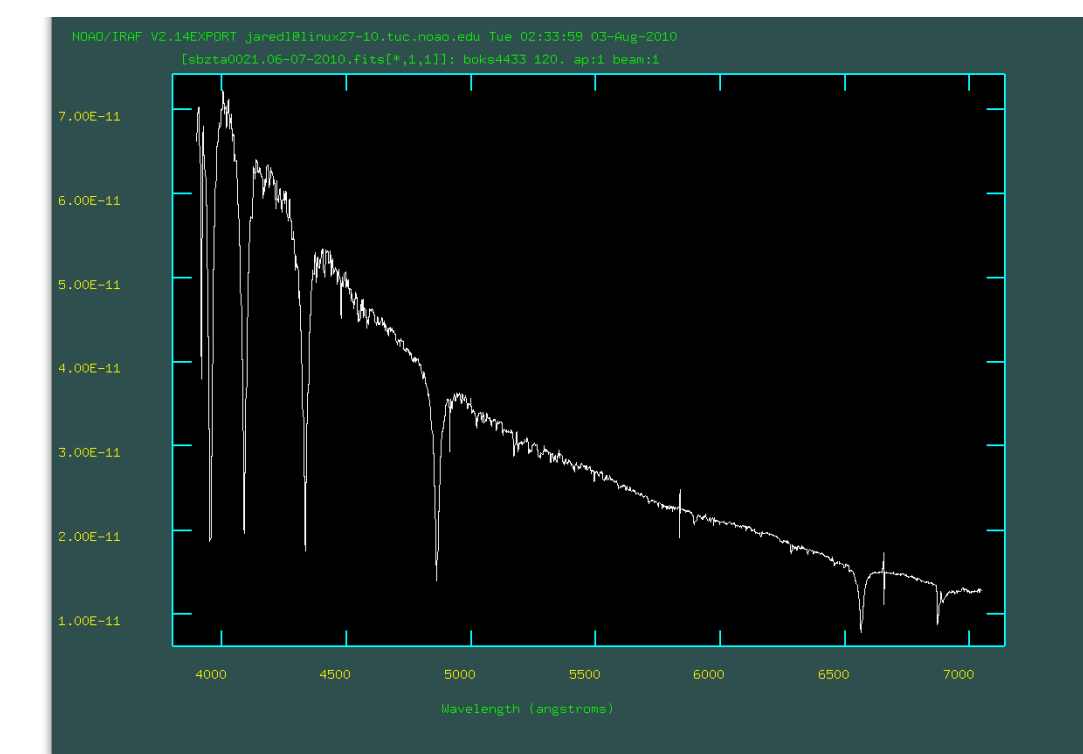


FIGURE 2: A STAR FROM THIS STUDY

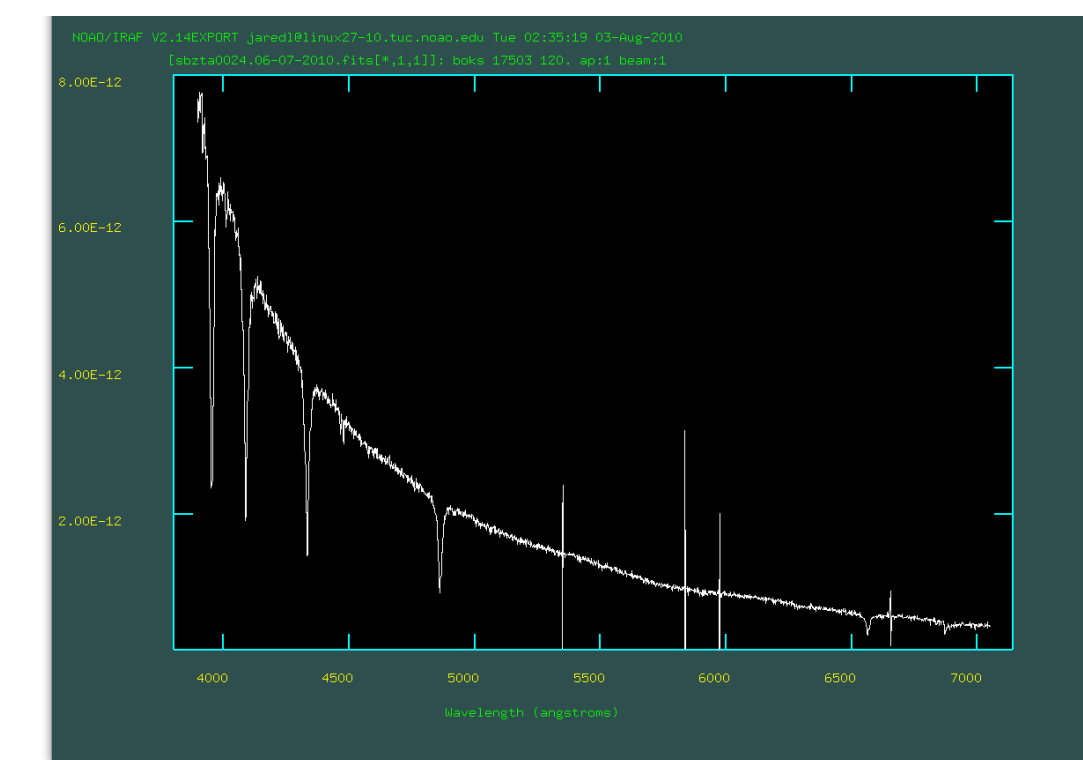


FIGURE 3: B STAR FROM THIS STUDY

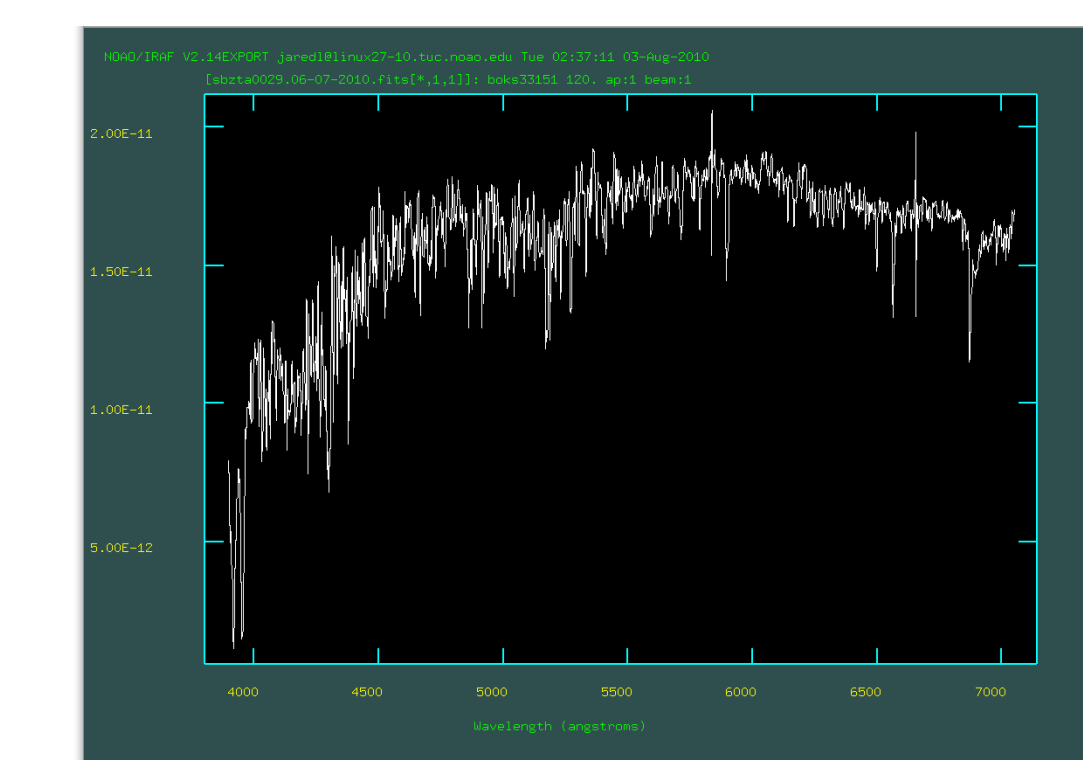


FIGURE 4: K STAR FROM THIS STUDY

FIGURES 5–9  
Data points are in blue, error bars in red and the black horizontal lines are the mean magnitude for a given night.

FIGURE 5: LIGHT CURVE OF BOK 28303  
FIGURE 6: LIGHT CURVE OF BOK 32170  
FIGURE 7: LIGHT CURVE OF BOK 50114  
FIGURE 8: LIGHT CURVE OF BOK 53856  
FIGURE 9: LIGHT CURVE OF BOK 27418

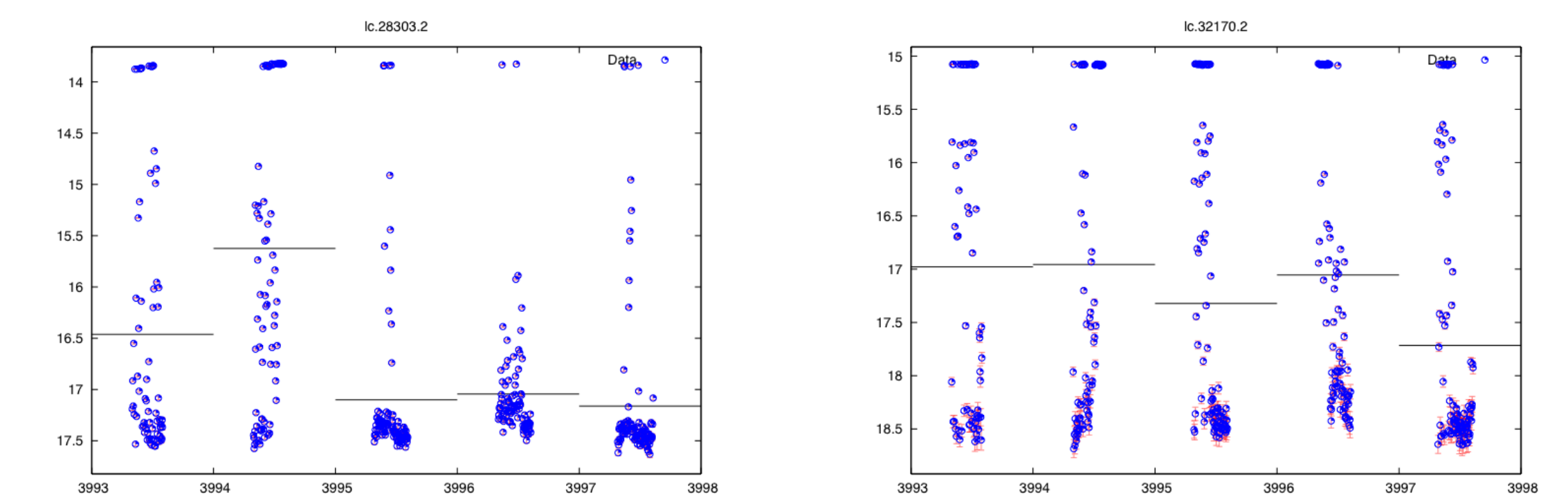


FIGURE 5

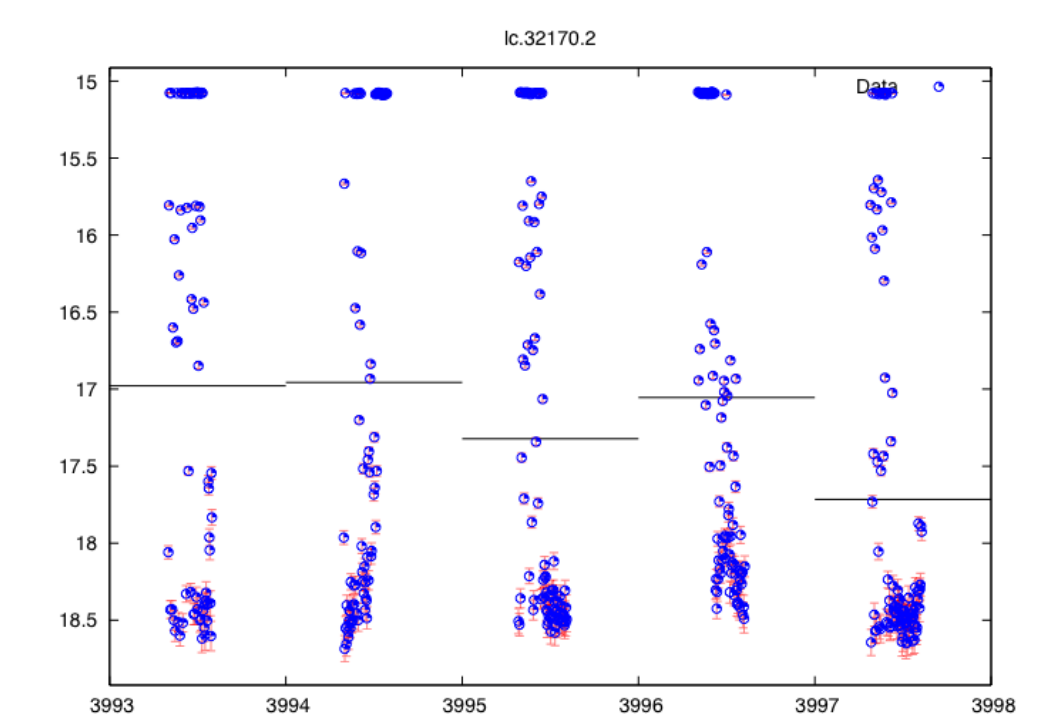


FIGURE 6

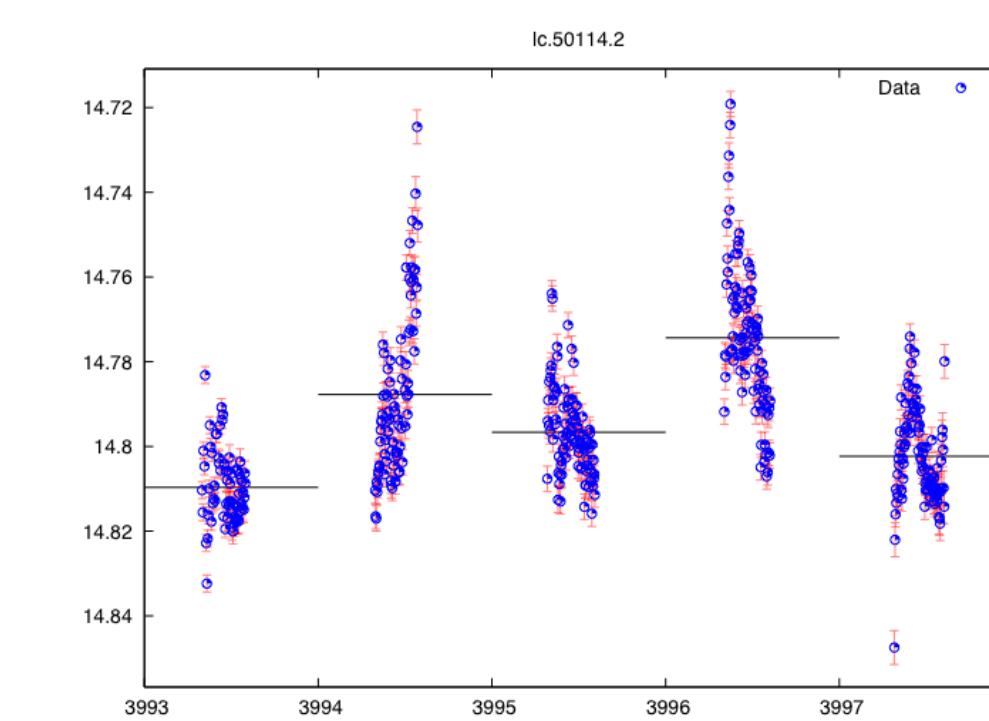


FIGURE 7

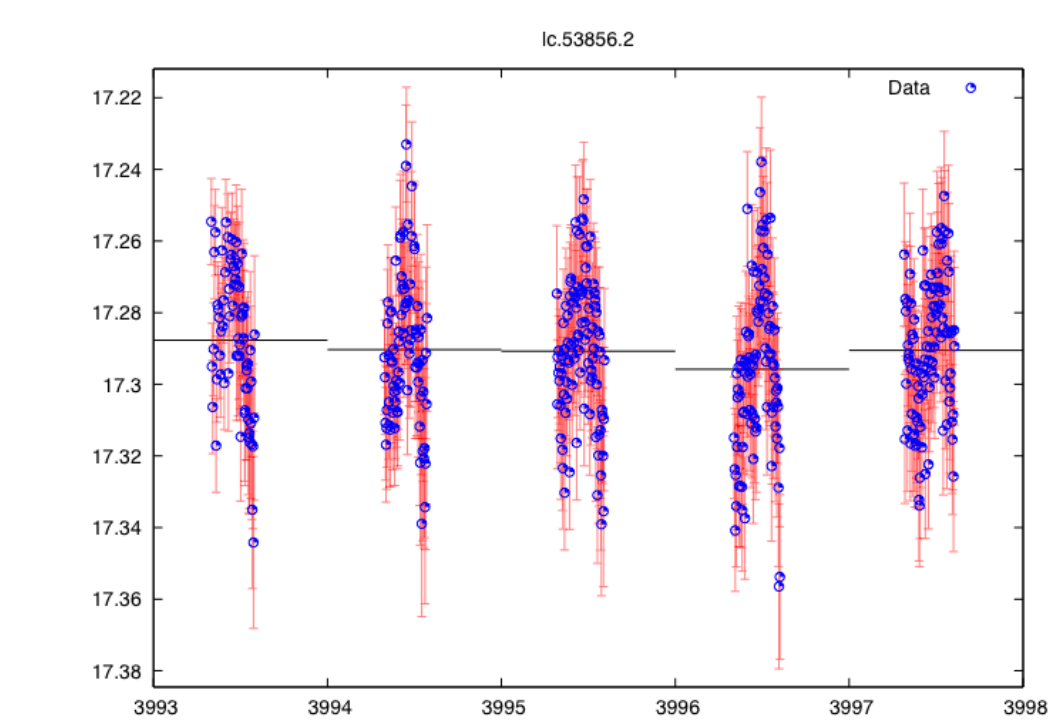


FIGURE 8

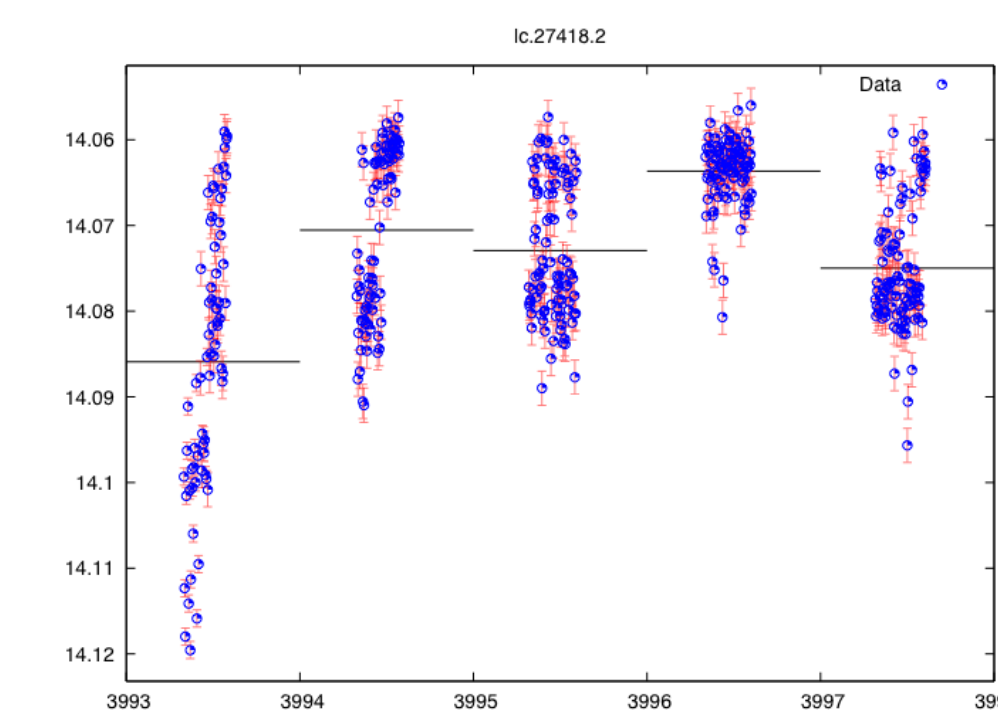


FIGURE 9

## FUTURE WORK

- Determine periods of the suspected variables
- Analyze nights with fewer than 5 nights of excellent photometry
- Acquire spectra for other stars in the data set

## ACKNOWLEDGEMENTS

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