

From PanSTARRS Candidates to New RR Lyraes in the *K2* Mission

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In this paper we report the discovery of 35 new RR Lyrae variables. These stars were found by a special searching technique. We crossmatched the catalog of the PanSTARRS (PS) sky survey with *K2* space photometry data to the validate candidates. It turns out that this technique can find eclipsing binaries as well.

1 Introduction

The PS 3π survey contains more than 25 million targets. Hernitschek et al. (2016) published a paper which supplements the catalog of the survey. In their study, they improved an existing method (Sesar et al., 2010) to add unique RR Lyrae probabilities to each target. They tagged nearly 400 000 stars above a 1 % probability of being an RR Lyrae variable. More than a thousand of them were measured by the *K2* mission of *Kepler*. This gives us the opportunity to search formerly unknown RR Lyrae variables using all the archive data of the first 12 fields of *K2*.

2 Targets and New Variables in the *K2* Field

We divided the potential targets into two categories. We estimated that 271 stars could be near enough to the main targets to appear on the target pixel files (TPF) as background stars. From these we were able to identify new RR Lyraes and also made light curves. We examined 939 main targets from *K2* data. These are usually known stars but some of them were misclassified. Our main goal was to find new RR Lyraes in the TPFs of *K2*.

First, we examined the 271 background targets. We paired the coordinates of the PS targets with the *K2* TPFs, and then we performed photometry of these stars with the PyKE software (Still & Barclay, 2012). We found 59 RR Lyraes and 21 among of them were not previously cataloged. The results shown on Table 1.

Secondly, based on the directly measured 939 *K2* targets, we found 779 RR Lyraes (Table 2). We identified 14 new RR Lyraes among these formerly known stars. These targets were misclassified as mostly eclipsing binaries but the *K2* data show clearly RR Lyrae shaped light curves.

3 Field 0 – the Case of the Anti-Center

RR Lyraes appear in the Galactic disk but mostly in the direction of the Bulge. Nonetheless, the PS data contain numerous candidates in the direction of the Galac-

Type	Number	%
RRab	54	19.9%
RRc	4	1.5%
RRd	1	0.4%
W UMa	38	14.0%
β Lyr	9	3.3%
β Per	11	4.1%
Unidentified	90	33.2%
Out of TPF	64	23.6%
All	271	100.0%

Table 1: Background targets.

Type	Number	%
RRab	635	68.2%
RRc	123	13.1%
RRd	21	2.6%
δ Cep	6	0.6%
W UMa	30	3.2%
β Lyr	23	2.5%
β Per	2	0.2%
Unidentified	99	10.5%
All	939	100.0%

Table 2: Directly measured targets.

tic anti-center. The first observing zone of the *K2* mission (Field 0) partially covered this area. The Galactic plane contains a lot of binaries at all Galactic longitudes. The majority of *K2* observed PS sources in Field 0 also turned out to be eclipsing binaries, suggesting that the large density of disk RR Lyrae candidates in the PS catalog may come from confusion between these two sources. The second iteration of the catalog (Sesar et al., 2017) excluded the Galactic plane with high extinction, and thus removed the most problematic areas of the survey.

4 Summary

Using the *K2* archive data, we revealed the true nature of 14 previously misclassified RR Lyraes and found 21 brand new ones (19 RRab, 2 RRc). Furthermore, we identified numerous new eclipsing binaries. We found that among the PS false positive targets, eclipsing binaries appear frequently. Based on *K2* Field 0 the Galactic disk could be particularly overrepresented with these impostors. It suggests that the PS catalog also provides the opportunity to find binaries in a similar way.

Acknowledgements. The research have been supported by the the ÚNKP-17-3 program of the Ministry of Human Capacities of Hungary, and the Hungarian National Research, Development and Innovation Office (NKFIH) grants K-115709, PD-116175, and the Lendület LP2014-17 grant of the Hungarian Academy of Sciences. LM was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

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