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Abstract of the doctoral thesis

Analysis of the three dimensional structure of the Magellanic System based on classical pulsators from the OGLE project

The Large and Small Magellanic Cloud (LMC and SMC, respectively) are among our closest galaxies. Together with the surrounding structures, they constitute the Magellanic System. This system can be named our "local laboratory" in the context of interacting galaxies. One of the most important evidences of these interactions is the existence of a structure spanning the area between the Magellanic Clouds, namely the Magellanic Bridge. In this doctoral thesis I analyzed the three dimensional structure of the Magellanic Clouds and the Magellanic Bridge. I based my studies on classical pulsating stars from the OGLE Collection of Variable Stars.

In the first part of my doctoral thesis I presented an analysis of the three dimensional spatial distribution of classical Cepheids in the Magellanic System (Jacyszyn-Dobrzeniecka et al., 2016, Acta Astronomica, 66, 149). In the LMC, Cepheids form substructures located in the plane of the disk, mainly in the bar and the northern arm. In the SMC, these stars are distributed more regularly and form a tri-axial ellipsoid, of which the longest axis is five times longer than the other two axes. The SMC is elongated almost along the line of sight.

The second part of the thesis presents an analysis of the three dimensional distribution of old pulsating stars – RR Lyrae variables (Jacyszyn-Dobrzeniecka et al., 2017, Acta Astronomica, 67, 1). In both Magellanic Clouds these stars form regular structures that can be described by tri-axial ellipsoids. I also compared the distributions of classical Cepheids and RR Lyrae stars, showing that the old stellar population reveal far broader distributions and do not form any additional substructures in contrast to young stars.

In the next step I presented a detailed analysis of an updated sample of classical Cepheids located in the Magellanic Bridge (Jacyszyn-Dobrzeniecka et al., 2020, The Astrophysical Journal, 889, 25). I showed that classical Cepheids form a connection between the Clouds in both two and three dimensions. Moreover, ages of most of the Cepheids support the hypothesis that these stars were formed in situ in the Bridge as an effect of the last encounter of the Clouds. Anomalous Cepheids that were also added to the Bridge sample are spread more evenly and do not form an evident connection between both galaxies.

The last part of my doctoral thesis concerns a detailed analysis of the distribution of RR Lyrae stars in the Magellanic Bridge (Jacyszyn-Dobrzeniecka et al., 2020, The Astrophysical Journal, 889, 26). In this study I showed that these old pulsating stars are present in the Bridge area, however they do not form an evident connection between the Clouds and their distribution rather resembles two overlapping halos. Additionally, I presented a reconstruction of the analysis performed by Belokurov et al. (2017, Monthly Notices of the Royal Astronomical Society, 466, 4711) showing that it is not possible to obtain their

bridge-like connection without many non-physical spurious sources in the final sample.