OPTICAL/NEAR-INFRARED LIGHT-CURVE PROPERTIES OF PULSATING VARIABLES IN THE CEPHEID INSTABILITY STRIP

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Making the distinction between Type I and II Cepheids found in the Vista Variables in the Via Lactea (VVV) ESO Public Survey is crucial for the studies of Galactic structure using these variables. As VVV provides only K_S-band light curves, this distinction has to be based on near-IR light-curve properties.

Because of their reduced amplitudes in the near-IR, however, it is not immediately obvious whether such a distinction can be unambiguously made. To assess this problem, we have compared the VVV and VVV Templates K_S-band light-curve properties of 213 Type I and 215 Type II Cepheids using Fourier decomposition. The Fourier parameters of these types were found to be different enough for the purposes of classification. For example, over most of the Cepheid period range, there is an upper limit for the amplitudes of Type I Cepheids. As 50 percent of the Type II variables lie above this limit, half of the variables that could be confused with Type I Cepheids are sorted out by this simple feature alone, suggesting that the automatic classification schemes under development for the VVV Survey will be able to classify such variables with a high degree of accuracy.

We have also found that bump Cepheids can be easily identified using VVV data, as the bump feature also appears in the near-IR light curves. Detailed modeling of the light curves of the bump Cepheids found in the VVV data will provide accurate stellar parameters for these stars.

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ON THE ORIGIN OF THE WIND VARIABILITY OF 55 CYG

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The early B-type supergiant 55 Cygni exhibits pronounced night-to-night variations in its Hα P-Cygni line profile, probably related to a strong variable stellar wind. In this work we studied a sample of spectroscopic observations, taken at the Observatory of Ondřejov (Czech Republic), in order to analyze the variations in the stellar and wind parameters. The observations were modeled using FASTWIND code (Santolaya-Rey, Puls & Herrero 1997, A&A 323, 488-512). Although we were not able to find an exact period from the Hα line profile variations, the same pattern (shape and intensity) seems to have a cyclic behaviour of about 17 days. The values for the wind and stellar parameters suggest changes of the mass loss rate by a factor of three during a cycle of variability. On the other hand, Kraus et al. (Precision Asteroseismology Proceedings, IAU Symposium 301, 2014) found that the HeI λ6678 photospheric absorption line presents a 1.09 day period, which could be superimposed over a longer period. From the analysis of our theoretical parameters we found that a gravitational mode of pulsation could not be the only agent responsible for the observed variations. As the stars evolving from the main sequence to the red supergiant stage (RSG) have different pulsation properties than those evolving back to the blue supergiant region (Saio, Georgy & Meynet, 2013, MNRAS, 433, 1246), we conclude that 55 Cygni could be in a post-RSG phase with multiperiodic pulsation modes. The variable mass loss could be attributed to the coupling of the oscillation modes.

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NIP OF STARS: EARLY RESULTS AND NEW ECLIPSING BINARIES

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We have performed a near-infrared photometric monitoring of 39 galactic young star clusters and star-forming regions, known as *NIP of Stars*, between the years 2009–2011, using the Swope telescope at Las Campanas Observatory (Chile) and the RetroCam camera, in H- and Y-bands. This monitoring program is complementary to the *Vista*

Variables in the Via Láctea (*VVV*), as the brightest sources observed in *NIP of Stars* are saturated in *VVV*. The aim of this campaign is to perform a census of photometric variability of such clusters and star-forming regions, with the main goal of discovering massive eclipsing binary stars. In this work, we present a preliminary analysis of this photometric monitoring program with the discovery of tens of candidates for variable stars, among them candidates for massive eclipsing binaries. We included also to the analysis of variability, a small set of images obtained in the Ks with the VISTA telescope in the framework of *VVV* survey (Minniti et al. 2010). In special, we announce the infrared discovering of four massive eclipsing binaries in the massive young cluster NGC 3603. The stars have been classified spectroscopically as O-type stars, and one of them, MTT 58, has a rare star with a spectral type of O2 If*/WN6, as one of its components. We present a preliminary analysis of the light-curves of these binaries.

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WHITE DWARF STARS IN THE JPAS SURVEY DETECTION - MASS DETERMINATION - TEMPERATURE DETERMINATION

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White dwarfs are the end state of all main sequence stars less massive than $8M_{\odot}$, which means that 98% of all stars will end up as white dwarfs. First and foremost, J-PAS will allow us to discover many new white dwarfs. It will go deeper than SDSS; most of SDSS spectroscopically confirmed white dwarfs have a magnitude below 20.5, while J-PAS will be complete (5σ detections) down to 22.5 in each filter. So we should see white dwarfs 2.5 times farther than SDSS and therefore the total volume will be (2.5^3 - 1 = 14.6 times larger. By definition every object in J-PAS will be spectroscopically observed, while in SDSS only chosen objects had their spectra taken, so our white dwarf sample will also be much more complete than SDSS. We expect to increase the total number of white dwarfs from approximately 20,000 to 300,000. Among our goals are the study of the white dwarf luminosity function and the mass distribution.

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WHITE DWARF STARS

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White dwarfs are the evolutionary endpoint for nearly 95% of all stars born in our Galaxy, the final stages of evolution of all low- and intermediate mass stars, i.e., main sequence stars with masses below $(8.5 \pm 1.5)\, M_{\odot}$, depending on metallicity of the progenitor, mass loss and core overshoot. Massive white dwarfs are intrinsically rare objects, tand produce a gap in the determination of the initial vs. final mass relation at the high mass end (e.g. Weidemann 2000 A&A, 363, 647; Kalirai et al. 2008, ApJ, 676, 594; Williams, Bolte & Koester 2009, ApJ, 693, 355). Main sequences stars with higher masses will explode as SNII (Smartt S. 2009 ARA&A, 47, 63), but the limit does depend on the metallicity of the progenitor. Massive white dwarfs are probably SNIa progenitors through accretion or merger. They are rare, being the final product of massive stars (less common) and have smaller radius (less luminous). Kepler et al. 2007 (MNRAS, 375, 1315), Kleinman et al. 2013 (ApJS, 204, 5) estimate only 1-2% white dwarfs have masses above 1 $M_{\odot}$. The final stages of evolution after helium burning are a race between core growth and loss of the H-rich envelope in a stellar wind. When the burning shell is exposed, the star rapidly cools and burning ceases, leaving a white dwarf. As they cool down, the magnetic field freezes in, ranging from a few kilogauss to a gigagauss. Peculiar type Ia SN 2006gz, SN 2007if, SN 2009dc, SN 2003fg suggest progenitors in the range $2.4 - 2.8\ M_{\odot}$, and Das U. & Mukhopadhyay B. (2012, Phys. Rev. D, 86, 042001) estimate that the Chandrasekhar limit increases to $2.3 - 2.6\ M_{\odot}$ for extremely high magnetic