XIV Latin American Regional IAU Meeting (Florianópolis/SC, Brazil, 25-30 November 2013)
Editors: A. Mateus, J. Gregorio-Hetem & R. Cid Fernandes

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

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field stars, but differential rotation induced by accretion could also increase it, according to Hachisu I. et al. 2012 (ApJ, 744, 69). García-Berro et al. 2012, ApJ, 749, 25, for example, proposes double degenerate mergers are the progenitors of high-field magnetic white dwarfs. We propose magnetic fields enhance the line broadening in WDs, causing an overestimated surface gravity, and ultimately determine if these magnetic fields are likely developed through the star's own surface convection zone, or inherited from massive Ap/Bp progenitors. We discovered around 20 000 spectroscopic white dwarfs with the Sloan Digital Sky Survey (SDSS), with a corresponding increase in relatively rare varieties of white dwarfs, including the massive ones (Kleinman et al. 2013, ApJS, 204, 5, Kepler et al. 2013, MNRAS, 439, 2934). The mass distributions of the hydrogen-rich (DA) measured from fitting the spectra with model atmospheres calculated using unidimensinal mixing lenght-theory (MLT) shows the average mass (as measured by the surface gravity) increases apparently below 13 000K for DAs (e.g. Bergeron et al. 1991, ApJ, 367, 253; Tremblay et al. 2011, ApJ, 730, 128; Kleinman et al. 2013). Only with the tridimensional (3D) convection calculations of Tremblay et al. 2011 (A&A, 531, L19) and 2013 (A&A, 552, 13; A&A, 557, 7; arXiv 1309.0886) the problem has finally been solved, but the effects of magnetic fields are not included yet in the mass determinations. Pulsating white dwarf stars are used to measure their interior and envelope properties through seismology, and together with the luminosity function of white dwarf stars in clusters and around the Sun are valuable tools for the study of high density physics, and the history of stellar formation.

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LINE IDENTIFICATION IN THE SUN'S SPECTRUM

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Synthetic stellar spectra are extensively used for many different applications in astronomy, from determining atomic parameters of new observed stars to the study of the stellar populations of galaxies. One of the inputs for the codes that generate these synthetic spectra are atomic and molecular line lists, which contain the atomic parameters of the absorption lines that should appear in each spectrum. Although these lists contain million of lines, very few of them were actually measured in laboratory. The consequence is that for many lines the errors in the parameters can be as large as 200%. Besides that, we do not know all the lines that appear in the stars. Even for the Sun, our closest and most studied star, the synthetic spectra misses many lines. This is one of the main reasons we still cannot reproduce the spectrum of observed stars. In this project we will develop a careful strategy to compare the synthetic and observed spectrum of the Sun to try to identify and quantify the lines still missing in the models. We will also try to identify lines with large errors in the atomic parameters, as for example, lines in which the central wavelength is wrong.

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PRE-MAIN SEQUENCE EVOLUTIONARY TRACKS AND ISOCHRONES IN COLOR-MAGNITUDE DIAGRAMS

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We presented non-gray pre-main sequence evolutionary tracks and isochrones in theoretical and observational Hertzsprung-Russel diagrams. Theoretical tracks were generated by ATON2.4 code (Landin et al., 2006, A&A, 456, 269) for the mass interval of 0.15-3.8 $M_\odot$ and metallicities of [Fe/H]=−0.24, 0.0 and +0.37. By using color-temperature relations and bolometric corrections in UBVRIJHKL (Bessel et al. 1998, A&A, 333, 231) and BVRI (VadenBerg & Clem, 2003, AJ, 126, 778) photometric systems, we converted theoretical tracks and isochrones to their counterparts in color-magnitude diagrams (CMD). Tracks in theoretical and observational Hertzsprung-Russel diagrams show the well known shift, in main sequence, to smaller temperatures (or higher V−I) with increasing metallicity. The tracks obtained with both transformations behave roughly the same way for larger masses, but for $M < 0.8\ M_\odot$ Bessel's transformations return B−V colors in disagreement with observations and theory especially for cool stars and it can be due to the opacity incompleteness in the blue and UV. Finally, our tracks and isochrones in CMD were used to investigate the evolutionary status of a multiple system and a young cluster. η Mus is a 22 Myr old system, consisting of two late B-type stars of 2.9 $M_\odot$ each and a 0.79 $M_\odot$ pre-main