

(the primary) via an accretion disc. In this poster we report the first results of long-term project to study cyclical period variations in CVs. The observations were done from 2008 to 2013 at Observatório do Pico dos Dias (OPD/LNA, Brazil). Time series of high speed CCD photometry were obtained using the 0.6 m and 1.6 m telescopes at OPD. We measured new white-dwarf mid-eclipse timings and combined them with published measurements to construct updated observed-minus-calculated (O-C) diagrams. The UU Aqr O-C diagram covers 24 years of observations and presents a 26 yr modulation with semi-amplitude of 47 s. The V2051 Oph data cover 35 years of observations and the new timings show significant deviations from the published linear plus sinusoidal ephemeris (22 yr modulation with a semi-amplitude of 17 s), indicating that the variation is not strictly periodic. We discuss the observed modulations in context of the two current explanations for the phenomenon: magnetic activity in the secondary star and the presence of a third body in the system.

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NEWLY DISCOVERED OLD OPEN CLUSTERS IN THE VVV SURVEY

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We report the discovery and fundamental parameters of 20 infrared open clusters projected in the inner disk and bulge area covered by the ESO public survey VISTA Variables in the Via Láctea (VVV). The most interesting candidates are as follow: The color-magnitude diagrams of VVV CL119, VVV CL143 and VVV CL150 show well defined red giant branch, some red clump and main sequence stars. They are projected at 6.8; 9.2 and 6.98 kpc respectively, are 5-10 Gyr old, intermediate metal poor, and could be classified as old open clusters. However, these objects in the inner few kpc from the Galactic center are quite unusual, because they should be rare in the inner Galaxy. Thus, these are promising candidates for new globular clusters in the galactic bulge. The open cluster candidates VVV CL124,

VVV CL160 and VVV CL161 show well defined sequence of evolved and main sequence stars and are classified as old open clusters. They are projected at 5.0; 5.5 and 8.7 kpc respectively. The cluster candidates VVV CL139 and VVV CL140, are projected very close each to other, show similar radial velocities and distance modulus of 3.8 kpc. The age of CL139 is estimated around 80 Myr, while CL140 is older (1.3 Gyr). Both clusters are relatively metal rich, and are good new cluster pair candidate. And finally, two cluster candidates from our sample, namely VVV CL117 and VVV CL130 show typical color-magnitude diagrams of red supergiant clusters, but more data are necessary to confirm their nature. In summary, 15% of new cluster candidates from our sample have ages between 100 Myr and 1 Gyr and 50% are older than 1 Gyr. All clusters are very reddened, reaching $A_V=28$ mag in some of the cases.

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UNVEILING TYPE IIB SUPERNOVA PROGENITORS: SN 2011HS FROM A SUPERGIANT STAR

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Type IIB Supernovae are the final evolutionary stage of massive stars that were able to retain only a thin ($\lesssim 1 M_\odot$) H/He external envelope at the time of the explosion. The mechanism of mass-loss that made such final structure possible and the nature of such progenitor stars are still open issues. We present the results obtained from the study of a sample of Type IIB SNe, in particular, of SN 2011hs (Bufano et al., 2013, MNRAS submitted). SN 2011hs was a relatively faint ($M_B = -15.6$ mag) and red Type IIB SN, characterized by a narrow light curve shape. Its spectral evolution showed the metamorphosis typical of this class of SN, from spectra dominated by H I lines to spectra where He I features dominate, but with broad absorption line profiles indicating high expansion velocities. Modeling the light curve of SN 2011hs and its velocity evolution with hydrodynamical calculations, we estimated that the SN is consistent with the explosion of a 3–4 M_\odot He-core star, from a main sequence mass of 12–15 M_\odot , ejecting a ^{56}Ni mass equal to 0.04 M_\odot and characterized by an explosion energy of $E \approx 8.5 \times 10^{50}$ erg s^{-1} .

Based on the light curve evolution, we assumed that the explosion occurred 6 days before the discovery ($2,455,872 \pm 4$ JD), resulting in an adiabatic cooling phase lasting 8 days, similarly to SN 1993J. Since the duration and the decreasing rate of the cooling branch depends mainly on the progenitor size, we could infer from it a progenitor radius of $\approx 500\text{--}600 R_{\odot}$, like a supergiant star. Our modeling rules out models with He core mass $> 5M_{\odot}$, i.e. main sequence masses above $20 M_{\odot}$. Such a lower limit for the progenitor mass could indicate the possibility of a binary origin, although the radio light curve does not show strong deviations, typically signature of the presence of a companion star.

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PHASE MIXING OF POPPED STAR CLUSTERS

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As star clusters are expected to form with low star formation efficiencies, the gas in the cluster is expelled quickly and early in their development: the star cluster pops. This leads to an unbound stellar system. Previous N-body simulations have demonstrated the existence of a stepped number density distribution of cluster stars after popping, both in vertical position and vertical velocity, with a passing resemblance to a Christmas tree. Using numerical and analytical methods, we investigate the source of this structure, which arises due to the phase mixing of the out-of-equilibrium stellar system as it evolves in a background analytical potential. Considering only the vertical motions, we construct a theoretical model to describe the time evolution of the phase space distribution of stars in a Miyamoto-Nagai disk potential and a full Milky-Way type potential comprising bulge, halo and disk components, which is then compared with N-body simulations. Using our theoretical model, we investigate the possible observational signatures and the feasibility of detection.

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DETAILED DIFFERENTIAL CHEMICAL ANALYSIS OF A METAL POOR STAR: NEW EVIDENCES ABOUT PLANET FORMATION

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The present project emphasizes on the study of metal-poor stars, with and without planets, to investigate the existence (or not) of a connection between anomalies in the chemical composition and the presence of planets by inspecting the high resolution spectra ($R = 65\,000$), in order to derive chemical abundances with high precision using the differential technique. In this method, measurements of equivalent widths of the target star are compared to a standard star with predetermined photospheric parameters that are similar to those of the target star (effective temperature, surface gravity and metallicity). Therefore, we have compared the star HD111232 (standard) with HD020794, such that the first holds a hot Jupiter-type planet and around the second one there are three super-Earths. These solar-type stars are moderately metal-poor and had their spectra collected with the MIKE spectrograph at the 6.5m Magellan telescope in the Las Campanas Observatory. Among the main results, we have derived the classical photospheric parameters and chemical abundances of refractory and volatile elements with such a high precision, particularly with errors about 0.01 dex, which is essential for the study of chemical connection between planets and star. We have also added to the differential method the spectral synthesis of molecular bands and atomic lines to recover abundances of volatile elements such as carbon, nitrogen and oxygen. We thus present the parameters effective temperature, surface gravity, metallicity $[\text{Fe}/\text{H}]$, microturbulence velocity and differential elemental abundances. For some elements, we have performed comparisons of the abundances measured by spectral synthesis with those obtained directly through measurements of equivalent widths. Specifically, the preliminary abundance difference $\delta[\text{E}/\text{H}]$ is 0.04(7) dex for carbon, 0.12(14) for nitrogen and 0.08(7) for oxygen.

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