

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 unidimensional mixing length-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 UBVR<sub>I</sub>JHK<sub>L</sub> (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.  $\eta$  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

sequence star. We estimated that NGC 2264 stars have masses, mainly, in the range  $0.1\text{-}0.6M_{\odot}$  and the mean age of stars' cluster is 3.5 Myr, what is in agreement with other works.

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### UNVEILING OPTICAL AND X-RAY PROPERTIES OF THE HIGH MASS X-RAY BINARY XMMU J054134.7-682550

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XMMU J054134.7-682550 is an X-ray source located in the Large Magellanic Cloud. Based on its X-ray properties, and from optical and near-infrared photometry, it was assumed to be a Be/X-ray binary. In this work we present the characterization of its optical counterpart from optical medium-resolution spectra acquired with the 3.6-m New Technology Telescope and the 4.1-m SOAR Telescope. Photospheric lines along with strong emission lines from the H $\alpha$ , H $\beta$  and several transitions of iron show that the optical counterpart is a Be star with a dense or large circumstellar disk. Thus, it is now conclusive that the system is indeed a Be/X-ray binary. Additionally, we present an ongoing program which aims to improve the characterization of the system from XMM-*Newton*, Swift/BAT and ASM/RXTE X-ray observations.

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### IN SEARCH OF PRECISE ISOCHRONAL AGES: MONTE CARLO AND BAYESIAN APPROACH

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Obtaining accurate ages for FGK stars is important to understand the Galactic structure and evolution as well as the evolution of exoplanetary systems. We build a dense grid of isochrones and evolutionary tracks aimed to identify, in several spectroscopic surveys, which are the most reliable stellar ages based on solid statistics. For this, we calculate their probability distributions of isochronal age and fundamental parameters such as mass, radius (at ZAMS) and surface gravity through Monte Carlo simulations and Bayesian inference. From these determinations, we will be able to derive a sample of MS and subgiant stars with very accurate isochronal ages covering an extensive domain of ages, masses and metallicities. This sample will be very useful for future observational follow-ups and, moreover, when applied to age-activity-rotation relationships will enable the construction of robust age calibrations for solar-type stars. Such calibrations of age and activity might contribute towards the establishment of firmer relations governing the evolution of angular momentum in solar-type stars.

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### SYMBIOTIC STARS IN X-RAYS AND UV

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Until recently, symbiotic binary systems in which a white dwarf accretes from a red giant were thought to be mainly a soft X-ray population. I will describe the detection with the Swift/XRT of 14 white dwarf symbiotics that were not previously known to be X-ray sources. The 14 new X-ray detections were the result of a survey of more than 50 symbiotic stars using Swift fill-in programs during three years. Their X-ray spectra are consistent with thermal emission and fall naturally into three distinct groups. The first group contains those sources with a single, highly absorbed hard component, which we identify as probably coming from an accretion-disk boundary layer. The second group is composed of those sources with a single, soft X-ray spectral component, which likely arises in a region where low-velocity shocks produce X-ray emission, i.e. a colliding-wind region. The third group consists of those sources with both hard and soft X-ray spectral components. Simultaneous Swift/UVOT data allowed us to find that unlike in the optical, where