Rafael Garcia-Dias

Curriculum Vitae

Education

2015–2018 **PhD in Astrophysics**, *Instituto de Astrofísica de Canarias - IAC*.

2013–2015 **Masters of Physics**, *Universidade Federal do Rio Grande do Sul - UFRGS*.

2013 **Physics Degree**, *Universidade Federal do Rio Grande do Sul - UFRGS*.

PhD Thesis

Title **Machine learning in high resolution spectroscopy**

Supervisors Allende Prieto & Sanchez Almeida

Description The data volume generated by many existing and forthcoming astronomical instruments is simply too large for traditional analysis techniques. Two extreme cases are the Large Synoptic Survey Telescope (LSST) and the Gaia mission. In stellar astrophysics, the legacy of the M-K spectroscopic classification scheme is undeniable. Despite its limitations, this system continues to be used today, but with the advent of massive spectroscopic surveys, the time is ripe to find a replacement. The MK system is a supervised classification algorithm based on spectral features easily identifiable by a human on a medium-resolution stellar spectrum. The system does not make any explicit connection to atmospheric parameters of the stars, such as effective temperature or surface gravity, making it independent from ever-changing physical models. Any future alternative should retain that property, and ideally be unsupervised, i.e. adopt *natural* groupings of stars, rather that *ad hoc* criteria. In this PhD project we are trying to explore machine learning algorithms to address this question.

Tenerife – Spain
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Masters Dissertation

Title ***Spectroscopy and photometry of open clusters – Understanding the Galaxy chemical evolution***

Supervisors Professor Charles Bonatto & Professor Alan Alves-Brito

Description The formation and evolution of the Galaxy is still poorly understood. As chemical abundance ratios are proportional to crucial variables such as the star formation rate and the timescale of chemical enrichment, a key observable to constrain the Galactic evolution model is the variation of the chemical abundances across the Galactic disk. Many studies were done in this area to date, but there is systematic abundance differences among them due to inhomogeneities in adopted methodologies. We aim to homogeneously analyze, photometric and spectroscopically, a sample of 60 open clusters to trace a reliable chemical profile of the Galactic disk. For this purpose we developed a python routine for automatically acquire stellar atmospheric parameters and chemical abundances based on 2013 version of MOOG (Sneden 1973) and Kurucz models (Castelli et al. 1997).

Courses

Sept. 12 - 16, 2016 **11th Heidelberg Summer School on the topic of Astrostatistics & Data Mining** The school looked at the principles of inference and methods of astronomical data analysis and data mining, also covering a range of numerical and statistical techniques and their application to different types of astronomical data.

Mar. 15 - 17, 2016 **Conference on Big Data from Space - BiDS'16** The objective of this conference is to bring together researchers, engineers and users working in the area of Big Data from Space.

Sept. 16 - 20, 2013 **5th INPE advanced course:** An overview of cosmology in the era of large telescopes: Theory, observation and simulations. The lectures were focused on the following topics: 1) Cosmic Microwave Background, with emphasis on the new results from Planck 2) the large scale structure as unveiled by the recently completed Sloan Digital Sky Survey and 3) cosmological simulations, which became an essential part of the research in this field.

Aug. 18-21, 2014 **ALMA and the Brazilian community workshop:** The goal of the workshop was to explore how the current science activity within the Brazilian community can benefit from the new ALMA observatory and millimeter/submm observations in general.

Sept. 02 - 12, 2014 **JPL-Caltech Virtual Summer School in Big Data Analytics:** Computational skills and methodology needed for the analysis and interpretation of ever more massive and complex data sets are essential for the scientific and technological workforce in the 21st century. This virtual summer school addressed this need.

Out. 18 - 19, 2014 **VIII workshop in neuroscience:** the workshop covered the themes memory, consciousness, neurotoxicity, neurodegeneracy and graduate programs in neuroscience. Bento Gonçalves, RS - Brasil. (UFRGS)

Out. 28 - 29, 2014 **III symposium of the UFRGS psychiatry league: controversial issue on neuroscience.** In the symposium the following themes was discussed: neuroimaging, drug regulation, suiciding and medicalization.

Experience

Vocational

2010–2011 **Intern**, Magnetism laboratory, UFRGS.
Developing experiments in nanotechnology related with giant magnetoresistance.

Details:
- Making nanotips by electrolysis;
- Using sputtering to make multilayer nanofilms;
- Building experimental apparatus.

2011–2013 **Intern**, Astrophysics laboratory, UFRGS.
Studying open Clusters

Details:
- Measuring star formation rate in solar neighborhood;
- SOAR photometry in clusters within the bridge between Magellanic clouds;
- Creating a pipeline to perform photometry in VVV (VISTA Variables in The Via Lactea) survey.

Miscellaneous

2010–2013 **Teaching**.
- Private tutor:
  - Spanish;
  - Physics;
  - Math.
- Euroschool – Informatics;
- Wizard – Spanish.

Computer skills

Basic C, FORTRAN, Scilab, R, HTML

Intermediate Microsoft office, OpenOffice, Indesign, Computer Hardware and Support;

Advanced Python, IRAF, VIM, DS9, Aladin, Shell Script, Linux, MOOG, LaTeX.

Communication Skills

2016 Día de Nuestra Ciencia

2014 Oral Presentation at ALMA and the Brazilian Community Workshop, at Rio de Janeiro, RJ - Brazil (ON).

2013 Poster at Latin American Regional IAU Meeting, at Florianopolis, RS - Brazil;

2010 – 2013 Oral and poster presentation at the annual scientific initiation meeting, at Porto Alegre, RS - Brazil (UFRGS)

Languages

Portuguese	**Native language**	
Spanish	**Advanced**	*Conversationally fluent*
English	**Advanced**	*Conversationally fluent*

Reference Persons

Allende Prieto, C.	**callende@iac.es**.
Sanchez Almeida, J.	**jos@iac.es**.

Publication List

Bica et al.	**Bridge over troubled gas: clusters and associations under the SMC and LMC tidal stresses**.
Muna et al. 2016	**The Astropy Problem**.
SDSS Collaboration et al. 2016	**The Thirteenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the SDSS-IV Survey MApping Nearby Galaxies at Apache Point Observatory**.
Blanton et al. 2017	**Sloan Digital Sky Survey IV: Mapping the Milky Way, Nearby Galaxies and the Distant Universe**.
Casamiquela L. and et al.	**OCCASO II. Physical parameters and Fe abundances for 18 Open Clusters**. submitted

Research interests

General topics	**Star formation/evolution, stellar clusters, stellar atmosphere, galactic chemical evolution, open source, machine learning.**, .
Techniques	**Photometry, spectroscopy, machine learning, K-means**.
Comments	**I've started my research performing infrared photometry in star clusters. Now I combine photometry and spectroscopy to study this objects. I'm a programming enthusiastic, I've wrote a pipeline for psf-photometry in VVV tiles and a routine to automatically calculate chemical abundances from equivalent widths. It would be fascinating if as next step I could work with machine learning, data mining or high complexity codes** .

Available to Pos doc. at August 2018