Annual Report 2011

Departamento de Astronomía y Astrofísica
Facultad de Física
Pontificia Universidad Católica de Chile

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Abstract

The Department of Astronomy and Astrophysics (DAA) at PUC is currently formed by 16 faculty. Through 2011, the DAA hosted 19 postdoctoral researchers and 38 graduate students. The DAA members published 119 refereed articles during 2011, and benefited from 37 grants. In the academic year 2011, 14 students received their *Licenciatura* degreee, 5 an M.Sc., and 3 a Ph.D.

1 Introduction

The *Departamento de Astronomía y Astrofísica* (Department of Astronomy and Astrophysics, DAA) is one of the two academic divisions of the Faculty of Physics of *Pontificia Universidad Católica de Chile* (PUC). This faculty offers undergraduate (*Licenciatura*) degrees in Astronomy and in Physics, and Ph.D. and Master's programs in Astrophysics and in Physics. The mission of the DAA is to be an international center of excellence for studies in Astronomy and Astrophysics, covering a broad range of topics in observational and theoretical astrophysics, and to prepare the next generations of students that will profit from the superb observational facilities available to Chilean astronomers and their collaborators. In this report, we review the main activities at DAA from January until December 2011.

2 Personnel

2.1 Changes in 2011

2.1.1 New Faculty

- Dr. J. Chanamé arrived from the Department of Terrestrial Magnetism of the Carnegie Institution for Science, Washington, DC, USA, to take on an Assistant Professor position.

2.1.2 New Postdocs

- Dr. A. Mesa-Delgado arrived from the University of Hawaii, USA, to take on a postdoctoral position.
- Dr. M. Montesinos arrived from the Observatoire de la Côte d'Azur in Nice, France, to take on a postdoctoral position.
- Dr. R. Muñoz arrived from the Observatoire Astronomique de Strasbourg, France, to take on a postdoctoral position.
- Dr. D. Murphy arrived from the University of Durham, UK, to take on a postdoctoral position.
- Dr. C. Sáez arrived from Penn State University, USA, to take on a postdoctoral position.

2.1.3 Postdoc Departures

- Dr. A. Alves-Brito left to take on a postdoctoral position at the Australian National University.
- Dr. J. Quinn left the DAA.
- Dr. S. Sale left to take on a postdoctoral position at Oxford University.

2.2 DAA Faculty

- Dr. Felipe Barrientos, Associate Professor (Ph.D. University of Toronto, Canada, 1999) – *Galaxy evolution and morphology. Elliptical galaxies. Clusters of galaxies. Observational cosmology.*
- Dr. Franz E. Bauer, Assistant Professor (Ph.D. University of Virginia, USA, 2001) – *AGN Demographics, Feeding, and Evolution. Coeval Growth of Galaxies and Super-Massive Black Holes. Deep Blank-field Surveys (Radio through X-ray). Nearby Supernovae and X-ray Binaries. Structure Formation and Galaxy Cluster Evolution.*
- Dr. Márcio Catelan, Full Professor (Ph.D. Universidade de São Paulo, Brazil, 1996) – *Stellar structure and evolution. Globular clusters. Variable stars. Stellar Populations. Galaxy formation and evolution.*
- Dr. Julio Chanamé, Assistant Professor (Ph.D. The Ohio State University, USA, 2005) – *Stellar dynamics. The Milky Way and the Local Group. Stellar structure and evolution.*
- Dr. Alejandro Clocchiatti, Full Professor (Ph.D. University of Texas at Austin, USA, 1995) – *Supernovae,*

near and far. Radiative Transfer. Galaxy Clusters. Cosmology.

- Dr. Jorge Cuadra, Assistant Professor (Ph.D. Ludwig-Maximilians-Universität München, Germany, 2006) – *Numerical astrophysics. Galactic nuclei. Super-massive black holes. Planet–disc interactions.*

- Dr. Rolando Dünner, Adjunct Assistant Professor, (Ph.D. PUC, 2009) – *Large scale structure and cosmology. Astronomical instrumentation.*

- Dr. Gaspar Galaz, Associate Professor (Ph.D. Université de Paris, France, 1998) – *Stellar population in galaxies. Galaxy evolution. Statistical properties of the galaxy distribution.*

- Dr. Leopoldo Infante, Full Professor (Ph.D. University of Victoria, Canada, 1990) – *Galaxy and structure evolution. Pairs, groups and clusters of galaxies. LSB, dwarf and star forming galaxies in relation to environment. High-z QSOs. Correlation functions.*

- Dr. Andrés Jordán, Assistant Professor (Ph.D. Rutgers University, USA, 2004) – *Search and characterization of transiting exoplanets. Galaxies in nearby clusters. Star clusters.*

- Dr. Dante Minniti, Full Professor (Ph.D. University of Arizona, USA, 1993) – *Globular clusters. Stellar populations and evolution. Extrasolar planets. Galaxy formation. Galactic structure. Gravitational microlensing. Astrobiology.*

- Dr. Nelson Padilla, Associate Professor (Ph.D. Universidad Nacional de Córdoba, Argentina, 2001) – *Numerical astrophysics. Galaxy and Structure Formation. Cosmology.*

- Dr. Thomas H. Puzia, Assistant Professor (Ph.D. Ludwig-Maximilians-Universität München, Germany, 2003) – *Star clusters and star cluster systems. Chemical evolution and enrichment histories of galaxies. Galaxy formation and evolution. Stellar dynamics. Stellar populations. Population synthesis models. Stellar abundances. Hierarchical structure formation. Mass assembly of galaxies.*

- Dr. Hernán Quintana, Full Professor (Ph.D. Cambridge University, UK, 1973) – *Observational astrophysics. Clusters of galaxies. Interacting galaxies. Large scale structure.*

- Dr. Andreas Reisenegger, Full Professor and DAA Chairman (Ph.D. Caltech, USA, 1993) – *Theoretical Astrophysics and Cosmology. Neutron Stars. Stellar Magnetic Fields. Structure Formation. Clusters and Superclusters of Galaxies.*

- Dr. Manuela Zoccali, Associate Professor, (Ph.D. Università degli Studi di Padova, Italy, 2000) – *Stellar Populations in the Milky Way. The Galactic Bulge. Star Clusters. Chemical Abundances.*

2.3 Postdoctoral Fellows 2011

The following scientists held postdoctoral positions at the DAA during the reported period.

- Dr. Javier Alonso-García (Ph.D. University of Michigan, USA, 2010) – *Stellar populations. Galactic astronomy. Stellar evolution. Stellar variability. Photometry.*

- Dr. Alan Alves-Brito (Ph.D. Universidade de São Paulo, Brazil, 2008) – *Stellar populations. Chemical abundances. High-resolution spectroscopy.*

- Dr. Rodolfo Angeloni (Ph.D. University of Padova, Italy, 2009) – *Symbiotic Stars. Interstellar Dust. Stellar variability. Photometry. Nebular Spectroscopy.*

- Dr. Timo Anguita (Ph.D. Ruprecht Karls Universität Heidelberg, Germany, 2009) – *Gravitational lensing. Galaxy evolution. Galaxy clusters.*

- Dr. István Dékány (Ph.D. Eötvös Loránd University, Hungary, 2010) – *Photometry. Time-series analysis. Stellar pulsation. Stellar evolution.*

- Dr. Harold Francke (Ph.D. Universidad de Chile, 2009) – *Galaxy formation and evolution. Cosmology and large scale structure of the universe.*

- Dr. Maren Hempel (Ph.D. Ludwig-Maximilians-Universität München, Germany, 2004) – *Globular cluster systems. Stellar Populations. Galaxy formation and evolution.*

- Dr. Krzysztof Hełminiak (Ph.D. Nicolaus Copernicus Astronomical Center, Poland, 2010) – *Derivation of fundamental parameters of late-type stars in binaries using precise photometry. High-resolution spectroscopy. Imaging with adaptive optics and optical interferometry.*

- Dr. Régis Lachaume (Ph.D. Université de Grenoble, France, 2003) – *The vertical structure of accretion discs around young-mass young stars.*

- Dr. Adal Mesa-Delgado (Ph.D. Instituto de Astrofísica de Canarias, Spain, 2010) – *Interstellar Medium. HII regions. Chemical abundances.*

- Dr. Matías Montesinos (Ph.D. Observatoire de la Côte d'Azur, France, 2011) – *Accretion disks. Active Galactic Nuclei. Supermassive black holes. Numerical Simulations.*

- Dr. Roberto Muñoz (Ph.D. PUC, 2009) – *Galaxy evolution. Galaxy dynamics. Galaxy clusters. Dark matter mass profiles. Gravitational lensing.*

- Dr. David Murphy (Ph.D. Durham University, UK, 2011) – *Large-scale structure & extragalactic physics. Filaments and clusters of galaxies. Galaxy evolution*

- Dr. Álvaro Orsi (Ph.D. Durham University, UK, 2010) – *Galaxy formation. Large Scale structure. Semi-analytical modelling. High redshift galaxies. Lyα radiative transfer.*

- Dr. Jason Quinn (Ph.D. Notre Dame University, USA, 2007) – *Supernova Spectro-polarimetry. Error analysis. Numerical methods.*

- Dr. Markus Rabus (Ph.D. Universidad de la Laguna, Spain, 2009) – *Search and characterization of exoplanets.*

- Dr. Cristián Sáez (Ph.D. Penn State University, USA, 2010) – *Active Galactic Nuclei. AGN X-ray evolution. AGN winds in broad absorption line (BAL) quasars.*

- Dr. Roberto K. Saito (Ph.D. Universidade Federal de Santa Catarina, Brasil, 2008) – *Cataclysmic Variable Stars. Stellar Astrophysics. Astronomical Data Processing.*

- Dr. Stuart E. Sale (Ph.D. Imperial College London, UK, 2009) – *Interstellar extinction. Galactic astronomy. Stellar variability. Photometry.*

Support for the postdoctoral fellows comes from a combination of DAA funds, the FONDECYT program, grants from the Joint ESO–Chile Committee for the Development of Astronomy in Chile, the ALMA–FONDECYT and Gemini–FONDECYT funds, the Millennium Scientific Initiative, and the FONDAP program (see § 4).

2.4 Technical Staff and Assistants

- Fernando Álvarez *Caretaker.*

- Dr. Maurizio Baffico (Electrical Engineer, PUC, 2005; Ph.D. in Physics, Universidad de Chile, 1997) *In charge of telescopes at Santa Martina.*

- Carmen Gloria Cordovez *Administrative Assistant.*

- Lorena Guzmán (Journalist) *Outreach activities.*

- Lilena Montenegro *Administrative Assistant.*

- Gladys Reineking *Secretary*

- Vincent Suc (Electrical Engineer, INSA, Lyon, France) *Engineer for HAT-South and LDSS-3 / Megacam / MMIRS.*

- Ignacio Toledo *Teaching Observatory.*

- Giselle Ulloa (Administrator, PUC Valparaiso) *Administrative Coordinator of the Department.*

- Juan Véliz (Software Engineer, Universidad de Chile, 1991), *System Manager. Software Specialist.*

- Mariela Villanueva *IT Assistant.*

2.5 Recognitions, Awards and Sabbaticals

D. Minniti took sabbatical leave, partly at ESO, Chile, and partly at Princeton University, USA.

M. Zoccali took sabbatical leave, partly at ESO, Germany, and partly at the Observatory of Bologna, Italy. She received a Fellowship from the John Simon Guggenheim Memorial Foundation.

3 Academic Programs

3.1 Graduate Program and Students 2011

3.1.1 Graduate Program

The DAA offers Ph.D. and Master programs in Astrophysics. They include core courses on Physical Processes in Astrophysics, Advanced Stellar Astrophysics, and Advanced Extragalactic Astrophysics. The programs are completed with elective courses, supervised research, and a thesis. Students typically start research projects during their first semester.

3.1.2 Graduate Students

Students enrolled during this period were[1]: Paula Aguirre, María Alonso, Pía Amigo, Heather Andrews, Ignacio Araya, Cristobal Armaza, Pamela Arriagada, Juan Beamín, Claudio Cáceres, Daniela Carrasco, Mauricio Carrasco, Esteban Castillo, Andrea Corvillón, Cristina García, Jorge González, Nicolás González, Paulina González, Iván Lacerna, Rodrigo Leiva, Pablo Marchant, Gustavo Morales, Alejandra Muñoz, Camila Navarrete, Mauricio Ortiz, Lara Rodrigues, Osmar Rodríguez, Alejandra Rojas, Álvaro Rojas, Felipe Rojas, Cristóbal Sifón, Mirko Šimunović, Martha Talavera, Gabriel Torrealba, Martin Tournebouef, Aldo Valcarce, Sergio Vásquez, Nicolás Viaux and Paula Zelaya.

[1]Throughout § 3, we consider the academic activities from March 2011 till Feb. 2012.

3.1.3 New Admissions

Rafael Brahm (PUC) Felipe Garrido (PUC) and Matthew Taylor (Victoria, Canada) were admitted to the Ph.D. program starting August 2011. Cristóbal Armaza (PUC), Camila Navarrete (PUC) and Martin Tourneboeuf (XXX, France) were admitted to the M.Sc. program starting August 2011.

Ángel Rincón (U. Central, Venezuela) was admitted to the Ph.D. program to start in March 2012. Ignacio Becker (PUC) and Sebastian Marchi (U. de Chile) were admitted to the M.Sc. program to start in March 2012.

3.1.4 Degrees obtained, Student News & Flux

- Ma. Luisa Alonso obtained her Master's Degree, defending her thesis entitled "*The Origin of sdB Stars in Globular Clusters: Asteroseismological Diagnostics*", supervised by M. Catelan. She then moved to the KU Leuven, Belgium, to start a Ph.D. program.
- Heather Andrews obtained her Master's Degree, defending her thesis entitled "*Search for Variable Stars in the Globular Cluster NGC 5694*", supervised by F. Barrientos. She then moved to the University of Leiden, NL, to start a Ph.D. program.
- Ignacio Araya obtained his Master's Degree, defending his thesis entitled "*Dark Matter annihilation energy output and its effects on the high-z IGM*", supervised by N. Padilla. He then moved to the University of Southern California, USA, to start a Ph.D. program.
- Dr. Sergio Flores obtained his Ph.D. Degree, defending his thesis entitled "*Inside and outside neutron stars*", supervised by A. Reisenegger.
- Lara Rodrigues obtained her Master's Degree, defending her thesis entitled "*A Search for Variable Stars in the Globular Cluster NGC 5694*", supervised by M. Catelan. She then moved to the Universidad de Chile to start a Ph.D. program.
- Cristóbal Sifón obtained his Master's Degree, defending his thesis entitled "*Scaling relations in galaxy clusters detected using the Sunyaev Zeldovich effect*", supervised by F. Barrientos. He will soon move to the University of Leiden, NL, to start a Ph.D. program.
- Dr. Aldo Valcarce obtained his Ph.D. Degree, defending his thesis entitled "*Study of the Helium Enrichment in Globular Clusters*", supervised by M. Catelan. He then moved to the UFRN, Natal, Brazil, to take on a postdoctoral position.
- Dr. Mónica Zorotovic obtained her Ph.D. Degree, defending her thesis entitled "*Post-common-envelope binaries from SDSS: constraining the common-envelope efficiency and magnetic braking*", supervised by M. Catelan. She then moved to the Universidad de Valparaíso, to take on a postdoctoral position.

Jorge González, Pablo Marchant, Alejandra Muñoz and Sergio Vásquez obtained graduate fellowships from Conicyt.

Mónica Zorotovic received the *Premio de Excelencia en Tesis Doctoral*, awarded to the best doctoral thesis on Exact Sciences.

Cristóbal Sifón spent a month visiting Rutgers University, USA, from there he also visited and gave a talk at Princeton University.

Carlos Eduardo Ferreira Lopes arrived from UFRN, Natal, Brazil, as an exchange PhD student. He is doing his thesis under the joint supervision of M. Catelan (PUC) and J.R. de Medeiros (UFRN).

3.2 Undergraduate Program and Theses

The PUC undergraduate program in Astronomy currently has ∼100 students, who are consistently drawn from the top 2% of the ∼300,000 high school seniors who take the nationally administered entrance examination (PSU) each year.

A group of 28 new students registered in the program to start in March 2012. The last admitted student scored 700.1 points at the PSU.

Undergraduate students work full time the last semester of the program on a research project under the supervision of a faculty member, sometimes with a co-supervisor from another institution. The 14 students who obtained their degree during this period, the subject of their theses, and their supervisors are:

- Cristóbal Armaza *Stability of magnetic field in barotropic stars* – (A. Reisenegger)
- Maite Barros *The large scale structure of a simulated Universe* – (Á. Orsi, N. Padilla)
- Ignacio Becker *Evolución de un campo magnético con simetría axial en una estrella de neutrones* – (A. Reisenegger)
- Rafael Brahm *Automated stellar spectral classification via cross-correlation* – (A. Jordán)
- Néstor Espinoza *Component analysis of astrophysical time series: an application to transiting exoplanets* – (A. Jordán)
- Patricio Gallardo *Sidelobes and spillover in ACT* – (R. Dünner)

- Felipe Garrido *Physical models for AGN feedback* – (N. Padilla)
- Catalina Infante *Morphological selection of elliptical galaxies in the fields of RCS2* – (F. Barrientos)
- Camilo Muñoz *Estabilidad de los espejos del Atacama Cosmology Telescope* – (L. Infante)
- Camila Navarrete *Period–luminosity relations for delta Scuti stars* – (M. Catelan)
- Silvio Rodríguez *The intrinsic shapes of galaxies in SDSS/Galaxy Zoo* – (N. Padilla)
- Pedro Salas *SN 2007bg: The complex circumstellar medium* – (F. Bauer)
- Astrid San Martín *A* WISE *search for hot, dusty ULIRGs* – (F. Bauer)
- Tatiana Tapia *Estudio polarimétrico de LMC IRAS 05247-6941* – (A. Clocchiatti)

4 Grants

4.1 Department Grants

The DAA currently administers some special programs with specific goals and long time-scales.

The FONDAP Center for Astrophysics is a large institutional grant from CONICYT, Chile, to support research in astronomy and academic exchange between the DAA, the Astronomy Department of Universidad de Chile, and the Astrophysics Group of Universidad de Concepción. It provides funds for research, postdoctoral positions, graduate student fellowships, conferences, and travel.

The BASAL Center for Astrophysics and Associated Technologies is a large institutional grant from CONICYT, Chile, awarded to the DAA, the Astronomy Department of Universidad de Chile, and the Astrophysics Group of Universidad de Concepción. This Center supports research in astrophysics, national and international academic exchange, and collaborations with the Observatories in Chile, providing funds for research, postdoctoral positions, graduate student fellowships, organization of workshops and conferences, and travel.

4.2 Group Grants

4.2.1 Anillo

Development of technologies for astronomical observations. Chile: from host to active partner in the construction of the next generation astronomical telescopes is a grant from CONICYT awarded to a team of scientists from the PUC School of Engineering (L. Vanzi (PI), A. Guesalaga, D. Celentano, et al.) and the DAA (L. Infante, A. Jordán, et al.). The goal of the project is to acquire and develop front line technologies in a number of selected areas of science and engineering to be employed in the next generation astronomical telescopes, to make the institutes involved, competitive in the specific fields selected and to convert them in attractive partners for the international organizations leading the design and construction of the next generation telescopes, in Chile as well as abroad.

4.2.2 Milenios

The Milky Way Millennium Nucleus is a grant from MIDEPLAN awarded to a team of scientists from the DAA (M. Catelan (PI), D. Minniti, A. Jordán, M. Zoccali) and the Universidad de Valparaíso (J. Borissova). The main aim is to support research related with the formation and evolution of the Milky Way. Specifically, the research project has its core in the VISTA Variable in the Via Lactea ESO Public Survey, which will obtain a time series map of the whole Bulge and a large fraction of the Disk of our Galaxy. This grant provides funding for research, postdoctoral fellowships, studentships, outreach, organization of conferences and other networking activities. (`www.milenio-vialactea.cl`)

The Millennium Center for Supernova Studies is a triennial grant originally from MIDEPLAN, now administered by MINECON, awarded in 2008 to a team of astronomers from the DAA (A. Clocchiatti) and the Department of Astronomy of Universidad de Chile (M. Hamuy, and J. Maza). The goal of the project is to further the study of SNe from Chile, both in detail to better know the astrophysics of progenitors and the physics of explosions, and to improve their usage as cosmologically relevant distance estimators. The grant was competitively renewed in early 2011 for an additional period of three years. The team has been enlarged to include G. Pignata (U. Andrés Bello) and F. Bauer (DAA).

4.3 Individual Research Grants

4.3.1 FONDECYT Regular Projects

- F. Barrientos: *Probing the Universe With Galaxy Clusters.*
- F. Bauer: *The Role of AGN Feedback in the Coeval Growth of Supermassive Black Holes and Galaxies.*
- M. Catelan: *Stellar Populations and Variability in the Local Group.*
- M. Catelan: *Low-Mass Stars in Stellar Systems as Astrophysical Laboratories.*
- G. Galaz: *The Impact of Environment on Stellar Formation in Low Surface Brightness Galaxies.*

- A. Jordán: *From Discovery to Understanding: the First 24-Hour Global Network to Find and Characterize Transiting Exoplanets.*
- D. Minniti: *Vista Variables in the Via Lactea.*
- N. Padilla: *Understanding the Origin and Evolution of Galaxies.*
- N. Padilla: *Lighting Up the Dark Universe.*
- A. Reisenegger: *Thermal and Magnetic Evolution of Neutron Stars.*
- M. Zoccali: *Formation and Evolution of the Milky Way Spheroid.*
- M. Zoccali: *A Complete Characterization of the Galactic Bulge Stellar Population.*

4.3.2 FONDECYT Initiation into Research Projects

- J. Cuadra: *Black Hole Mergers and Kicks in Gas-Rich Galaxies.*
- R. Dünner: *Chile ACT Ultradeep Survey.*

4.3.3 FONDECYT Postdoctoral Grants

- A. Alves-Brito: *Galactic Archeology: Red Giant Stars As Probe of Galactic Chemical Evolution.*
- R. Angeloni: *Topics in Stellar Variability: From Vista to Alma.*
- H. Francke: *Clustering Properties of High-Redshift Galaxies.*
- K. Hełminiak: *Detached eclipsing binaries in large photometric surveys – precise characterization for a new level of stellar astrophysics.*
- M. Montesinos: *Dynamics of astrophysical accretion disks.*
- D. Murphy: *Probing the nature and content of the universe with galaxy clusters.*
- Á. Orsi: *Galaxy formation in the LSST era.*
- C. Sáez: *A multiwavelength study of AGN evolution and quasar outflows.*
- M. Rabus: *Rising exoplanets: a major chilean contribution to the emerging field of exoplanetology.*

4.3.4 ALMA–CONICYT Projects

- F. Barrientos: *Support for the Graduate Program in Astrophysics at PUC.*
- F. Bauer: *The PUC–ALMA Initiative.*
- R. Dünner: *Academic Radio Interferometer (ARI).*

4.3.5 Gemini–CONICYT Projects

- N. Padilla: *Postdoc position for the Center of Astro-Engineering UC.*
- T.H. Puzia: *The Next Generation Virgo Cluster Survey - Infrared (NGVS-IR).*

4.3.6 Other External Grants

- N. Padilla: FONDECYT International collaboration Research Project *Understanding the Origin and Evolution of Galaxies.*
- A. Reisenegger: DFG–CONICYT Project *Magnetic Fields of Massive Stars and their Compact Remnants.*

4.3.7 PUC-funded Grants

- J. Cuadra: *Massive black holes, stars and gas in the central parsecs of galaxies.*
- R. Dünner: *Chile ACT Ultradeep Survey.*

5 Exchange Agreements and International Networks

5.1 Bilateral agreements

The DAA has agreements with several institutions with the goal of strengthening its research activity and its graduate program. These agreements allow exchange visits of researchers and students. In some cases, the thesis is recognised by both institutions, resulting in a double PhD degree. Currently, we have agreements with the Universities of Heidelberg, Johns Hopkins, Maryland, Padova, and Princeton.

As a result of these agreements, PUC PhD student Mauricio Carrasco is spending one year working with Matthias Bartelmann at ITA-Heidelberg on *Dark Matter Distribution in Massive Strong-Lensing Galaxy Clusters*, and Maryland–PUC Postdoctoral Scientist Dr. Demerese Salter will spend 2012 at PUC.

5.2 Marie Curie network LACEGAL

The Latin American–Chinese–European Galaxy Formation (LACEGAL) network was approved in November 2010 to bring together internationally recognised experts in the theory of galaxy formation and the modelling of the growth of cosmic structure. The network allows new research collaborations to be made between the main groups working in the subject in Latin America and China, and the principal centres in computational galaxy formation and astrophysics in Europe. The local coordinator is Nelson Padilla.

The programme first call at PUC was made in 2011, and visiting trips for the period 2011–2012 were awarded to S. Contreras (Durham), J. Cuadra (MPA),

H. Francke (Durham), N. González-Jiménez (MPA), Á. Orsi (Durham), N. Padilla (Durham), S. Salazar and J. Véliz (Durham).

6 Office, Computing and Teaching facilities

The DAA occupies 1,815 m^2 in the joint building of the Faculties of Physics and Mathematics, located in the San Joaquín Campus of PUC, to the south of downtown Santiago. Of that surface, 1410 m^2 correspond to the DAA proper, while the remaining 405 m^2 are occupied by the Centre for Astro-Engineering. The building accommodates offices for faculty, postdocs and graduate students, optics and electronics workshops, a special room for our super-computer, joint computer rooms for undergraduates, and conference rooms, including an auditorium seating 100 people.

The building also hosts the "Gauss" Physics and Math library with ∼30,000 books and journal volumes. Staff members, students and visitors also have access to the University library system with more than 300,000 books and hundreds of periodical publications, including around 60 titles in different branches of physics. The University supports, in addition, on-line access to all major astrophysics journals. Finally, the DAA hosts since 1998 the first Latin-American mirror of NASA's Astrophysical Data System (ADS).

The DAA has a computer network maintained by a full-time software engineer and a half-time assistant. It includes a cluster consisting of 64 nodes with a total of 128 Intel Xeon Quad-Core CPUs (512 cores), 1024 GB of RAM, 40 TB of disk space (iSCSI), and a Linux system for 64-bit architecture running over a 1 Gbps ethernet network. Development and execution tools include Intel Fortran and Intel C compilers (ifort, icc), mpich2, Distributed Resource Management (DRM) software SGE (Sun Grid Engine), and standard tools (gcc, g++, gfortran, etc). Users at DAA have access to the cluster via personal accounts and get access to the cluster resources by the DRM system that defines use and priority of each user to the total resources. Postdoctoral fellow Á. Orsi dedicates a fraction of his time to help manage the use of the computing cluster.

6.1 Santa Martina Observatory

The DAA maintains a small Observatory in the eastern outskirts of Santiago at an altitude of 1450 m, some 60-minute drive from Campus, mostly dedicated to teaching and astronomy laboratories for our undergraduate students. Permanently installed in a joint dome are a 50 cm telescope (the old ESO 50 cm), and a 40 cm telescope (one of the two old CTIO 16-inch telescopes) and, in a separate dome, a commercial Meade 40 cm used with a CCD camera for basic teaching. The two professional telescopes have locally-upgraded control systems and new instrumentation, including CCD cameras, spectrographs and a new fibre spectrograph at the 50 cm. All three are controlled from a common control room when needed. The two professional telescopes are partly used for testing and developing instrumentation and for some advanced student research programs. A Meade 30 cm is available for visual observations by students and visitors. Besides, the site hosts the dome of one of the SLOOH world network telescopes, remotely controlled via the Web. A small planetarium is also available to teach students the celestial coordinate systems. Current activities take place three to four times weekly (weather permitting) and include teaching, scientific and outreach experiences.

6.1.1 The 'PUCHEROS' spctrograph

In January 2011, the PUC High Echelle Resolution Optical Spectrograph (PUCHEROS) was installed at the ESO50 cm telescope in Santa Martina. The instrument provides spectroscopy over the entire visible range with a resolution of 20,000 and a limiting magnitudes of V about 9. Commissioning was carried out during the first months of the year and then an early science phase started. PUCHEROS is the result of a three year effort including design, manufacturing and assembling realized at the Center of Astro Engineering UC (AIUC). The technical details and early results are described in Vanzi et al. 2012 (submitted to A&A).

The installation of the instrument is a really important step in the development of the Observatory and of the area of astronomical instrumentation at PUC. PUCHEROS allows for the first time to use the UC observatory for scientific research and to our knowledge it is the first entirely Chilean instrument collecting photons, in fact it was involved in the monitoring campaign of the recurrent Nova T Pyxidis during its 2011 burst. PUCHEROS is currently in operation at the observatory, the observing time is shared among a number of projects, mainly monitoring of Be stars, luminous blue variables, and binary stars. The instrument is intensively used by students in their advanced courses of astrophysics and in some cases in their work of thesis, as it allows them to get experience with the main features of professional level instruments.

7 Meetings supported

One of the activities of the DAA is to support meetings and graduate schools in Chile to foster the development of local professional astronomy. In the period reported, activities organized, sponsored, and/or supported were (name of meeting/school, organizing institution, place and date)

- *Galaxy Formation in a Hierarchical Universe* (DAA; Campus San Joaquín, Santiago, March 2011).
- *Astronomical Instrumentation and Opto-Mechanics* (University of Arizona / AIUC; Campus San Joaquín, Santiago, March 2011).
- *Science Jamboree* (DAA; Campus San Joaquín, Santiago, March 2011).
- *Mini Workshop on Cosmology and Astrophysics* (PUC; Campus San Joaquín, Santiago, April 2011).
- *Optical/IR Galactic Plane Surveys Meeting including The 2nd VVV Science Meeting* (University of Hertfordshire, UK, July 2011)
- *Exploring the Nature of the Evolving Universe* (PUC-Rio, Brazil, Aug. 2011)
- *Pucheros Science Day* (AIUC; Campus San Joaquín, Santiago, Nov. 2011).

8 Outreach

The outreach activity at the DAA was centered on appearances in mass media and in activities for schools and the general public.

During 2011, several students and staff appeared in newspapers a total of 41 times, in television 19 times, 5 in radio stations, and 16 times in UC media.

The outreach activities carried out in 2011 include the organization of the talk given by Susana Biró, author of "Otros mundos en la Luna", and the mini-workshop on History of Astronomy lead by Alberto Righini, both held at the Centro de Extensión UC. At the Centro, we held the new edition of the course "Astronomía", which consisted in 9 talks by members of the Department, and the new cycle "Astronomía de Película", which featured 4 talks with explanations of the physics and astronomy behind science fiction movies.

One of the major activities of the year was done in collaboration with the Science Museum of La Pintana, one of the communes with the lowest standard of living in Santiago, with whom we presented the DAA–Milenio para la Vía Láctea Mobile Planetarium to 12 public schools. Approximately 1000 primary and secondary school students participated in the activity, where staff, postdocs and graduate students of DAA explained astronomical subjects covering from the Solar System to Cosmology.

Other activities included our participation in the Astro-photography workshop held at ESO, organized by the ACHAYA, and a course of 10 talks for the UC program for the elderly.

Other activities included our participation in the Astro-photography workshop held at ESO, organized by the ACHAYA, a course of 10 talks for the UC program for the elderly, and participation of several DAA graduate students in the cycle "Noche de Estrellas" organized by ESO.

9 Refereed Publications

Astronomers from the DAA, including students, participated in 119 refereed papers published in 2011. The full list is given below.

1. Acquaviva V., Gawiser E., **Guaita L.**: *Spectral Energy Distribution Fitting with Markov Chain Monte Carlo: Methodology and Application to $z = 3.1$ Lyα-emitting Galaxies.* ApJ 737, 47
2. Adami C., Mazure A., Pierre M., Sprimont P. G., Libbrecht C., Pacaud F., Clerc N., Sadibekova T., Surdej J., Altieri B., Duc P. A., **Galaz G.**, Gueguen A., Guennou L., Hertling G., Ilbert O., Le Fèvre J. P., **Quintana H.**, Valtchanov I., Willis J. P., Akiyama M., Aussel H., Chiappetti L., Detal A., Garilli B., Lebrun V., Lefèvre O., Maccagni D., Melin J. B., Ponman T. J., Ricci D., Tresse L.: *The XMM-LSS survey: optical assessment and properties of different X-ray selected cluster classes.* A&A 526, A18
3. Alexander D. M., **Bauer F. E.**, Brandt W. N., Daddi E., Hickox R. C., Lehmer B. D., Luo B., Xue Y. Q., Young M., Comastri A., Del Moro A., Fabian A. C., Gilli R., Goulding A. D., Mainieri V., Mullaney J. R., Paolillo M., Rafferty D. A., Schneider D. P., Shemmer O., Vignali C.: *X-Ray Spectral Constraints for $z \approx 2$ Massive Galaxies: The Identification of Reflection-dominated Active Galactic Nuclei.* ApJ 738, 44
4. **Alonso-García J.**, Mateo M., Sen B., Banerjee M., von Braun K.: *Mapping Differential Reddening in the Inner Galactic Globular Cluster System.* AJ 141, 146
5. **Alves-Brito A.**, Karakas A. I., Yong D., Meléndez J., Vásquez S.: *CNO and F abundances in the barium star HD 123396.* A&A 536, A40
6. **Alves-Brito A.**, Hau G. K. T., Forbes D. A., Spitler L. R., Strader J., Brodie J. P., Rhode K. L.: *Spectra of globular clusters in the Sombrero galaxy: evidence for spectroscopic metallicity bimodality.* MNRAS 417, 1823
7. **Angeloni R.**, Di Mille F., Bland-Hawthorn J., Osip D. J.: *Discovery of a Giant, Highly Collimated Jet from Sanduleak's Star in the Large Magellanic Cloud.* ApJ 743, L8

8. Béky B., Bakos G. Á., Hartman J., Torres G., Latham D. W., **Jordán A.**, **Arriagada P.**, Bayliss D., Kiss L. L., Kovács G., Quinn S. N., Marcy G. W., Howard A. W., Fischer D. A., Johnson J. A., Esquerdo G. A., Noyes R. W., Buchhave L. A., Sasselov D. D., Stefanik R. P., Perumpilly G., Lázár J., Papp I., Sári P.: *HAT-P-27b: A Hot Jupiter Transiting a G Star on a 3 Day Orbit.* ApJ 734, 109

9. Baruteau C., **Cuadra J.**, Lin D. N. C.: *Binaries Migrating in a Gaseous Disk: Where are the Galactic Center Binaries?.* ApJ 726, 28

10. Bensby T., **Alves-Brito A.**, Oey M. S., Yong D., Meléndez J.: *A First Constraint on the Thick Disk Scale Length: Differential Radial Abundances in K Giants at Galactocentric Radii 4, 8, and 12 kpc.* ApJ 735, L46

11. Bielby R. M., Shanks T., Weilbacher P. M., **Infante L.**, Crighton N. H. M., Bornancini C., Bouché N., Héraudeau P., Lambas D. G., Lowenthal J., **Minniti D.**, **Padilla N.**, Petitjean P., Theuns T.: *The VLT LBG Redshift Survey - I. Clustering and dynamics of ≈1000 galaxies at $z \approx 3$.* MNRAS 414, 2

12. Borissova J., Bonatto C., Kurtev R., Clarke J. R. A., Peñaloza F., **Sale S. E.**, **Minniti D.**, **Alonso-García J.**, Artigau E., Barbá R., Bica E., Baume G. L., **Catelan M.**, Chenè A. N., Dias B., Folkes S. L., Froebrich D., Geisler D., de Grijs R., Hanson M. M., **Hempel M.**, Ivanov V. D., Kumar M. S. N., Lucas P., Mauro F., Moni Bidin C., Rejkuba M., **Saito R. K.**, Tamura M., **Toledo I.**: *New Galactic star clusters discovered in the VVV survey.* A&A 532, A131

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17. Ceccarelli L., Paz D. J., **Padilla N.**, Lambas D. G.: *Large-scale anisotropies on halo infall.* MNRAS 412, 1778

18. Chilingarian I. V., Mieske S., Hilker M., **Infante L.**: *Dynamical versus stellar masses of ultracompact dwarf galaxies in the Fornax cluster.* MNRAS 412, 1627

19. Clarkson W. I., Sahu K. C., Anderson J., Rich R. M., Smith T. E., Brown T. M., Bond H. E., Livio M., **Minniti D.**, Renzini A., **Zoccali M.**: *The First Detection of Blue Straggler Stars in the Milky Way Bulge.* ApJ 735, 37

20. **Clocchiatti A.**, Suntzeff N. B., Covarrubias R., Candia P.: *The Ultimate Light Curve of SN 1998bw /GRB 980425.* AJ 141, 163

21. Cockcroft R., Harris W. E., Ferguson A. M. N., Huxor A., Ibata R., Irwin M. J., McConnachie A. W., Woodley K. A., Chapman S. C., Lewis G. F., **Puzia T. H.**: *The M33 Globular Cluster System with PAndAS Data: the Last Outer Halo Cluster?.* ApJ 730, 112

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