Report of the National Institute of Science and Technology in Astrophysics (INCT-A) - 2010

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What is the INCTA? – An executive summary

Context

Brazilian Astronomy, although young, has already made some important achievements. The first graduate programs were established in the 1970´s and, since then, the community experimented continuous and vigorous growth. Today nearly 30 institutions support of astronomical research at some level. The first scientific equipment were planned and built in the early 1970´s; an important strategic step was the construction of LNA – the first (and for long time the only one) national laboratory to operate in Brazil. Thanks to this laboratory, Brazilian Astronomy experienced a growth, both in quantity and in quality. This allowed joining the Gemini and SOAR consortia in the 1990´s. These consortia operate world class astronomical instruments.

The situation of optical and infrared astronomy is, thus, quite favorable. The participation in the Gemini and SOAR consortia has put our community in contact with the best practices of science management and, at the same time, integrated networks of specialists. Although the SOAR telescope does not have its full instrumentation operational, we already can state that Brazilian contribution to the publications of both Gemini and SOAR consortia is at the highest ranking. At the same time the perspective of world–class instrumentation has revitalized the various groups and attracted young talented people to the graduate programs.

For the next decade, world astronomy is planning new and significant steps. At all wavelengths, a next generation of telescopes is under construction: optical 20-40m class (GMT, TMT, ELT) telescopes, radio-interferometers (ALMA, SKA), a new generation of space-borne instruments (IXO, Webb) and a large deep optical survey telescope (LSST). Many of these equipments are multinational initiatives, given the high costs involved, some of them, in the range of a billion dollars and will take 10 to 15 years to be built. Direct participation in such

projects is beyond our possibilities, but there are niches from which our astronomy may benefit. The form and intensity of these benefits depend on some new investments but mostly on careful and strategic planning. If this is not done, our community will have less and less opportunities in the international scenarios for the coming decades.

In the present INCT, a significant number of researchers from many institutions meet, to plan and implement actions, having in mind the future of Brazilian Astronomy. ***We are researchers from diverse institutions and of distinct specialties, but we all need the same scientific infrastructure and above all, similar collective strategies.*** *These are the characteristics that provide the* ***unity*** *to this initiative. These strategies are more and more necessary, given the high costs of the new research equipment and timescales needed for their construction.*

Our community already has a national laboratory (LNA) that operates the national infrastructure in optical and infrared astronomy. The INCTA aims toward a partnership with LNA and other institutions to mobilize the community in fostering the best insertion of Brazilian Astronomy in the great international projects underway and those that still will be proposed.

Moreover, we want to promote the culture of technological innovation by supporting the development of world class instrumentation aimed at basic research.

If in the recent past Brazilian Astronomy has advanced in a significant way, its future depends on our planning and organization capabilities. New large and expensive projects are under way in the developed countries, many of them in the form of international consortia, given their high costs, which are prohibitive toward our direct participation. However it is possible to create alternative routes, identifying niches that can bring benefits to our science through creative strategies of international cooperation.

Such associations will increase the networking, both institutional and individual, showing us the best international practices of organization, planning and management of science. This effort is of fundamental importance to provide the environment for the next generation of scientist to perform frontier research.

The "Instituto Nacional em Ciência e Tecnologia em Astrofísica – INCTA", in addition to the host institute, has one associated laboratory (LNA), 3 other MCT research institutes, 14 federal universities, 3 state universities and 6 private universities, comprising a total of 32 research groups, 12 being consolidated and 20 emerging ones in 27 different institutions. A total of 144 PhD scientists are joining the institute; 52 of them have CNPq scientific productivity fellowship, 12 being level 1A.

Misssion

The mission of the National Institute of Science and Technology in Astrophysics is to insert Brazilian Astronomy into the future of the World Astronomy.

Strategic Goals

1- Maximizing the return from the Gemini and SOAR telescopes.

a) Scientific return: Brazil already presents the highest productivity index among the Gemini partners (Brazilians have used 2.3% of the time and published 10% of the papers). For the SOAR telescope this statistical comparison is still premature as the telescope was built about 5 years later than Gemini. Surely the numbers that matter are not only the number of papers.

Quality is also relevant. As a goal, we propose that Brazil maintains the leadership in scientific productivity for both Gemini and SOAR consortia for the next 5 years.

b) Graduate programs: There are 10 graduate programs that offer Master+PhD programs in Astronomy (USP; UFRGS; UFMG; ON; INPE; UFRN; UFSC; UNIVAP; UFSM; FEG-UNESP). Another 4 offer master degree only (UNICSUL; OV-UFRJ; UESC; UERN). The possibilities opened with the access to the Gemini and SOAR telescopes have attracted many new talented people to Astronomy. Today we have a good number of promising talented young people in our graduate programs and integrating them in the scientific production with the use of large telescopes and world-class instruments is one of the most effective ways of attracting and educating more talented people. Our goal is to double the number of papers published by Brazilian graduate students with data from the Gemini and SOAR telescopes in the next 3 years (2009-11 compared to 2006-08) with a following growth of 15% per year.

c) Supporting emerging groups: Besides attracting and educating talented people, we also want them to get a job in our country. Our major research institutes seem to be saturated growth wise. At the same time, the vast majority of universities do not have a single astronomy professor. In recent years Brazilian Astronomy has, in fact, experimented a new phenomenon: non-traditional universities, both public and private, have hired a number of young and productive astronomers in their faculty. These new groups, often very small in number, need to be supported, integrated in networks and have access to the best existing equipment. Our goal is to double the number of papers published with authors from emerging groups with data obtained from Gemini, SOAR and alike, for the next 3 years, followed by a growth of 15% per year. Among other incentives, INCTA will provide support to their research, by supplying computer equipment to researchers that obtain observing time with large telescopes provided they are justified within the aims of the Institute. We propose to support the participation of people from emerging groups in scientific meetings when presenting results from large telescopes. These groups will also have access to financial support to foster national and international networking, that is, contact with scientists for seminars, to avoid intellectual isolation, as most of these groups are located far from the main centers.

d) Stimulate the development of instrumentation for the Gemini and SOAR telescopes. The Brazilian participation in the Gemini and SOAR consortia has allowed, for the first time, the effective construction of modern instruments for large telescopes. Currently Brazil is concluding the construction of the SIFS – SOAR Integral Field Spectrograph – with 1300 fibers, capable of operating with adaptive optics. Other two instruments are in distinct phases of construction: the Steles (high resolution spectrograph) and the BTFI (Fabry-Perot large field imaging spectrograph). Our goal: to conclude the construction and commissioning of the three instruments underway and begin a new one in the next three years.

2 – Brazilian Astronomy in the era of the LSST and ELT projects. *The next generation of large telescopes is being planned now. The GMT, TMT and E-ELT are in the process of starting their construction. It is important for Brazilian astronomy to establish a strategy for the era of ELTs, that will be operational by the year 2020. The Large Synoptic Survey Telescope, on the other hand, is a North-American initiative for building and operating a telescope of 6.5 m effective aperture (8.4m nominal) to monitor the sky in 6 filters. This will be a deep survey with an*

unprecedented approach in the sense that it will revisit the same regions in the sky at about every 4 days, so that it will add a temporal dimension to the data. The magnitude limit for single observations will be r ~24 and it will have a cumulative limit of r~27.5. This project has 4 main broad goals: a) the nature of dark energy and dark matter; b) The transient sky; c) The structure of the Milky Way and d) The structure of the Solar System. This project will make some observations available in real time having profound impact on Brazilian Astronomy.

Participation in the VISTA-VVV project will be a pilot to learning how to treat large datasets.

***3 – Virtual observatories**. Great part of the data from space missions and also from ground based telescopes is available in databases. These datasets contain a wealth of information and mining them may be of enormous benefit to Brazilian Astronomy, without proportional financial investments. Significant effort in software is imperative to make the appropriate and necessary development. Our goal is to have an operational network of virtual observatories in Brazil within the next 3 years.*

***4 – New projects of scientific equipment**. A minimum of 3 new projects, to be defined by the Science committee, will be elaborated and proposed: at least one in radio-astronomy, at least one scientific satellite and at least one in optical/infrared astronomy. These projects will be elaborated to the point where they can be presented to the funding agencies or to possible international partners.*

*5 – **Education activities:** Brazil has currently about 300 000 teachers of Science and Mathematics. The content and knowledge of Astronomy is minimum. We propose to organize a distance learning course on Astronomy for science teachers all over the Country. The idea is to establish a virtual ambient for an online "distance learning course". We propose to establish partnerships with the State Governments and Universities to create a large network to foster this idea.*

INCT-A: Institutions

INCT-A is a network of 144 researchers of the following institutions

Host Institution:
Instituto de Astronomia, Geofísica e Ciências Atmosféricas – Universidade de São Paulo

Associated Laboratory:
Laboratório Nacional de Astrofísica – LNA

Associated Universities and Institutes:
UFRGS – Universidade Federal do Rio Grande do Sul-RS
UFRJ – Universidade Federal do Rio de Janeiro-RJ
UFMG – Universidade Federal de Minas Gerais-MG
UFSC – Universidade Federal de Santa Catarina-SC

UFSM – Universidade Federal de Santa Maria-RS
UFPel – Universidade Federal de Pelotas-RS
UFJF – Universidade Federal de Juiz de Fora-MG
UNIPAMPA – Universidade Federal do Pampa-RS
UFABC – Universidade Federal do ABC-SP
UNIVASF – Universidade Federal do Vale do São Francisco-PE
UNIFEI – Universidade Federal de Itajubá-MG
UFSCar - Universidade Federal de São Carlos – SP
UNB – Universidade de Brasília - DF
UNIFESP - Universidade Federal de São Paulo - SP
UNESP – Universidade Estadual Júlio de Mesquita Filho-SP
UESC – Universidade de Santa Cruz – Ilhéus/BA
UEL – Universidade Estadual de Londrina -PR
Universidade Presbiteriana Mackenzie - SP
UNICSUL – Universidade Cruzeiro do Sul - SP
UNIVAP- Universidade do Vale do Paraíba - SP
UCS – Universidade de Caxias do Sul - RS
UDESC – Universidade para o Desenvolvimento do Estado de Sta. Catarina
Fundação Santo André –SP

Observatório Nacional – ON
Instituto Nacional de Pesquisas Espaciais – INPE
Centro Brasileiro de Pesquisas Físicas – CBPF

Site: WWW.astro.iag.usp.br/~incta

The report: 2009 and 2010

Introduction

This is a scientific report of the National Institute for Science and Technology in Astrophysics - INCT-A. The activity INCT-A began in May 2009, after the first resources were received. Soon after we had the meeting of the IAU General Assembly in Rio de Janeiro, which required very large concentration of efforts of the main leadership. Therefore the activities started in fact in the second half and were accelerated in 2010.

Also in May 2009 the Scientific Committee of INCT-A decided to adopt as a method of planning, the elaboration of "White Papers" for the different activities. Two months later, the MCT has formed a Special Committee on Astronomy - CEA. This Commission also decided to produce "White Papers" (WP), hence the initiative of the WP/INCT-A merged with those of CEA and a significant number of WP was released. This is the first step of planning INCT-A and WP with strong participation of members of INCT-A are reproduced in the annexes and make up the essence of this report. Both this report as the other documents are available to the public on the website of INCT-A:

www.astro.iag.usp.br / incta

Below we present results, by item, of our five strategic objectives.

1 - Return on investments in the Gemini and SOAR

1a - Scientific Production

In 2009, the 144 researchers of the INCT in Astrophysics published 148 papers (see Annex A). Of these, 83% were published in journals classified as Qualis A by CAPES (see Table 1). It is true that significant scientific output would have occurred without the existence of INCT. On the other hand it shows that the group of researchers linked to INCT has a great capacity for scientific work and that a strategic plan for that area makes sense.

Brazil's participation in the Gemini and SOAR has shown significant return. In Gemini, the Brazilian participation in refereed publications is already about 10% and is growing. In 2009, Brazilian authors participated in 13% of the papers and 9% were the first authors. Altogether 69 authors have signed Brazilian papers with data from Gemini to date.

In SOAR, scientific production is still incipient. This telescope began its operation five years after the Gemini. Still, we can say that Brazil accounts for 54% of the papers published to date, having used only 30% of the time. We list the publications of Brazilian authors containing data from the Gemini and SOAR telescopes bellow. Perhaps more important at this time is that the SOAR Telescope has enabled Brazilian Astronomy to establish a world class instrumentation program (see below).

1b / c - Human Resources and Emerging Groups

In terms of human resource training, the INCTA allocated postgraduate scholarships for Masters,

restricted to emerging groups. In addition, the emerging groups produced a "White Paper" proposing a strategy for action (Annex 1b).

A collection of books in Astronomy, written in Portuguese, was acquired by INCT-A and allocated to all emerging groups.

A total of 7 lap-tops, 5 desk-tops, 2 VO servers and 1 Videocon equipment were allocated to the emerging groups.

The researchers of the INCT-A advised 11 Ms and 8 PhD theses in 2009 and 15 Ms and 8 PhD theses in 2010

1d - Instrumentation

The SOAR Telescope has enabled the development of a world-class instrumentation program. In December/2009, SIFS (SOAR Integral Field Spectrograph see Annex 1d) was sent (with financial support from INCT-A) to Chile. This spectrograph is already installed on the telescope and is in its commissioning phase (see Annex Item 1d). The spectrograph, with a cost of U.S. $ 1 420 000.00, was funded mostly by FAPESP with a contribution from LNA/MCT. The participation of INCTA was small (components, transportation and fixing).

Most of the INCT/FAPESP spending in the first year was related to BTFi (Brazilian Tunable Filter Imager). This project, coordinated by Prof. Claudia Mendes de Oliveira, has a budget of one million dollars and is being funded directly by FAPESP (53%), indirectly by FAPESP through INCTA (29%) and by LNA (13%). The instrument has been transported to Chile and is being commissioned.

2 - Brazil in the era of LSST and ELTs

The discussions on ELTs (Extremely Large Telescopes) have taken much of the efforts of INCTA. Several contacts and meetings were held between the sub-group with special responsibility and the various projects. Annexes 2a, 2b and 2c describe these activities.

3 - Virtual Observatories

A sub-group was appointed that is responsible for drafting a "White Paper" (see Annex 3a). Three researchers participated in international events in the IVOA-International Virtual Observatory Alliance in Munich and in Victoria. Their trip reports can be found on the INCTA site. Trough INCTA, Brazil became a member of the IVOA.

4 - New projects

With respect to this item, a sizable number of white papers were produced (see annexes 4). As for projects, they can be classified between instrumental and purely scientific. They map the demand from Brazilian astronomy with detail.

The INCT along with INESPAÇO hosted a workshop on the prospects of space astronomy in Brazil.

The INCT-A has supported the study of a collaboration between groups from Spain and Brazil to built the J-PAS, a 2.5 meter telescope with 7 square degrees of field of view and 42

narrow band filters. This project aims to study the Physics of the Accelerating Universe (PAU). A southern version (PAU-Brasil) is under consideration.

5 - Education

For the past decade the number of professional astronomer has grown considerably in Brazil. Meanwhile, the educational paradigms for basic levels schools have also changed. A broad range of new scientific and technological approaches are now mandatory, and Astronomy has finally been placed as a key theme for science teaching. However, despite of the increasing number of astronomers in the country, Astronomy has not reached the teacher's undergraduate courses. As a consequence, lectures at all basic level schools lack on scientific precision and essential concepts are misunderstood even by those who are supposed to teach. Currently, there are around 300,000 teachers of basic levels schools teaching Astronomy without any undergraduate level courses.

In this context, the INCT-A approved the creation of a working group on Astronomy Education to develop one of the strategic goals of the project. The working group is responsible for:

- create a course of Astronomy for teachers of basic level schools (completely free);
- establish a virtual ambient for an online "distance learning course";
- establish partnerships with local state government and federal government in order to guarantee professional advantages for the teachers;
- establish a network between the centers of Astronomy in Brazil in order to reach the maximum number of teachers, focusing on the less developed regions of the country.

The working group is formed by astronomers of several institutions including universities in South, Southeast and Northeast regions of Brazil. It also counts with the presence of experts on educational sciences that helps on the creation of the texts, podcasts, movies and animations that are been created for the online courses. The production of texts on basic Astronomy and Astrophysics was provided by the scientists members of the INCT-A. The current stage of the project is of adapting the texts to its educational context, which is being done by the learning science experts hired for this purpose. Meanwhile, the virtual ambient is also in the production process. The group estimates March/April as final deadlines for the material to be online and launching date for the course to the first group of teachers.

Investments made in the period 2009-2010

Acquisition of computer facilities for emerging groups:

Lap-tops:
Cássio Barbosa (UNIVAP)
Alexandre Soares de Oliveira (UNIVAP)
Lucimara Martins (UNICSUL)
Fabrício Ferrari (UNIPAMPA)
Nadja Magalhães (UNIFESP)
Paulo Afrânio Lopes (OV-UFRJ)

Desk-Tops:
Rogemar Riffel (UFSM)
Irapuan Rodrigues (UNIVAP)
2 x Gustavo Lanfranchi (UNICSUL)
Diego Falceta-Gonçalves (USP-Leste)
Henri Plana (UESC)

Videocon equipment
Sílvia Lorenz (UFRJ)

Virtual Observatory servers:
Paula Coelho (UNICSUL)
Roberto Cid Fernandes (UFSC)

Acquisition of Astronomy books for emerging groups

- UNIPAMPA
- UFRJ/Observatório Valongo
- UNIFEI
- UNICSUL
- UESC
- UFSM
- UFABC
- UFSC
- UNIVAP
- UNIFESP

Acquisition of computer facility for community use

High Performance GPU processor
Alex Carciofi (IAG-USP)
This equipment, running at 2.3 teraflops, has been installed at IAG-USP for community use.

Desk-top computer were allocated to people working for the INCT-A
Carlos Paladini (IAG-USP)
Anne Louise Scarinci (IAG-USP)
Maria Teresa Lopes (IAG-USP)

International Travel

- Visit to ALMA (Chile)
- Visit to TMT and GMT (Pasadena CA-USA)
- PFS (Los Angeles – USA)
- J-PAS (Teruel - Spain)
- SPIE Astronomical Telescopes and Instrumentation (San Diego-USA)
- Asymmetric Planetary Nebulae V (UK)-Denise Gonçalves
- Virtual Observatory (Munich - Germany)
- Virtual Observatory (Victoria - Canada)
- Gemini users training (Tucson – USA)
- Visit to SPARTAN (Chile)
- Observation mission to IRTF (Hawaii)

Support to Instrumentation

- SIFS – SOAR Integral Field Spectrograph
- BTFI –Brazilian Tunable Filter Interferometer
- LLAMA- Latin-American Astronomical Milimetric Array

Events held in 2009 and 2010

Space Astronomy in Brazil
IAG-USP, held in September 2009
INCT-A + INCT INESPAÇO

Instrumentation
USP-São Carlos, School on Instrumentation for Astronomy and Organic Electronics held in September 2010.
INCT-A + INCT Organic Electronics

HUMAN RESOURCES

Master dissertations and PhD theses graduated in 2009 and 2010 under the advice of INCT-A members.

2009: Ms - 25; PhD – 10

2010: Ms – 25; PhD - 12

FELLOWSHIPS ALLOCATED BY THE INCT-A

Fellowships: Science training

Adam Smith Gontijo Brito de Assis (Adviser: Ivan Soares Ferreira)
Anderson Seiji Okada (Advisera: Nadja Magalhães)
Davi Rohe Salomon da Rosa Rodrigues (Adviser: Daniel Müller)
Dino Beghetto Junior (Adviser: Irapuan Rodrigues Oliveira Filho)
Felipe de Paula Lima (Adviser: Ivan Soares Ferreira)
Francisco Elânio Bezerra (Adviser: Gustavo Lanfranchi)
Frederico Vilela de Lima (Adviser: Anderson Caproni)
Helder José Farias Lima (Adviser: Alexandre Soares de Oliveira)
Jamille Almeida Feitosa (Advisera: Maria Jaqueline Vasconcelos)
Renato da Silva Severo (Adviser: Fabricio Ferrari)
Walter Silva Martins Filho (Adviser: Thais Mothé Diniz)

Fellowships: master

Luciana de Oliveira Ruiz (Adviser: Gustavo Lanfranchi/UNICSUL)
Suzi Izaquiel Ferreira Diniz (Adviser: Lucimara Martins/UNICSUL)
William Schoenell (Adviser: Roberto Cid Fernandes Junior/UFSC)

Fellowship: Doctorate

Carlos Augusto Molina Velasquez (Paulo Afrânio Augusto Lopes/OV-UFRJ)

Fellowship: Technological and industrial development

Marília Jobim Sartori (LNA)

Fellowships: Post-Doctorate

Anne Louise Scarinci Brandao (Adviser: Diego Falceta Gonçalves-EAD/USP)
Cintia Quireza Campos (Advisera: Denise Rocha Gonçalves/OV-UFRJ)
Daniela Borges Pavani (Adviser: Eduardo Bica/UFRGS)
Iranderly Fernandes de Fernandes (LNA)
Marcos Vinicius Borges Teixeira Lima (Adviser: Laerte Sodré/IAG-USP)
Natalia Vale Asari (Adviser: Roberto Cid Fernandes Junior/UFSC)

SCIENTIFIC PRODUCTION – 2009

Table 1 - Distribution of the papers published by the INCT de Astrofísica researchers in 2009, by journal

Journal	Qualis	Nr of papers	%
A&A	A2	34	23
MNRAS	A2	35	23
ApJ	A1	27	18
PhRvD	A2	10	7
AJ	A2	10	7
PhRvL	A1	1	1
AstL	s/c	1	1
CoPhC	s/c	1	1
JCAP	A1	5	3
PhLB	A2	3	2
Icarus	B1	2	1
GReGr	B2	1	1
AdSpR	s/c	4	3
APh	B3	1	1
P&SS	s/c	1	1
CeMDA	B4	1	1
ApSS	B4	4	3
RMxAA	B1	1	1
New Astron	B2	2	1
IJMPA	B3	3	2
PASJ	B1	1	1
PASA	s/c	2	2
Ast L	s/c	1	1
PhRvL	A1	1	1
CoPhC	s/c	1	1

Total: 148 papers:

83% Qualis A
11% Qualis B
6% Others

PLANNED EVENTS FOR 2011

These events are planned but have not been approved yet by the Management Committee

A - Science with Gemini and SOAR

Gemini:

1) *National event for user training* (2011A) – Eduardo Cypriano
2) *South American event for users training* (2011B) -Eduardo Cypriano

SOAR:

International event on SOAR instrumentation - Cássio Barbosa/ Alberto Ardila

Workshop:

3D spectroscopy in Astronomy – Thaisa Storchi-Bergmann/ Claudia Mendes de Oliveira
In the context of SOAR (SIFS+BTFI) and Gemini (GMOS+NIFS) instrumentation

B- Virtual Observatory (Bravo) events:

1) *Advanced scientific computing in Astronomy* – Alex Carciofi/ BRAVO (2011A)
   4 day school + workshop for 80/100 people, to be held at UNICSUL
2) *School + workshop on Virtual Observatories* – Alex Carciofi/BRAVO (2011B)

C - J-PAS

Bi-national scientific event on observational cosmology – Spain + Brazil
(Dupke/Laerte/Claudia)

D – EAD

Science teachers training in Astronomy
Beginning of the first course.

Annex A

Articles published by researchers of the INCT of Astrophysics in 2009

1. Abdalla, Elcio; Abramo, L. Raul; Sodré, Laerte; Wang, Bin
   Signature of the interaction between dark energy and dark matter in galaxy clusters
   2009PhLB..673..107A
2. Abramo, L. R.; Batista, R. C.; Liberato, L.; Rosenfeld, R.
   Physical approximations for the nonlinear evolution of perturbations in inhomogeneous dark energy scenarios2009PhRvD..79b3516A
3. Abramo, L. R.; Batista, R. C.; Rosenfeld, R.
   The signature of dark energy perturbations in galaxy cluster surveys
   2009JCAP...07..040A
4. Abramo, L. Raul; Bernui, Armando; Pereira, Thiago S.
   Searching for planar signatures in WMAP 2009JCAP...12..013A
5. Althaus, L. G.; Panei, J. A.; Miller Bertolami, M. M.; García-Berro, E.; Córsico, A. H.; Romero, A. D.; Kepler, S. O.; Rohrmann, R. D.
   New Evolutionary Sequences for Hot H-Deficient White Dwarfs on the Basis of a Full Account of Progenitor Evolution 2009ApJ...704.1605A
6. Alves-Brito, Alan; Forbes, Duncan A.; Mendel, Jon T.; Hau, George K. T.; Murphy, Michael T.
   The outer halo globular clusters of M31 2009MNRAS.395L..34A
7. Amôres, E. B.; Lépine, J. R. D.; Mishurov, Yu. N.
   The corotation gap in the Galactic HI distribution 2009MNRAS.400.1768A
8. Balbinot, E.; Santiago, B. X.; Bica, E.; Bonatto, C.
   The globular cluster NGC 6642: evidence for a depleted mass function in a very old cluster 2009MNRAS.396.1596B
9. Barbosa, F. K. B.; Storchi-Bergmann, T.; Cid Fernandes, R.; Winge, C.; Schmitt, H. - Gemini/GMOS IFU gas velocity `tomography' of the narrow line region of nearby active galaxies 2009MNRAS.396....2B
10. Barbuy, B.; Cayrel, R.
    Chemical composition and kinematics of Galactic disk stars. Commentary on: Edvardsson B., Andersen J., Gustafsson B., et al., 1993, A&A, 275, 101
    2009A&A...500..443B
11. Barbuy, B.; Zoccali, M.; Ortolani, S.; Hill, V.; Minniti, D.; Bica, E.; Renzini, A.; Gómez, A. - VLT-FLAMES analysis of 8 giants in the bulge metal-poor globular cluster NGC 6522: oldest cluster in the Galaxy?. Analysis of 8 giants in NGC 6522
    2009A&A...507..405B
12. Bonatto, C.; Bica, E. -Investigating the age and structure of the infrared old open clusters LK1, LK10, FSR1521 and FSR1555 2009MNRAS.392..483B
13. Bonatto, C.; Bica, E. - Probing the age and structure of the nearby very young open clusters NGC2244 and 2239 2009MNRAS.394.2127B

14. Bonatto, C.; Bica, E. - The nature of the young and low-mass open clusters Pismis5, vdB80, NGC1931 and BDSB96 2009MNRAS.397.1915B
15. Bonatto, C.; Bica, E.; Ortolani, S.; Barbuy, B.
Further probing the nature of FSR1767 2009MNRAS.397.1032B
16. Bonifacio, P.; Spite, M.; Cayrel, R.; Hill, V.; Spite, F.; François, P.; Plez, B.; Ludwig, H.-G.; Caffau, E.; Molaro, P.; and 6 coauthors
First stars XII. Abundances in extremely metal-poor turnoff stars, and comparison with the giants 2009A&A...501..519B
17. Bonnefoy, M.; Chauvin, G.; Dumas, C.; Lagrange, A.-M.; Beust, H.; Desort, M.; Teixeira, R.; Ducourant, C.; Beuzit, J.-L.; Song, I.
The young, tight, and low-mass binary TWA22AB: a new calibrator for evolutionary models?. Orbit, spectral types, and temperature 2009A&A...506..799B
18. Bordalo, Vinicius; Plana, Henri; Telles, Eduardo
The Internal Kinematics of the H II Galaxy II Zw 40 2009ApJ...696.1668B
19. Burkhart, Blakesley; Falceta-Gonçalves, D.; Kowal, G.; Lazarian, A.
Density Studies of MHD Interstellar Turbulence: Statistical Moments, Correlations and Bispectrum 2009ApJ...693..250B
20. Camargo, D.; Bonatto, C.; Bica, E. - Astrophysical parameters of 14 open clusters projected close to the Galactic plane 2009A&A...508..211C
21. Caproni, A.; Monteiro, H.; Abraham, Z.
Cross-entropy optimizer: a new tool to study precession in astrophysical jets 2009MNRAS.399.1415C
22. Carciofi, A. C.; Okazaki, A. T.; Le Bouquin, J.-B.; Štefl, S.; Rivinius, Th.; Baade, D.; Bjorkman, J. E.; Hummel, C. A.
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ANNEXES - The “White Paper”

If you want to access these annexes, click here pressing, at the same time, the control key:

http://www.astro.iag.usp.br/~incta/Rel_Anual_2009/relatorio_2009_anexos.htm

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