The ICRANet Brazilian Science Data Center
ICRANet BSDC
presented to MCTI on September 8th, 2014

SUMMARY

ICRANet activities in Brazil

The recent signature of the Agreements of collaboration between ICRANet and Brazilian (see Fig. 1), as well as international, Universities and Research Centers (see Fig.2) has allowed the first step toward the definition of an organic program of collaboration between ICRANet and Brazil (see Fig. 3 and 4).
The activities of ICRANet in Brazil do present a coordinated action which encompasses three major directives:

a) The Academic and Outreach program (see Fig.5);

b) The Space Science (see Fig.6);

c) The Brazilian Space Data Center (BSDC, see Fig.7).

All these actions are complementary and essential in creating a coordinated approach in the field of Relativistic Astrophysics which will a) form the scientists by their participation to the joint Ph.D. program, the IRAP PhD; b) develop selected topics of research with the participation of post-doctoral fellows, sabbatical scientists, senior visiting scientists in all participating institution in Brazil and in the Network with the support of CAPES; and c) create a totally new digital data repository, the BSDC. It will create in Brazil a new reality in research, building infrastructure and training personal which is specialized in high level relativistic astrophysics with academic, scientific research, data analysis. The ICRANet activities in Brazil will be creating a very rich program ranging from the technical development and human resources point of view with new management and develop analysis infrastructure in the country. The skills that people working on such structure will learn can then be transferred to many other fields of science and applied elsewhere in society.

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Prof. Remo Ruffini
Director of ICRANet

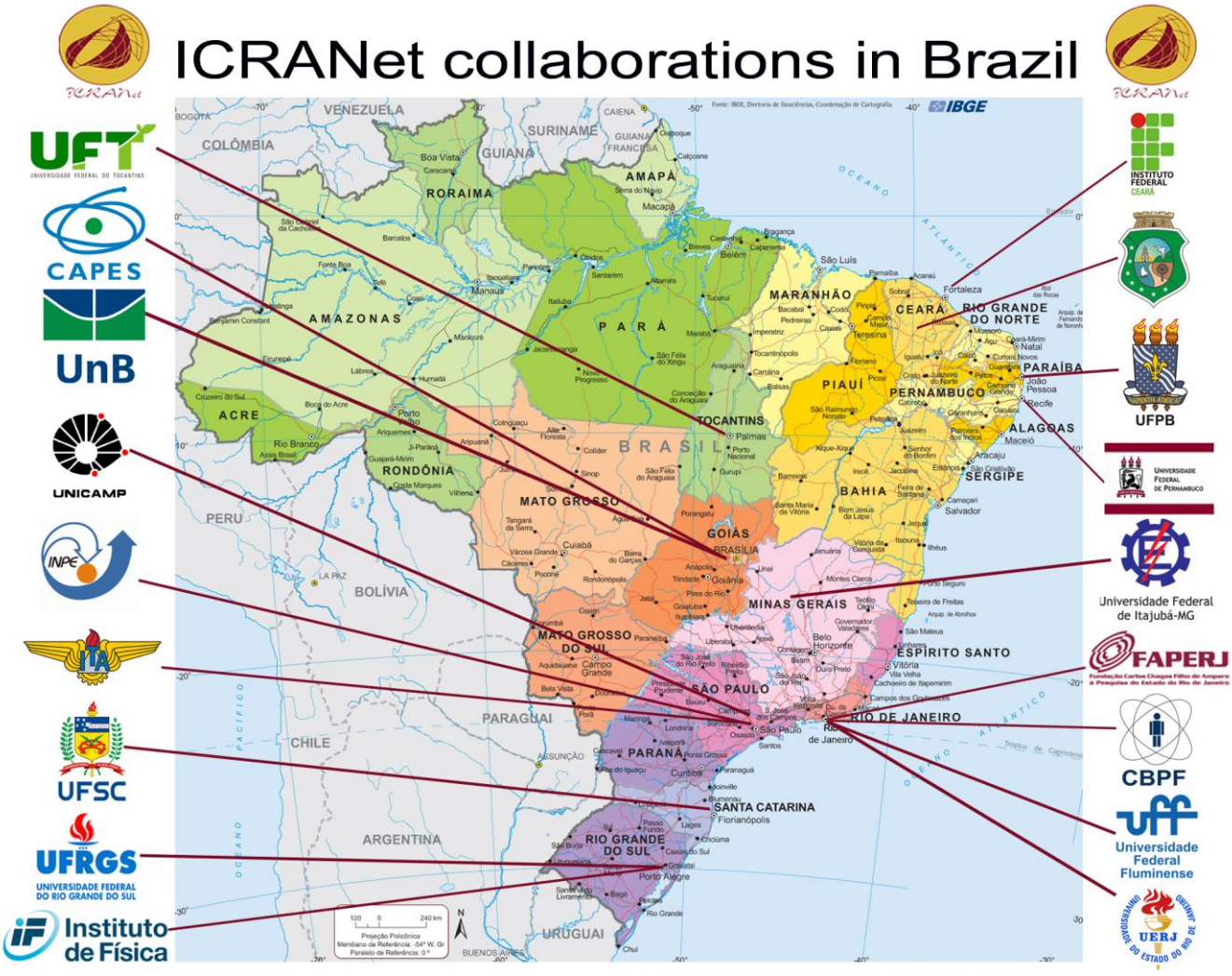


Fig. 1. ICRANet Collaborations in Brazil

ICRANet

 ICTP	 Ceará	 CBPF	 ITA	 IHEP	 UNS
 CAPES	 University "Sapienza" of Rome	 UFPB	 UNAM	 INPE	 UIS
 UNICE	 SCSA	 NAS Armenia	 FAPERJ	 Pescara GARR	 BSU
 IHÉS	 NASB	 ASI	 UNIFEI	 Al-Farabi Kazakh National University	 UFRGS
 IFUFRGS	 UERJ	 UFF	 UAM	 CNR	 UFSC
 UFPE	 INFN	 IFCE	 LeCosPa	 UnB	 Isfahan University of Technology
 UNICAMP	 Sharif University of Technology	 Shiraz University	 IASBS	 University of Ferrara	 IPM

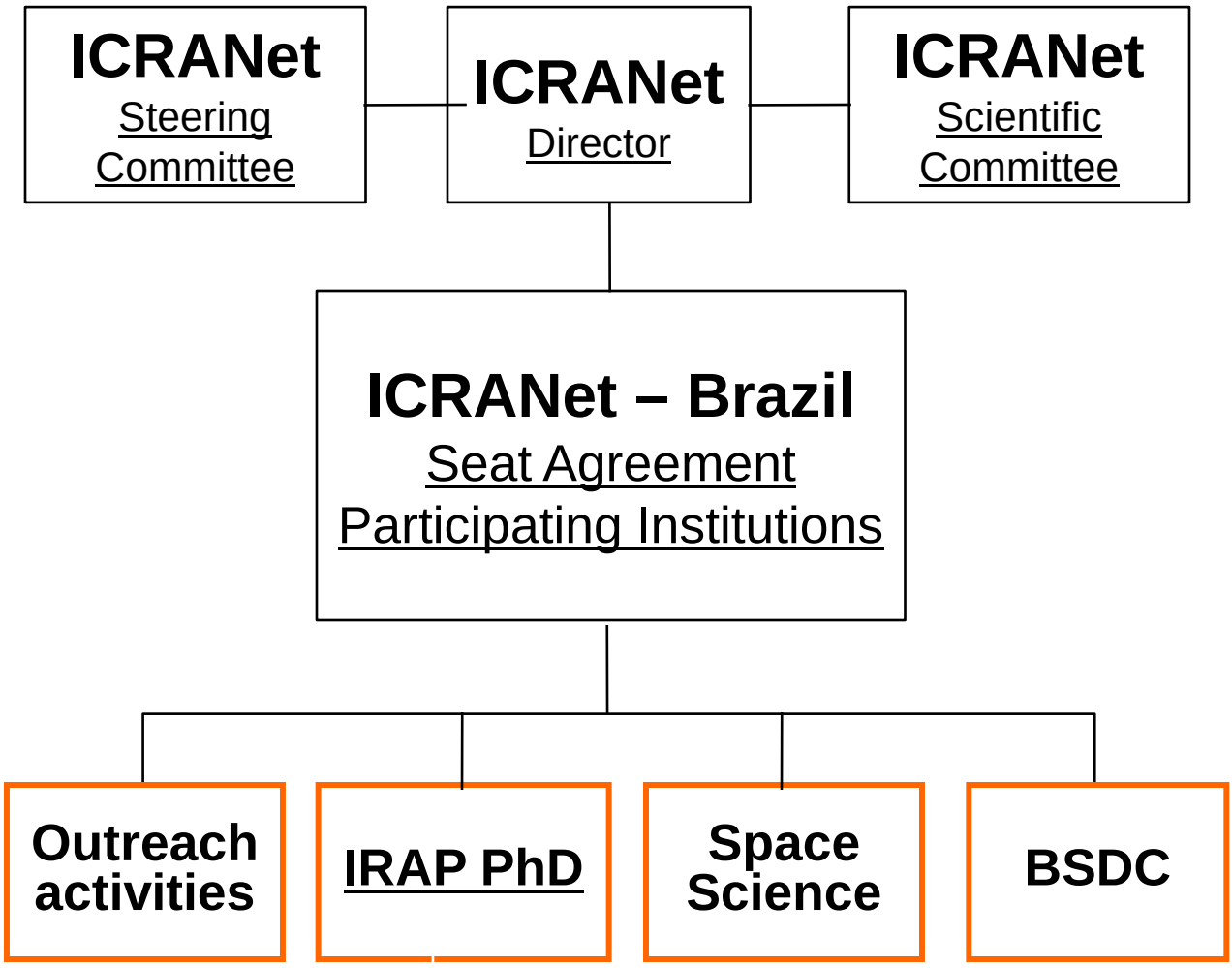


Fig. 3. The three subfields of activities within ICRANet – Brazil

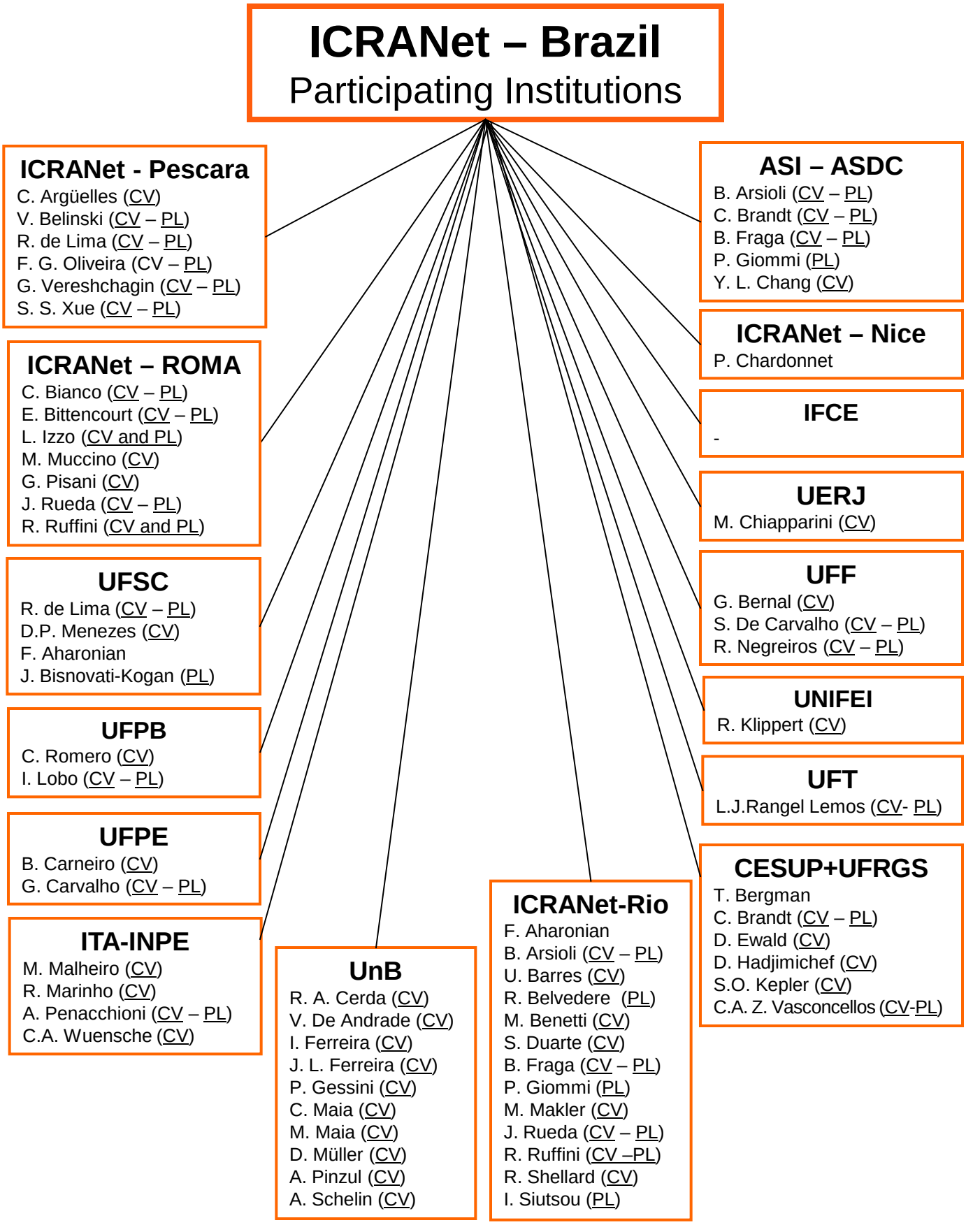


Fig. 4. ICRANet – Brazil Participating Institutions with indicative participants.

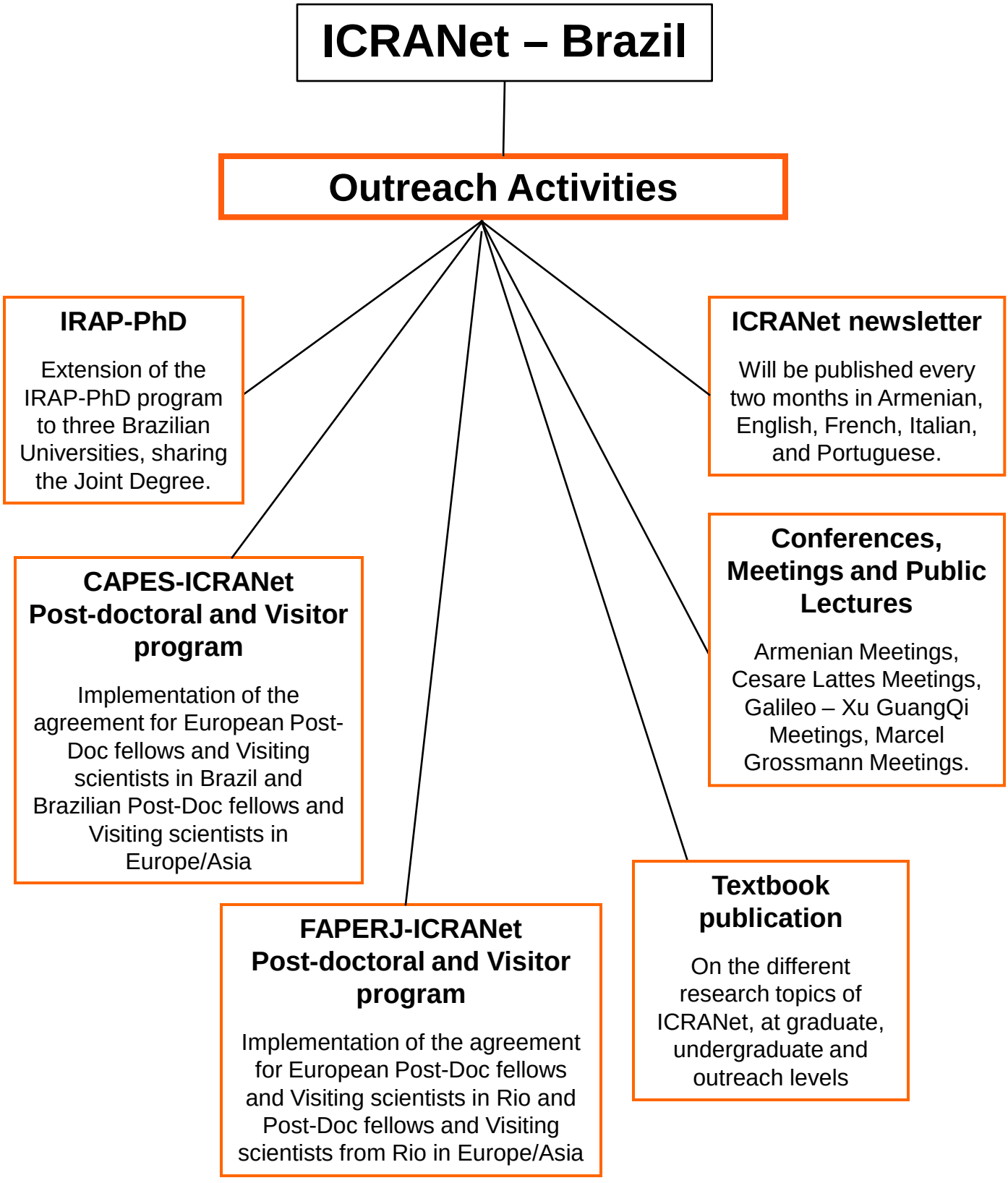


Fig. 5. ICRANet – Brazil Outreach Activities

ICRANet – Brazil

Space Science (SpS)

Neutron Stars:
- Equation of state
- Structure equations: static and rotating
- Internal and external fields
- Data analysis
- Gravitational waves

Supernovae and induced gravitational collapse
- Stellar evolution: single and binaries
- Supernova explosion
- Hypercritical accretion
- Gravitational collapse
- Data analysis

Relativistic Quantum Field Theories
- Quantum electrodynamical processes
- Unified field theories

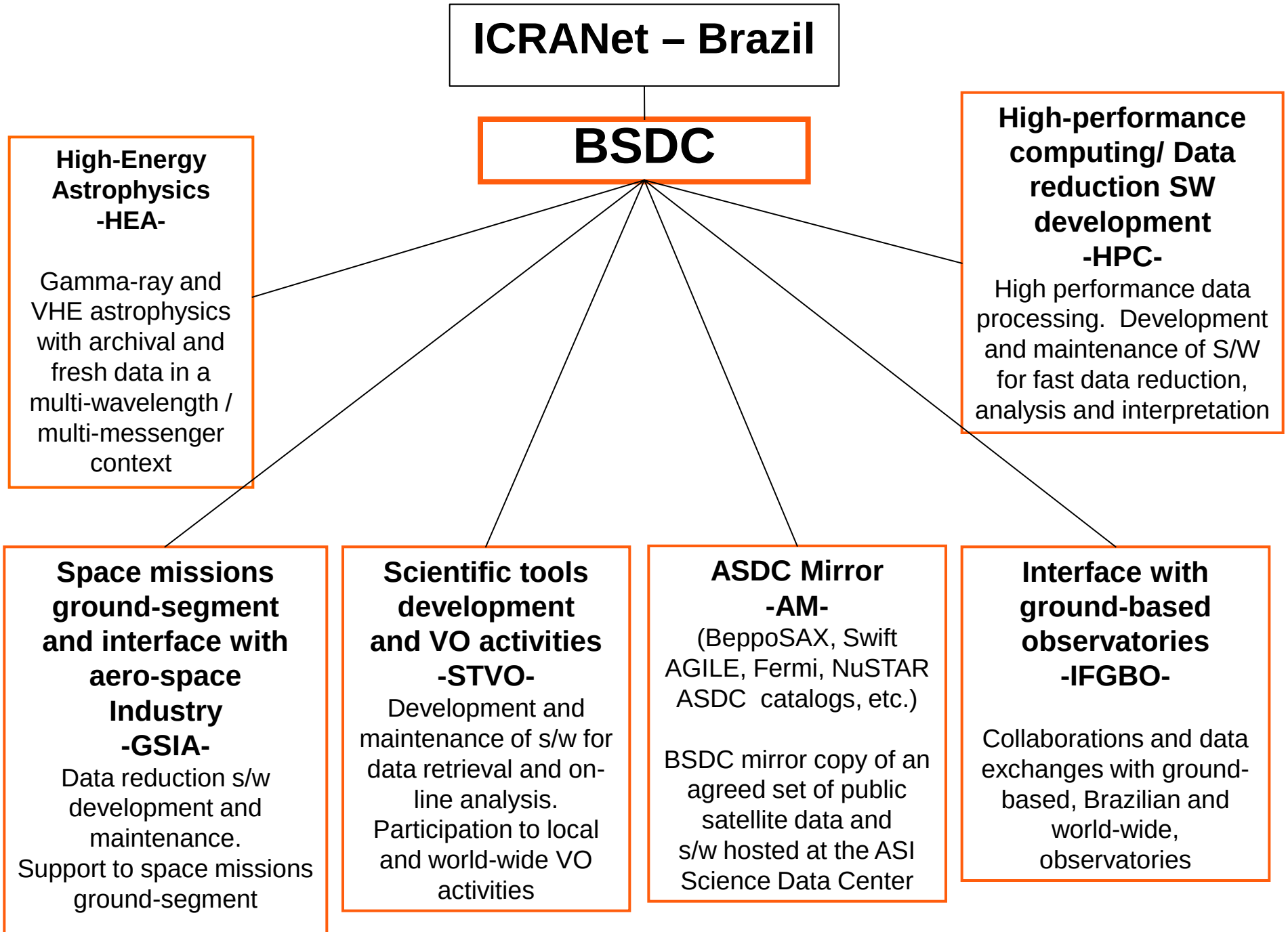
UHE sources
- Blazars and AGNs
- Cosmic rays
- Fermi mechanism
- Extragalactic background light
- Data analysis

White dwarfs and Magnetars
- Equation of state
- Structure equations: static and rotating
- Internal and external fields
- Data analysis

Cosmology and Dark matter
- Galactic dynamics
- Galactic center
- Supermassive black holes
- Dark matter particle physics
- Large scale structure
- Structure formation

Gamma-Ray Bursts
- Relativistic hydrodynamics
- Relativistic plasma
- Radiative processes
- Data analysis

Exact solutions of Einstein-Maxwell equations
- Exact solutions in GR
- Applications to cosmology and astrophysics
- Fundamental relativity


ICRANet – Brazil
BSDC
High-Energy Astrophysics -HEA-
Gamma-ray and VHE astrophysics with archival and fresh data in a multi-wavelength / multi-messenger context
High-performance computing/ Data reduction SW development -HPC-
High performance data processing. Development and maintenance of S/W for fast data reduction, analysis and interpretation
Space missions ground-segment and interface with aero-space Industry -GSIA-
Data reduction s/w development and maintenance.
Support to space missions ground-segment
Scientific tools development and VO activities -STVO-
Development and maintenance of s/w for data retrieval and on-line analysis.
Participation to local and world-wide VO activities
ASDC Mirror -AM-
(BeppoSAX, Swift AGILE, Fermi, NuSTAR ASDC catalogs, etc.)
BSDC mirror copy of an agreed set of public satellite data and s/w hosted at the ASI Science Data Center
Interface with ground-based observatories -IFGBO-
Collaborations and data exchanges with ground-based, Brazilian and world-wide, observatories

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REGISTRO UFFICIALE
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Il Presidente

Prot/Prz/CE/2014/150

Rome, 8th September 2014

Subject: ASI endorsement to the Letter of Request for support to BSDC

Dear Sirs,

With regard to the Letter of Request for support to the ICRANET Brazilian Science Data Center (BSDC), that is being presented to the Brazilian Ministry of Science Technology and Innovation, I am pleased to inform you that the Italian Space Agency (ASI) fully supports this initiative.

I look forward to a very fruitful cooperation between our institutions within the framework defined in the ASI-ICRANet agreement (2013-048-A.0) signed on 26 June 2013.

Sincerely yours,

Roberto Battiston

Via del Politecnico, s.n.c. 00133 ROMA - Tel 068567821 - 068567829 - Fax 068567468

Letter of endorsement of ASI President, Prof. Roberto Battiston

Letter of Request
presented to the

Ministry of Science, Technology and Innovation in Brazil

Request for support to the
ICRANET- Brazilian Science Data Center (BSDC)

For the
International Center for Relativistic Astrophysics Network
(ICRANet)

September 2014

Presentation: Starting with the official entry of Brazil in ICRANet, a series of investigations have been performed to identify opportunities and means of supporting the rapid development of astrophysics, cosmology and space research in Brazil on an ongoing basis. The results of these efforts have resulted in the following actions:

1. ACTIONS PERFORMED

1.1 Creation by ICRANet of the "International Relativistic Astrophysics Doctoral program" (IRAP-PhD), in collaboration with AEI – Albert Einstein Institute – Potsdam (Germany), Bremen University (Germany), CBPF – Brazilian Centre for Physics Research (Brazil), Ferrara University (Italy), IHEP-CAS – Institute of High Energy Physics of the Chinese Academy of Science (China), IHES (France), Indian centre for space physics (India), Nice University Sophia Antipolis (France), Observatory of the Côte d'Azur (France), Oldenburg University "Carl von Ossietzky" (Germany), Rome University "Sapienza" (Italy), Savoie University (France), Shanghai Astronomical Observatory (China), Stockholm University (Sweden), Tartu Observatory (Estonia); grant of post-graduation fellowships in astrophysics and cosmology to Brazilian students; grant for advanced internship at ICRANet in Pescara and in other European research centers;

1.2 Promotion of workshops and seminars in Brazil and support for meetings between Brazilian scientists and scientists coming from advanced centers for research; these objectives are being developed. In particular:

a) The following IRAP-PhD schools with participation of Faculty, students and researchers from Brazil have been organized: February, 1-19, 2010 – Nice (France); March 22-26, 2010 – Ferrara (Italy); September, 6-24, 2010 – Nice (France); March 21-26, 2011 – Pescara (Italy); April 3-8, 2011 – Les Houches (France); May 25th – June 10th, 2011 – Nice (France); September 5th -17th, 2011 – Nice (France); October 2-7, 2011 – Les Houches (France); September 3-21, 2012 – Nice (France); May 16-31, 2013 – Nice (France); September 2-20, 2013 – Nice (France); February 23 - March 2, 2014 – Nice (France); May 10-16, 2014 – Les Houches (France).

b) The following advanced scientific meetings, with the participation of Brazilian scientists and students, have been organized in Brazil and abroad: 1stBego Scientific Rencontre (6-17 February 2006 – Nice, France); 1stCesare Lattes Meeting (25 February – 3 March 2007, Rio de Janeiro, Brazil); 1st Galileo - XuGuangqi Meeting (26-30 October 2009 – Shanghai, China); 2nd Galileo - XuGuangqi Meeting, (12-18 July 2010 – Ventimiglia, Italy, and Nice, France); 3rd Galileo - XuGuangqi Meeting (12-16 October 2011 – Beijing, China); 2nd Bego Scientific Rencontre (16-31 May 2013 – Nice, France); 1st URCA meeting on Relativistic Astrophysics (24-29 June 2013 – Rio de Janeiro, Brazil); 1st Scientific ICRANet Meeting in Armenia (30 June - 4 July 2014 – Yerevan, Armenia).

c) After the great success of the 10th edition of the Marcel Grossmann Meeting (which are organized by ICRANet every three years), held in Rio de Janeiro (Brazil) on July 20-23, 2003, all the successive editions have seen a large participation of Brazilian scientists and students: the 11th Marcel Grossmann Meeting (23-29 July 2006 – Berlin, Germany); the 12th Marcel Grossmann Meeting (12-18 July 2009 – Paris, France); the 13th Marcel Grossmann Meeting (1-7 July 2012 – Sockholm, Sweden).

1.3 Cooperation agreements with the following Brazilian institutions have been signed: Coordenação de Aperfeiçoamento do Pessoal de Nivel Superior (CAPES); Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ); Centro Brasileiro de Pesquisas Fisicas (CBPF), Government of the State of Ceará; Instituto Nacional de Pesquisa Espaciais (INPE), Instituto Tecnologico da Aeronautica, (ITA), Universidade do Estado do Rio de Janeiro (UERJ); Universidade Federal de Itajubá (UNIFEI), Universidade Federal Fluminense (UFF), Universidade Federal da Paraíba (UFPB), Universidade Federal do Rio Grande do Sul (UFRGS), realizing in this way a wide and continuous scientific collaboration in the fields of Astrophysics, cosmology and similar disciplines, and the use of its premises in the Seat of Rio de Janeiro for the temporary location of ICRANet office in Brazil. Meanwhile, there are other ones which are being evaluated: Instituto Federal de Educação, Ciência e Tecnologia do Ceará (IFCE), Universidade Federal de Pernambuco (UFPE) and Universidade Federal de Santa Catarina (UFSC).

In addition to the above results, specific to Brazil, agreements with many other International Research Institutions have also been signed by ICRANet. Among the ones particularly relevant for

this proposal, we recall the ones with: the Italian Space Agency (ASI), the International Centre for Theoretical Physics (ICTP) and the Third World Academy of Science (TWAS).

2.PERMANENT ACTIONS

2.1 The Seat of ICRANet in Brazil has been activated, at first in the premises granted by CBPF (see Attachment 1); with the a possible expansion to the Cassino da Urca; it has been planned the development of a annual meetings in Rio de Janeiro within the Cesare Lattes Program and dedicated to relativistic astrophysics (see above). It is planned a school of Cosmology and Astrophysics which can initially act on the premises of CBPF in Rio de Janeiro, with the aim of a) offering advanced education in astrophysics, cosmology and related fields, and b) promoting a continuous program of refresher courses for Brazilian and South-American scientists.

2.2 With the support of FAPERJ and CAPES the development of the Cesare Lattes Program includes: a) the exchange of ICRANet researchers for activities to be implemented at ICRANet Rio and at the centers which have signed cooperation agreements in Brazil; b) the offer to Brazilian professors to spend periods of research at one of the ICRANet Seats; c) grant of annual scholarships to 20 graduate students within the IRAP PhD.

2.3 the development of the Brazilian Science Data Center (BSDC), which has been already operative for several months a minimal configuration at the seat in Rio de Janeiro (see details in the present document).

3.INSTITUTIONAL ACTIONS

3.1 All necessary actions with the Ministry of External Relations have been taken to sign the Seat Agreement for the Seat ICRANet-Rio, see attachment;

4.PROJECT OF BRAZILIAN SCIENCE DATA CENTER

4.1 Introduction: The development of scientific research in the fields of astrophysics, cosmology and space research has been confined to a non optimal, old-fashioned approach in Brazil, due to the lack of a Data Center able to receive, archive, process and disseminate to Brazilian scientists the information coming from the stations and laboratories connected to satellites, telescopes and radio-telescopes, as well as to other space stations and other centers producing scientific data. For this reason Brazilian scientists and technicians had access to important data with more difficulty and often late. This has limited their competitiveness with respect to their colleagues from other Countries, who on the contrary benefit from efficient services, providing the necessary expertise for an optimal interpretation of data. Modern data centers also consent to do researches based on very large volumes of data, coming from many instruments, a very efficient type of research, which could not be carried out by individual researchers. It is a problem then, whose solution cannot be postponed.

4.2 Solution: ICRANet, in addition to bringing together theoretical and observational astrophysicists who work on the most important researches, have the collaboration of high qualified technicians who are able to plan and install the Brazilian Data Center and provide assistance during its implementation. Moreover, it avails itself of the support and cooperation of ASI Science Data Center (ASDC), a branch of the Italian Space Agency (ASI) equipped to provide support to space missions in the fields of astronomy, astrophysics, cosmology, solar system exploration, and astro-particle physics. A detailed description of ASDC activity, its infrastructure, the amount of data hosted, the space missions supported and the services offered to the astronomical community, can be found in the document " The ASI Science Data Center", ADF TN2011-2, here enclosed (Attachment 2).

The main scientific and training activities of ICRANet are included in the three volumes of the Report of the Director to the Scientific Committee here enclosed (Attachment 3 – DVD). The cooperation of ASDC in the project of BSDC started in the phase of the requests for the elaboration

of the project BSDC and is currently ongoing. Among the preliminary activities for the installation of the BSDC a series of meetings have been held in Italy with ASDC. A series of seminars have been held at CBPF and INPE by the astrophysicist Paolo Giommi, Director of ASDC. The Director of ICRANet, Prof. Remo Ruffini, has kept personal contacts with the Director of CBPF and from there it arose the inclusion of the BSDC project in the partnership signed by the two institutions. The cooperation by BSDC will consist in offering technical support, provide the BSDC with public data of all scientific missions hosted at ASDC, promote the exchange of software packages and offer scientific cooperation.
BSDC will not only represent a source of valuable data and information in the fields astrophysics, cosmology and astro-particles, which Brazil needs to develop as a pole of attraction for scientists working in these fields. It will also act as a tool for a Latin-American integration once its strategic information and its expertise will be made available to the scientists from South America.
BSDC, since the beginning of its activities, will benefit of the participation to international collaborations of high level, which have already started by the ASDC in the field of Virtual Observatory. An example is the current collaboration among ASDC, CfA (Cambridge, USA) and ISDC (Geneva, Switzerland) for the realization of advanced tools (IRIS and ASDC-SED builder) for the management and scientific analysis of multi-frequency data (radio, infrared, optical, X-ray and gamma ray) and multi-temporal data of extragalactic sources.

5. OBJECTIVES OF BSDC

The main objective of BSDC is to provide data of all international space missions existing on the wavelength of X and gamma rays, and later on the whole electromagnetic spectrum, for all the galactic and extragalactic sources of the Universe. A special attention will be paid to the achievement and the complete respect of the levels defined by the International Virtual Observatory Alliance (IVOA). In addition to these specific objectives, BSDC will promote technical seminars, annual workshops and it will assure a plan of scientific divulgation and popularization of science with the aim of the understanding of the universe. The implementation of the BSDC will take place in three steps: the first one is already ongoing at CBPF and it consists in the installation of a minimum research infrastructure for an early implementation of the project and scientific exploitation of the facility. The second, which consists in the proper installation of the Data Center, will take place simultaneously at CBPF and UFRGS, once the Ministry of Science and Technology agrees to support the project. The third and final phase consists in the expansion towards a larger scale data center and will be of long-term implementation.
The first phase of the project is dedicated to the demonstration of its technical feasibility, ahead of full implementation and support by the Ministry of Science and Technology. Initially, a first prototype of the WEB software and a part of the data archives of the satellites AGILE and Swift have been installed in one of the computers located at CBPF in Rio de Janeiro. A prototype of the BSDC site is already reachable at the address http://bsdc.icranet.org/main.
Presently, a high-capacity front-end machine has been acquired and is currently being installed at CBPF to function as a server for external users interface, and the technical specifications of two other machines are being derived for acquisition: a storage center with capacity for about 30 TB of data, and a medium-to-high performance computing machine, for processing data and running simulations for data analysis.
Once this minimal infrastructure is established, there are some immediate actions that will be taken in order to initiate the science exploitation phase of the facility:
(a) An ICRANet/MAGIC agreement has been signed. This will lead to the inclusion at the BSDC server in CBPF the complete VHE Gamma-ray Astronomy database of the MAGIC Collaboration, which will constitute the first public data repository of TeV Gamma-ray data ever built in the world.
(b) Once this is accomplished, we will seek to extend similar agreements with the H.E.S.S. and VERITAS collaborations, thus turning the BSDC at CBPF the very first complete TeV Gamma-ray Data center in the world, giving it immediately visibility and putting from the start at a central

position in the international high-energy astrophysics scenario.
(c) In the past year, two scientific catalogues have been constructed as part of the ICRANet activities and collaborations in Brazil, namely a White Dwarf SDSS catalogue and a catalogue of AGN VHE-source candidates, which will be added to BSDC as the first two examples of scientific results achieved within our collaboration.
(d) Already now, and this shall be expanded as the Data enter grows, scientific exploitation of the data has been ongoing for the production of original scientific research at CBPF and formation of human resources.
(e) Finally, a call is currently being prepared and candidates are being sought for to serve as system manager for the incipient Data Center.

6.TECHNICAL ASPECTS. A POSSIBLE INITIAL CONFIGURATION OF BSDC: THE HIGH VALUE HARDWARE AND THE NECESSARY HUMAN PERSONNEL
6.1 Archive of astronomical data of ASDC which can be reproduced in the BSDC: Brazil will receive copy of a part or total of a set of data and services available in the ASDC, in accordance with the policy of each specific mission, that is:
6.2 Archives in the active missions:
6.2.1 Agile (~0.7 TB);
6.2.2 Swift (~ 7TB)
6.2.3 Fermi (~1.0TB)
6.2.4 Chandra (1.4TB) following the negotiation of an agreement with Harvard CfA
6.2.5 Herschel (1.0TB)
6.2.6 NuSTAR (0.5TB)
6.2.7 GAIA (after 2017)
(The magnitude of such archives refers to June 2014. On the base of the current evaluations we estimate that the total volume will increase up to about 1.5TB per year).
6.3 Missions concluded and no more operative (historical archives)
6.3.1 Beppo SAX (1.3) TB
6.3.2 EXOSAT (<1GB)
6.3.3 EINSTEIN (< 1GB)
6.3.4 ROSAT (<1GB)
6.3.5 ASCA (<1GB)
6.4 Archives of current VHE Gamma-ray Astronomy Collaborations (Ground-based instruments)
6.4.1 MAGIC (~ 1.0 TB)
6.4.2 H.E.S.S. (~ 1.5 TB)
6.4.3 VERITAS (~ 0.7 TB)
The possibility of hosting a unique a UHE Cosmic-ray database, unique in the world, with data provided by the Pierre Auger Observatory, is also being considered, to complement BSDC's Astroparticle Physics data portfolio.

7. IMPORTANT OBSERVATIONS
7.1 ASDC is supplied with copies of dozens of public astronomical catalogs; the majority is of small dimensions, but some of them are of significant volume (for example WISE, NVSS, SDSS, GAIA).
These datasets complement the catalogs hosted at the Brazilian LNA (Laboratorio Nacional de Astrofisica), an important institution with which the BSDC will collaborate.
7.2 Other catalogs are products of ASDC or, in some cases, ASDC is the main site for their publication, such as for catalogs of Beppo SAX detected sources, serendipitous sources discovered with the Swift XRT, the AGILE catalogue of the gamma ray sources, the ROXA survey, several catalogs of Fermi gamma-ray sources, the Sedentary survey, the Rome-BZcat, the catalogs of Planck ERCSC, PCCS and AGN, etc.

7.3 The total dimension of this set of data is approximately 2TB.

8.WEB SERVICES AND SOFTWARE INSTRUMENTS. INCLUDED SOFTWARES:
8.1 Interactive multi-mission ASDC archive;

8.2 Spectral Energy Distribution (SED) builder tool;

8.3 Data Explorer;
8.4 Interactive interface for ASDC catalogs;
8.5 Instruments of visualization and analysis of data online.

9.SOFTWARE OF THE VIRTUAL OBSERVATORY AND ASDC-BSDC TOOLS
9.1 ASDC and BSDC will be involved in the full accomplishment of the level defined by the Virtual Observatory (VO). ASDC is acting with significant efforts toward this aim of the development of the software VO and it is actively cooperating with the other international data centers (such as CfA, ESA-ESAC, ISDC, ecc.). In particular the software interfaces that implement the TAP protocol (Table Access Protocol) have been implemented for the access to the ASDC catalogs and the SAMP protocol (Simple Application Messaging Protocol) which consents to the tools based on VO to communicate one with each other.
9.2 Sharing with BSDC the VO software implemented by ASDC will offer:
9.2.1 The adequate software for the access to the data stored in the remote archives, in accordance with the level fixed by IVOA (International Virtual Observatory Alliance), which offers a series of java functions allowing the remote access to the astronomical catalogs by using the Table Access Protocol (TAP).
9.2.2 Software tools necessary for the analysis of multi-frequency data with the functions compatible with VO (results in the format of tables VO, integrated with other VO instruments).
9.2.3 The software for the connection between interactive catalogs based on the web and on the VO tools.

10.BSDC and the ASTRI/CTA project
The world-appreciated experience accumulated at ASDC in the support of the acquisition, processing and archiving of satellite (as well as CTA) data can be of immediate use for programs of current interest to Brazil. One such project is ASTRI (*Astrofisica con Specchi a tecnologia Replicante*), a prototype of the Small Size Telescopes (SST) array that is under construction in Italy and that is planned to become a crucial part of the full CTA array. Brazil has recently become significantly involved in the ASTRI project and therefore the BSDC could act as the natural place to host a data repository and software support site for this telescope/array. The experience gained in the first stage of the implementation of BSDC at CBPF, with the creation of a VHE Gamma-ray Astronomy database in collaboration with MAGIC, H.E.S.S. and VERITAS will prepare the expertise and the infrastructure to allow the more ambitious project of working as an ASTRI project data center. Likewise, the work with ASTRI could be understood as a potential precursor of strategic value for Brazil, that could prepare the country for hosting a full-fetched data center and a regional science center for the CTA.

11. BSDC PUBLIC DATA THAT WILL BE ACCESSIBLE TO ASDC
11.1 In exchange for the set of data, software and infrastructure that ASDC will supply to BSDC, the latter will assure a copy of all public data which will be stored in the BSDC as part of the local activities, such as the set of public data of the Brazilian astronomical missions and of the ground-based observatories.
11.2 ICRANet will contact LNA for an agreement about the use of public data from National ground based observatories.

12.STAFF

12.1 Basing on the experience of ASDC, the chart of the staff in the initial configuration of BSDC will be composed by: 1 Director, with the responsibility of the direction of the center; a secretary with the functions of general administrator and one system Administrator;

12.2 In addition to this local and permanent staff, scientists and technicians of ASDC will regularly visit BSDC and will offer remote technical assistance from Italy, mainly collaborating for the realization of the site and assuring the alignment with the server and the set of ASDC data (for an overall engagement equivalent to the one of a full-time worker).

12.3 ICRANet will set up an interface among the BSDC activities and its researchers and professors, two senior scientists, five post-doc and graduate students of the IRAP PhD Program in order to develop the scientific research associated to the data flow coming from BSDC.

12.4 ICRANet activities will be developed within the Cesare Lattes Program, approved by the Scientific Committee of ICRANet on 15th December 2010 and by the ICRANet Board (see Attachments 4 and 5). The Cesare Lattes Program has been activated with the collaboration of CAPES, FAPERJ and of the Program " Ciência sem fronteiras".

13.COSTS

13.1 The budget necessary to set up the BSDC and guarantee its operation during the first year is summarized in the following outline:

STAFF	NUMBER	COSTS IN EURO (PER YEAR)
Director of BSDC	1	€ 90,000.00
Secretary	1	Provided by ICRANet
System Administrator	1	€ 40,000.00
Support to 10 participating Brazilian scientists	10	€ 100,000.00
Travel expenses and support to European visitors	---	€ 25,000.00
Hardware and its implementation (e.g. SW licenses etc.)	---	€ 30,000.00
Scientific publications and material for Public Outreach	---	€ 15,000.00
TOTAL		€ 300,000.00

14.REQUEST TO THE MINISTRY OF SCIENCE AND TECHNOLOGY FOR ANNUAL SUPPORT FOR A 5 YEAR PERIOD

14.1 A project of this magnitude and complexity could not be activated without the financial and institutional support of Brazil, a contribution that we here recall, leaving to the Minister of Science and Technology to freely establish, after an analysis of this document, the level of financial support to be assigned.

15.MOTIVATION

15.1 The implementation of a Data Center in Brazil is an essential milestone for the development of the theoretical and observational multi-frequency astrophysics, as well as for space research, which is of strategic importance for Brazil. This project has been developed with the aim of achieving its objectives in a carefully planned way and through a very cost effective approach, considering the terms given by ICRANet about involving the essential partnership with the Italian Space Agency (ASI) and supply, through its scientists and those of the affiliated institutions, the needed scientific and technical assistance. The division in steps of the implementation of BSDC can be done exactly thanks to this peculiarity.

We are experiencing an uncommon and favorable opportunity to build a much needed Brazilian facility for the management, repository and analysis of multi-frequency, multi-messenger astronomy, cosmology and cosmic-ray data. The valuable skills that the people involved in such a high-profile structure will acquire can be transferred to many other fields and applied elsewhere in the society.

Brasilia, September 8th, 2014

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Prof. Ulisses Barres de Almeida
Professor of CBPF

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Prof. Paolo Giommi
Director of ASDC

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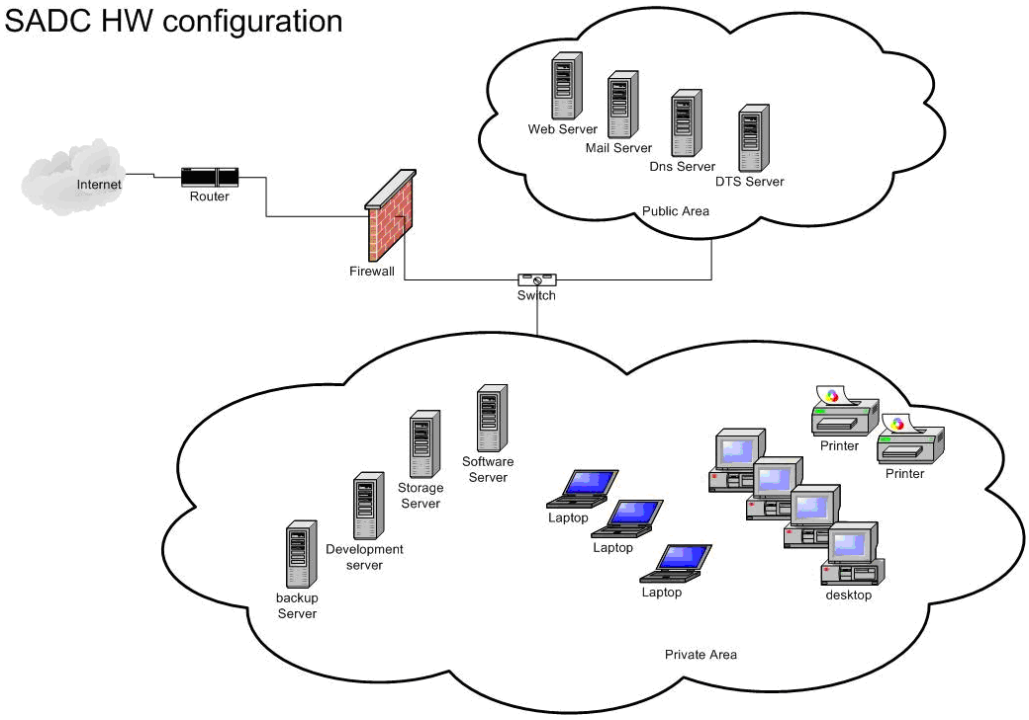
Prof. Remo Ruffini
Director of ICRANet

ANNEX:

Hardware Infrastructure of BSDC

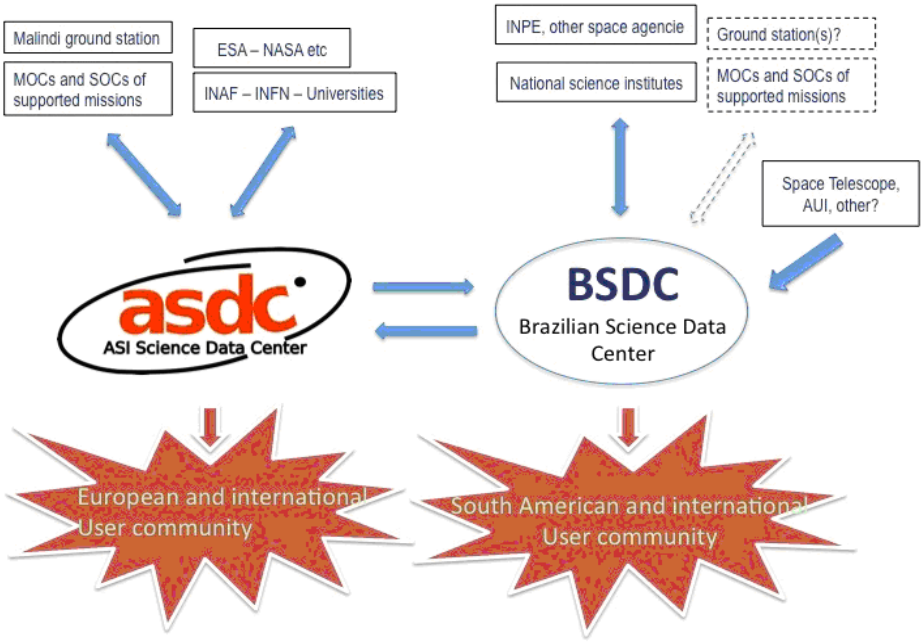
Based on the experience of ASDC we can present a possible configuration for the hardware BSDCin the following figure:



We indicate here below a preliminary list of BSDC hardware required for the implementation of the proposed configuration:

1 server used as archive with the capacity of 30 TB
1 back up server
1 web server
1 mail-DNS-DHCP-DTS server
1 work station for each one of the local users and for a medium number of visitors
1 firewall
1 high-performance machine dedicated to scientific applications
Various materials, including switches, routers, printers, etc.

Interactions ASDC-BSDC
A high level draft showing how BSDC should act and interact with ASDC and other institutions is showed here below:



ASDC is funded by the Italian Space Agency (ASI),has its base at the ASI's Headquartes site in Roma, Italy, and is dedicated to serve the national, European and international scientific community; it works in accordance with the agreements with the Italian institutions, NASA, ESA and other agencies. The ASDC receives scientists coming from the National Institute of Astrophysics (INAF) and the National Institute of Nuclear Physics (INFN). It is connected with the Italian Ground Station in Malindi (Kenya) and with the Mission Operation Centers (MOCs) and Science Operation Centers (SOC) of a number of space missions.
During the first phase the BSDC will be located within the ICRANet Center at CBPF, Rio de Janeiro and at CESUP, Porto Alegre. The equipment and personnell initially hosted at CBPF will be later moved to ICRANet Center in the Cassino da Urca. Its services will be mainly addressed to the Brazilian, South-American scientific community of Brazil, South America and International community; agreements with national and international agencies will be signed in order to support its activity.
The two centers will be connected through safe communication channels (such as internet and dedicated lines) to ensure that collected data will be adequately protected.

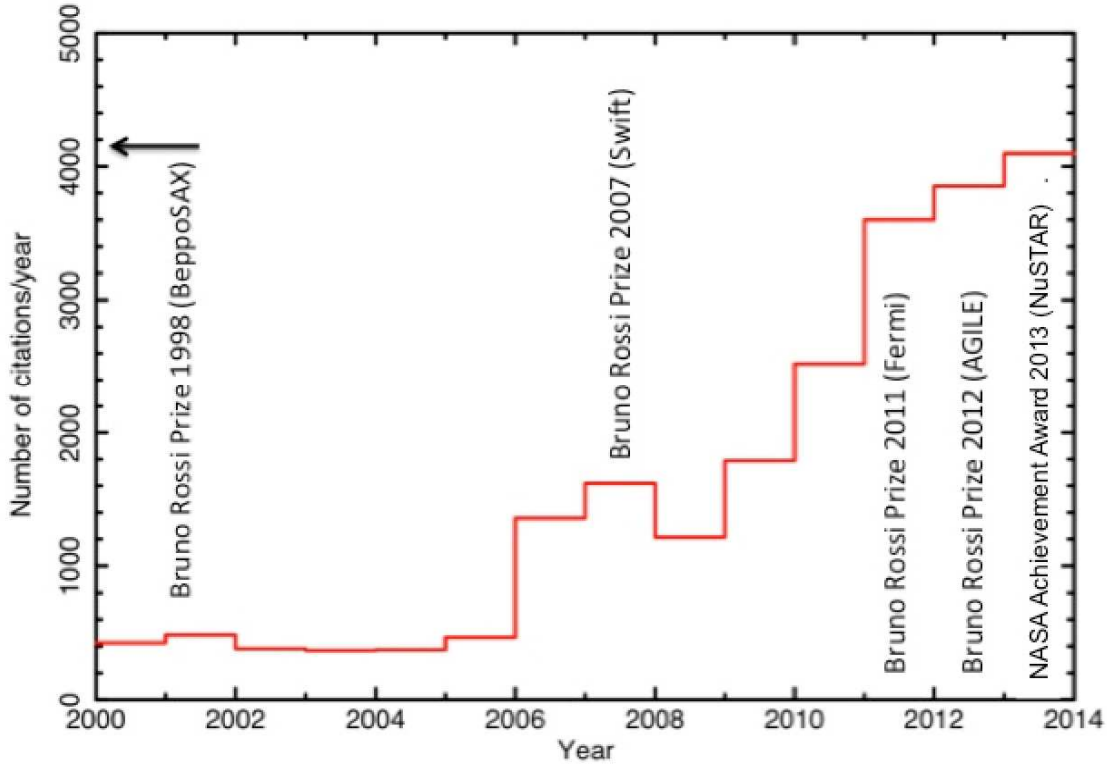
1. SCIENTIFIC COOPERATION AMONG ICRANet, INPE, ASI, ASDC e BSDC

In view of the developments of BSDC and of the collaboration between Italy and Brazil in Space Missions, it has been developed a specific collaboration agreement between INPE and ICRANet, which will be signed on March 14th 2013. A similar agreement has been proposed for the signature between ICRANet and ASI. Considering all these activities it would be appropriate an update of the collaboration agreement between ASI and the Brazilian Space Agency (AEB).
The main objective is promoting a strong interaction among scientists of ICRANet and the

team of ASDC and BSDC charged of data acquisition and processing. ICRANet will also promote the scientific research activities of the ASDC staff, deeply involved in the research activities connected to the missions and to the data stored in its electronic archives.
This will lead to a better use of the data archives of both institutions and, on the other hand, to better services for the global community of users.

2. SUCCESS OF ASDC WITH MISSION BeppoSAX, Swift, Fermi, AGILE and NuSTAR

Among all possible scientific activities the one of the Space Observatories it has been for sure one of the most productive, considering the huge amount of publications and the relevant scientific progress that it generates.
ASDC has actively and strongly participated in this process, advancing with the analysis of the data coming from all above-mentioned missions and sharing the co-publishing in all publications of each specific mission.
It was thus that the presence of ASDC in scientific publications has grown in line with the number of missions, as shown in the following figure.



In particular, the relevant improvements are registered after the launch of Swift (Nov 2004), AGILE (Apr 2007), Fermi (June 2008) and NuSTAR (June 2012).
The participation ASDC has been so relevant, not only for the analysis of the data, but also in the promotion of scientific success of each mission, that four successive awards "Bruno Rossi" by the American Astronomical Society were given to the staff of the ASDC:in 1998as part of the Beppo SAX team, in 2007as part of the Swift team, in 2011as part of the Fermi team, and in 2012 as part of the team of AGILE. Recently (June2012),NuSTAR mission was launched successfully. As part of the scientific team NuSTAR, the ASDCis responsible for the development and maintenance of the software for the reduction of official data.

In 2014 the director of the ASDC, Paolo Giommi, was included in the Thomson Reuters list of the world most cited and most influential scientists.