OPEN DATA IN SPACE SCIENCES: PERSPECTIVES AND OPPORTUNITIES FOR DEVELOPMENT

Ulisses Barres de Almeida
Brazilian Center for Research in Physics (CBPF)
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CBPF was found in 1949, as the first research institute in Brazil, following the wake from C. Lattes’ discovery of the pion in Bristol and later laboratory production in Berkeley.

- Confluence of interests from several spheres of society led to the creation of other institutes and, within a decade, the National Research Council (CNPq).

- Pushed the development of experimental physics in Brazil, and the creation of the first international collaboration: the Brazil-Japan Cosmic-ray Collaboration, and an associated international lab in Chacaltaya, Bolivia.

- A concrete example of the impact of science and international collaboration in national development.
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- A concrete example of the impact of science and international collaboration in national development.

A motivating element, provided by Lattes’ fundamental discoveries

Appropriate social-political context

The right entry-point: cosmic-ray physics was cheap to develop and sustainable!
• **Space represents a frontier in many fields**: scientific knowledge, innovation and technology, applications to modern global challenges such as climate change and disaster management, etc.

• **And access to space and to the benefits of space exploration is a powerful tool for development** — direct and indirect implications to the welfare of society and economic growth as well as international cooperation and integration, and ultimately peace.
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But a word of caution: Who is reaping the dividends of space exploration the most? Space, and the space age, can dangerously contribute to world inequality!
“If the benefits of the use of outer space are put, in spite of justice, to the service of only a small group of nations, in exclusion of others […] who then would fail to realise that the recent and wonderful discoveries of science have turned themselves against man, and now work for its unhappiness, instead of contributing to the happiness of humanity?

Scientific and technological progress are usually not matched by comparable progress in moral, legislation, and international cooperation, for the benefit of all peoples. I think here particularly of those who, owing to their lower state of technological or cultural development, are kept in a state of unjust inferiority […] To use the resources of space exploration for their benefit is to contribute to advance humanity to justice and peace.”

http://w2.vatican.va/content/paul-vi/en/messages/pont-messages/documents/hf_p-vi_mess_19680806_conferenza-onu.html
THE FOURS PILLARS OF SPACE

The four pillars of Space 2030: space economy, space society, space accessibility and space diplomacy.

Fundamental ingredient for developing countries, as a means to enable new actors to take their place, and benefit from, the future of space.
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Fundamental ingredient for developing countries, as a means to enable new actors to take their place, and benefit from, the future of space.

“The difference between developed and developing countries is amplified by the circle that connects lack of infrastructure to poverty and poverty to the lack of capability to improve infrastructure. This can only be broken by the use of space technology [...] which is essential to developing countries lacking of alternative means [...]”

G. Genta & M. Rycoft, Space, the final frontier? (CUP, 2003) quoted by J. Montserrat Filho, Direto e Política na Era Espacial (2007)
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Fundamental ingredient for the developing countries as a means to enable new actors to take their place, and benefit from, the future of space.

Data is the key element of our times:
- Technological barriers for data access, two-way data exchange, data storage and processing are drastically reduced
- Data is generated beyond our capacity to convert it into knowledge
- Data is cheap and sustainable: a gateway to space for the developing world
• Gathering the full force of existing infrastructure and data services: fundamental technologies and services (e.g., IVOA) are already in place and must have their full potential extracted through new use concepts.

• Push for PI-quality, high-level data provision: attainable with only small modification of agencies’ cost-to-implementation models

• Achieve global coordination and cooperation: can actually reduce costs by avoiding duplication of efforts by organising the collaboration between data centres and data providers

• Develop new technological paradigms and innovative tools: can bring a revolution in the software level to boost data and space accessibility at low-cost, with impact in education, capacity building and citizen science.
THEMATIC PRIORITIES

• Global partnership in space exploration and innovation
• Legal regime of outer space and global governance
• Enhanced information exchange on space objects and events
• International framework for space weather services
• Strengthened space cooperation for global health
• International co-operation towards low emission and resilient societies
• Capacity-building for the 21st Century
Space Data for Development

Thematic Priorities

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“[science] Data as the gateway to space for development

“The developing countries rapidly need to build national capacity to face specific local problems at the best cost-benefit. [For this] it is important to secure the development of human resources, producing young scientists and technicians to whom they can entrust the application of space technology in national tasks”

Prof. U.R. Rao, ex-chair of COPUOS (2000)
THE CONTEXT OF THE INITIATIVE

Open Universe is being proposed to integrate the Agenda 2030 for Sustainable Development of the United Nations, through the activities of UNOOSA.
Open Data can directly impact in education and capacity building in developing nations, provided that high-level, truly accessible and usable data is available. [Transparent Data]
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Citizen Science is expected to have great impact in future societies.

NOV/18 Report from NAS “Learning through citizen science” https://www.nap.edu/download/25183
SUSTAINABLE DEVELOPMENT GOALS

Where do we want to go?

Computing

Interpretation

Knowledge

Analysis

Data & Information

DEMOCRATISED ACCESS LEVEL

MWL Astronomy Community

Specialist Community

Provider

RESURFACE DATA

BASE mining and integration solutions, as well as bringing

used standards, processing from raw

developing enhanced
data

by identifying inaccessible data and working with national and regional
entities to solve the challenges to make them public, including legacy data,

resources:

INCREASE TRANSPARENCY

solutions, interfacing and facilitating cooperation between data providers and data
data to web

principles, promoting the adoption of widely

promoting FAIR (Findable, Accessible, Interoperable, Reusable) guiding

Growing

new main players and actors in the international space science arena into the

users; and by promoting STEM education, particularly among

women and youth in developing countries.

potential end

necessary tools to use astronomy and space science data for a range of target

as well the rapidly growing community of citizen scientists, by providing the

BROADEN THE USER

Initiative and in contact with other public data access solutions.
Open Data can directly impact in education and capacity building in developing nations, provided that high-level, truly accessible and usable data is available. [Transparent Data]

Transparent data can also be a tool for horizontal collaboration between developing and emerging countries, improving local action.
The **BRICS countries** form a particular bloc of emerging countries. Heterogeneous in many senses, they have a similar development context, and can mostly benefit from capacity building to access space technology and the derived benefits.

- E.g., see the BRICS Astronomy Working Group directory: [www.bricsastronomy.org/](http://www.bricsastronomy.org/)

- A good number of medium / small astronomical facilities across different fields
- Insertion in large international projects, either abroad or as host
- Varying degree of direct space accessibility and capabilities
- Generally poor dissemination of advanced knowledge, and lack of human resources.
A SNAPSHOT OF ASTRONOMICAL DATA IN BRAZIL

OBSERVATORIES

Facilities in Chile

SOAR

GEMINI

Itapetinga Radio Observatory

Pico dos Dias Observatory

SANTOS DUMONT 1,1 PFLOPS

DATA PROCESSING CAPABILITY

Vienna — 07/02/2017

Committee On the Peaceful Uses of Outer Space

15th Session

Facilities in Chile

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SANTOS DUMONT 1,1 PFLOPS

DATA PROCESSING CAPABILITY
Brazil - BRICS Collaboration
Clarivate Analytics | Research in Brazil

<table>
<thead>
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<td>30,467</td>
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Figure 9 Top 20 countries that collaborate with Brazil 2011 – 2016 by number of papers.

Source: CAPES InCites Report 2017
Brazil - BRICS Collaboration

Clarivate Analytics | Research in Brazil

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"[...] a strategy of expanding strategic collaborations with the BRICS countries would yield greater dividends than collaboration [...]"

High Impact Research in collaboration with BRICS countries.

Source: CAPES InCites Report 2017

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The Open Universe Initiative was proposed by the Govt. Italy and ASI to COPUOS in 2016, as an answer to the United Nations SDGs and the 2030 Agenda. A/AC.105/2016/CRP.6

— Developed in preparation for UNISPACE+50
— Formally supported by Brazil

Experts Meeting at ASI, Feb 2017
http://www.openuniverse.asi.it/documents/ou_documents.php

United Nations Workshop, Nov 2017

UNOOSA Report on Open Universe found at:
**PILLARS OF THE OPEN UNIVERSE INITIATIVE**

**INCREASE TRANSPARENCY** of already accessible resources: including promoting FAIR (Findable, Accessible, Interoperable, Reusable) guiding principles, promoting the adoption of widely-used standards, processing from raw data to web-ready products, enhanced data-mining and integration solutions, interfacing and facilitating cooperation between data providers and data centres and archives…

**RESURFACE DATA** and other hidden or otherwise hardly accessible resources: by identifying inaccessible data and working with national and regional entities to solve the challenges to make them public, including legacy data, as well as bringing new main players and actors in the international space science arena into the Initiative and in contact with other public data access solutions.

**BROADEN THE USER-BASE** of astronomy and space science data: to include as well the rapidly growing community of citizen scientists, by providing the necessary tools to use astronomy and space science data for a range of target groups, including educators and students, planetariums, amateur scientists or other potential end-users; and by promoting STEM education, particularly among women and youth in developing countries.

Summary from the UN Workshop on the Open Universe Initiative, November 2017
PILLARS OF THE OPEN UNIVERSE INITIATIVE

Open UNiverse

Open Universe is an initiative under the auspices of COPUOS/UNOOSA for expanding availability of and accessibility to open space science data.

Open Universe documents

- Open Universe paper
- Original proposal A/AC.105/2016/CRP.6
- Open Universe Expert Meeting, 11-12 April 2017, ASI-HQ, Rome, Italy
- Report on the Open Universe Expert Meeting
- Open Universe Workshop, Vienna 20-22 November 2017
- Report on the Open Universe workshop

Open Universe Technical presentations

- June 2016 - COPUOS, 59th session
- June 2017 - COPUOS, 60th session
- February 2018 - COPUOS-STSC, 55th session

www.openuniverse.asi.it

Ulisses Barres de Almeida / CBPF

UNOOSA High-Level Forum / Bonn 2018
PILLARS OF THE OPEN UNIVERSE INITIATIVE

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**OPEN UNIVERSE KIT**
Accessibility tool for data publication.

**CAPACITY BUILDING & TRAINING INITIATIVES**
Enabling independent local actions.
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Enabling independent local actions.

Focal point within the UN OOSA is the right way to take it forward.
THANK YOU!

Open Universe

Space science data for everyone

Ulisses Barres de Almeida
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