

# The United Nations Open Universe Initiative and the Brazilian Science Data Center (BSDC)

Ulisses Barres de Almeida<sup>1</sup>

<sup>1</sup> Centro Brasileiro de Pesquisas Físicas (CBPF), Rua Dr. Xavier Sigaud 150, 22290-180 URCA, Rio de Janeiro, Brazil e-mail: [ulisses@cbpf.br](mailto:ulisses@cbpf.br)

**Abstract.** Space-science related activities and access to astronomical facilities and data can offer a cost-effective, entry-level path for capacity building and science and technology education. In 2016, the government of Italy, working together with the Italian Space Agency (ASI), proposed the "Open Universe" Initiative, under the auspices of the Committee on the Peaceful Uses of Outer Space. The Initiative, which is included in the preparation for UNISPACE+50, has the main objective of promoting and facilitating visibility, free accessibility and easy utilisation of astronomical data collected by space-based and ground-based facilities among everybody in the world. In this report we will describe the Open Universe Initiative at its current status and its related activities currently in course in Brazil.

**Resumo.** Atividades associadas às Ciências Espaciais, e o acesso a facilidades astronômicas e dados, podem oferecer um modelo de entrada efetivo e sustentável para desenvolvimento de capacidades e educação em ciência e tecnologia. Em 2016, o governo italiano, trabalhando junto com a Agência Espacial Italiana (ASI), propuseram a Iniciativa "Open Universe", sob os auspícios do Comitê para os Usos Pacíficos do Espaço Exterior (COPUOS). A Iniciativa, a qual está incluída nas preparações para o UNISPACE+50, tem o objetivo principal de promover e facilitar a visibilidade, o acesso livre e a fácil utilização de dados astronômicos coletados por facilidades terrestres e espaciais, a cidadãos do mundo todo. Neste breve documento, descreveremos a Iniciativa Open Universe em seu estado atual e as atividades a ela relacionadas atualmente em curso no Brasil.

**Keywords.** Astronomical databases: miscellaneous – Standards – Virtual observatory tools

## 1. Introduction

"Open Universe" is an initiative under the auspices of the Committee on the Peaceful Uses of Outer Space (COPUOS) that aims at stimulating a dramatic increase in the availability and usability of space science data, extending the potential of scientific discovery to new participants in all parts of the world. Originally proposed by Italy<sup>1</sup>, the initiative is carried out in cooperation with the United Nations Office for Outer Space Affairs (UNOOSA), as part of the activities in preparation for UNISPACE+50 – the 2018 conference that will define a comprehensive United Nations Space2030 agenda for the contribution of space to the UN Sustainable Development Goals.

Open Universe seeks to trigger a major evolution of current space science data availability, fostering the publication of all existing open space science data in a way that is easily discoverable and immediately usable, thus responding to the growing global demand for transparency.

To this aim, the Office for Outer Space Affairs and the Open Universe Initiative will work towards enhancing and completing the on-line availability and visibility of astronomical and space science data, following existing data standards and developing additional ones whenever necessary. Additionally, they will work to promote the development of software tools for science, education and outreach, with the objective to further the cultural and knowledge progress of society, with particular attention to emerging and developing countries, such as Brazil.

## 2. Space Science and Data Transparency

Much has already been done to offer open access to scientific data, but further efforts are necessary to consolidate and expand services, in order to promote substantial data-driven increase in technical and science training, education and discovery. A pre-condition for such process is that it must aim at leading to a broader level of transparency of space science data, across a large user base, from specialists to the citizen-scientist, supported by a wide initiative of international cooperation among space science providers.

In fact, most of data in scientific research is generated with public money, with an approximate 15 Billion Euros being invested every year for the sector of space science alone, according to data from 2016 by the Secure World Foundation (1). This alone justifies the application of new transparency criteria that will ensure that the benefits of the space sector will reach all citizens, increasing the amount of knowledge extracted from the existing data and democratising access to information across the world and among all nations.

Open data policies can be implemented in ways that benefit not only the user, but ensure a science reward for the provider, increasing its impact and the overall return for the investment on the generation of the scientific data. This has the potential of reinforcing the importance of the facilities that generate data, guaranteeing in turn continued funding and future operation.

When talking about transparency in space science data, one must consider the open access to high level calibrated data products like images, spectra, etc., which are readily usable by all, be it for purposes of efficient research and data mining by the scientists, or application to educational purposes, or even increasing discoverability by the citizen scientist.

<sup>1</sup> Cf. COPUOS document A/AC.102/2016/CRP.6

In this regard, internet technologies are key, and represent an unprecedented two-way channel of communication across the globe, between producers and users of data. For this reason, transparent data must also be web-ready, and the availability of data products must be accompanied by the development of appropriate interfaces and software tools for mining, visualisation and efficient utilisation of this data by all sectors.

### 3. The Open Universe Workshop

With the purpose of drawing recommendations for the Open Universe Initiative, the United Nations, together with the Government of Italy, organised, between the 20 and 22 November 2017, at the headquarters of UNOOSA in Vienna, a Workshop on the Open Universe Initiative. An official report, along with a set of recommendations for the General Assembly of COPUOS is being currently prepared.<sup>2</sup>

The Workshop, in the context of the preparations for UNISPACE+50, had the following main objectives:

- Review the status of current initiatives in space science with regard to data sharing and data availability;
- Promote the universal adoption of established good practices and standards in the field of astronomy and planetary science, of the FAIR principles in data sharing (Findable, Accessible, Interoperable, and Reusable), aiming at enabling transparent access and use of science-ready high-level data (2);
- Discuss the long-term sustainability of astronomy and space science data archives as an enabler for the robust provision and preservation of high-level science-ready data;
- Examine the opportunities for education and capacity-building in the field of space-science data, with special attention to emerging and developing countries; and
- Discuss coordination of international efforts of providers of space science data according to a set of criteria on ease of access, quality, robustness, transparency, completeness and timeliness.

### 4. A web portal for the Open Universe Initiative

As a first contribution to the Initiative, the Italian Space Agency (ASI) is developing a prototype Open Universe portal, that is a multi-discipline (astrophysics, planetary sciences, cosmic-ray and atmospheric physics) web site where a large number of space science data sets, analysis tools, bibliography and general information services, provided by many on-line space science data archives, can be found next to each other.

The ASI web portal, which is accessible at [www.openuniverse.asi.it](http://www.openuniverse.asi.it), can be thought of as a sort of virtual "shopping mall" dedicated to space science data, where professional scientists and common citizens alike can go, call on the many "shops" (data archive sites, each identified by its own brand) offering different services and data products. In this way, they can use the results to learn about space science or perform scientific analyses, while the software that is running behind the portal communicates with all components, in an attempt to adapt to the user's needs.

<sup>2</sup> A preliminary recommendations document is available online or from the UNOOSA website under the following reference code A/AC.105/2017/CRP.22

### 5. Open Universe and related activities in Brazil

Brazil is an active participant in the Open Universe Initiative, since its first proposals, through the institutional support of the Brazilian Space Agency (AEB) and activities under development at the Brazilian Center for Research in Physics (CBPF). In particular, we cite the Brazilian Science Data Center (BSDC), a novel data center initiative under development at CBPF since 2016 (3). The BSDC is built, from the start, over the concepts and ideas proposed by the Open Universe Initiative, as a virtual interface for data access, visualisation and mining in astrophysics and space science, based on Virtual Observatory Tools and Protocols. It has been focused from the start on topics related to Extragalactic Astrophysics and in particular blazars and active galactic nuclei (AGN) science.

Although it is a multi-messenger archival and data interface, the BSDC is focusing in activities to resurface some datasets which are either unavailable or hard to access. One of these is very-high-energy (VHE) gamma-ray data, for which no comprehensive online repository is available, due to restrictive data sharing policies in the field. We are working at the moment in a project to publish the full legacy AGN catalogue and standardised high-level data products for the VERITAS Collaboration, as a pathfinder project before extending the initiative to their data providers in the field.

A similar effort is being undertaken regarding AGN optical polarimetry data. In this case, much data is freely available online, but the lack of standards in data provision among different providers, lack of compliance to VO standards and protocols and poor repository infrastructure make these data hard to find and use. We are currently working with some data providers in this field, and across the globe, to create the first centralised repository for AGN high-level optical polarimetry data, developing standards, protocols and data interfaces whenever it is necessary, for the homogeneous provision, integration and publication of as much new and past data as possible.

The BSDC online interface is expected to be launched early next year and will be accessible via the following address: [www.bsdc.cbpf.br](http://www.bsdc.cbpf.br).

*Acknowledgements.* I thank Paolo Giommi, Andy Pollock and Massimo De Angelis for numerous discussions and exchanges about the Open Universe Initiative. The Brazilian participation in the Open Universe Initiative has the institutional support of the Brazilian Center for Research in Physics (CBPF), the Brazilian Space Agency (AEB). The BSDC has been partly funded by FAPERJ, under the thematic project 110.148/2013.

### References

- Secure World Foundation 2016. UNOOSA High Level Forum of Dubai, <http://www.unoosa.org/oosa/en/ourwork/hlf/2016/first-hlf-meeting.html>.
- Wilkinson, M.D. et al. 2016. *The FAIR Guiding Principles for scientific data management and stewardship*, Sci. Data 3:160018.
- Barres de Almeida, U, et al. 2017. *The Brazilian Science Data Center (BSDC)*, arXiv:1702.06828.