CBPF UNOOSA serrapilheira

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES MCTIC

THE OPEN UNIVERSE INITIATIVE: ACCESS TO SPACE FOR ALL

Ulisses Barres de Almeida[1], Paolo Giommi[2], Jorge Del Rio Vera[3]

[1] Brazilian Center for Research in Physics (CBPF)
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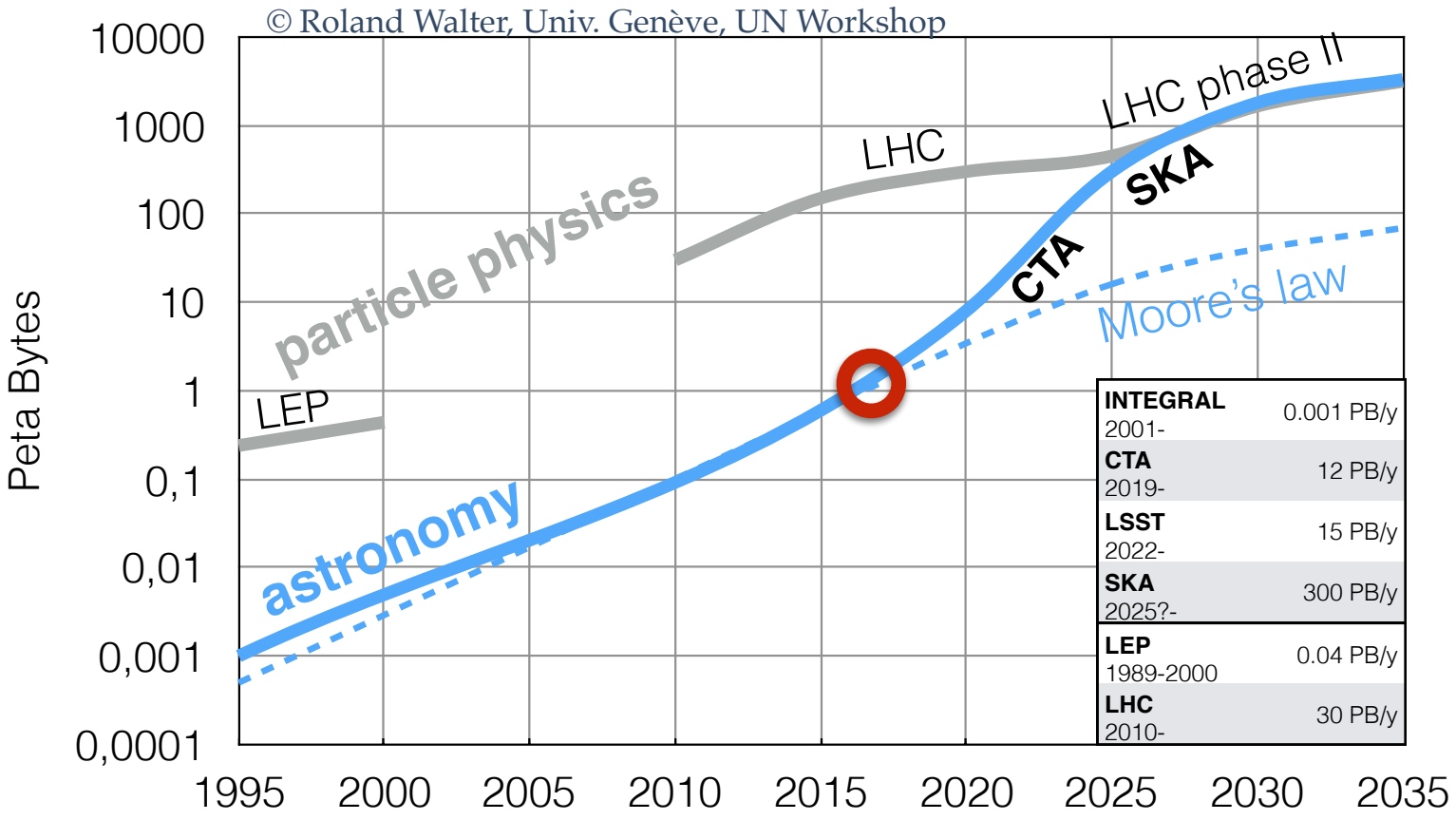
[3] United Nations Office for Outer Space Affairs (UN-OOSA)

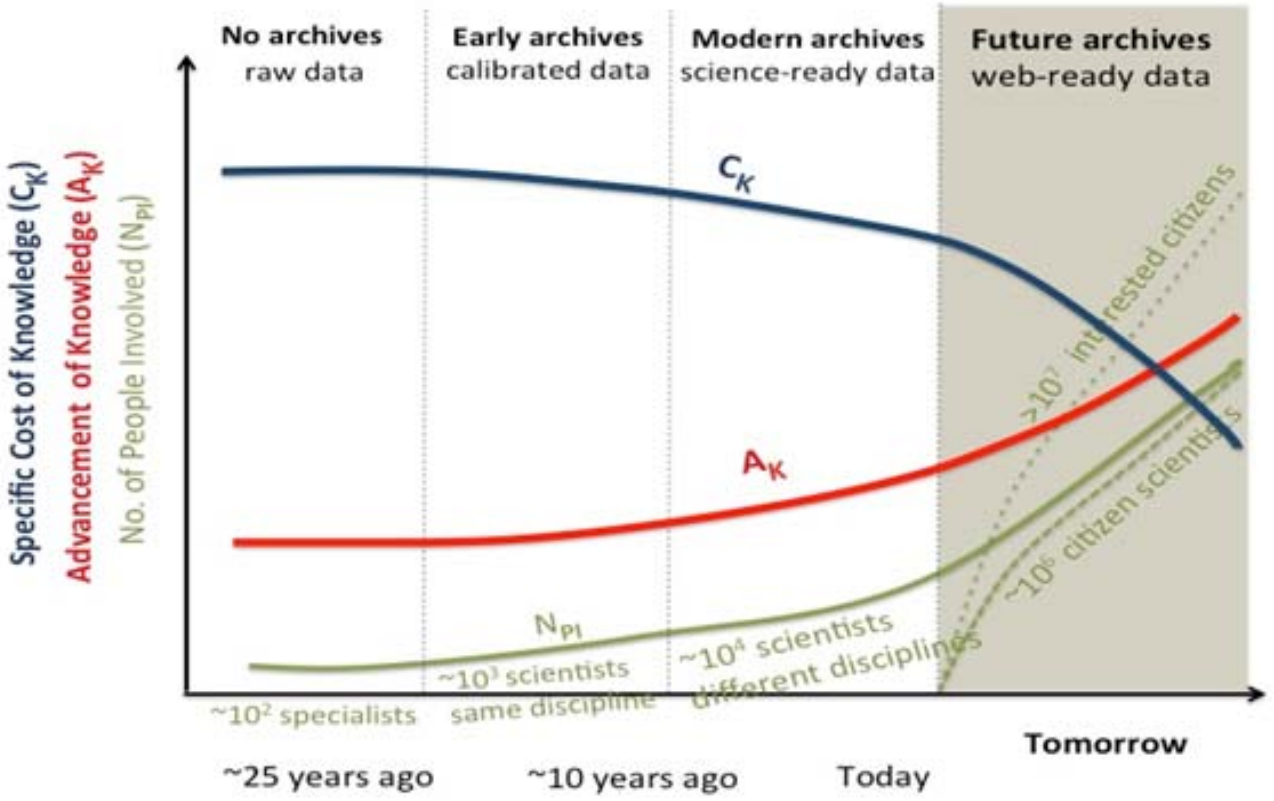
PREMISES

I - Dramatic increase in the volume of data produced in astronomy and space sciences



PREMISES

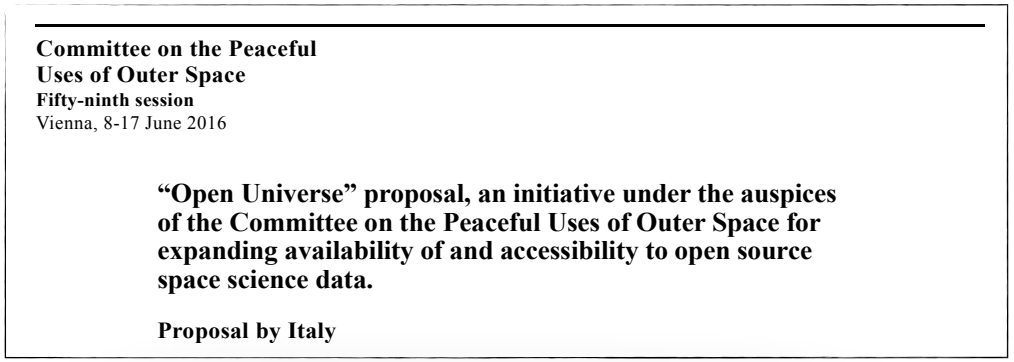
II - Evolution of information technology opens new opportunities for data sharing, accessibility, and utilisation.



From the original COPUOS proposal by Italy

ORIGINS OF THE INITIATIVE

Original Open Universe Proposal at 59th COPUOS:
A/AC.105/2016/CRP6



Committee on the Peaceful Uses of Outer Space
Fifty-ninth session
Vienna, 8-17 June 2016

"Open Universe" proposal, an initiative under the auspices of the Committee on the Peaceful Uses of Outer Space for expanding availability of and accessibility to open source space science data.

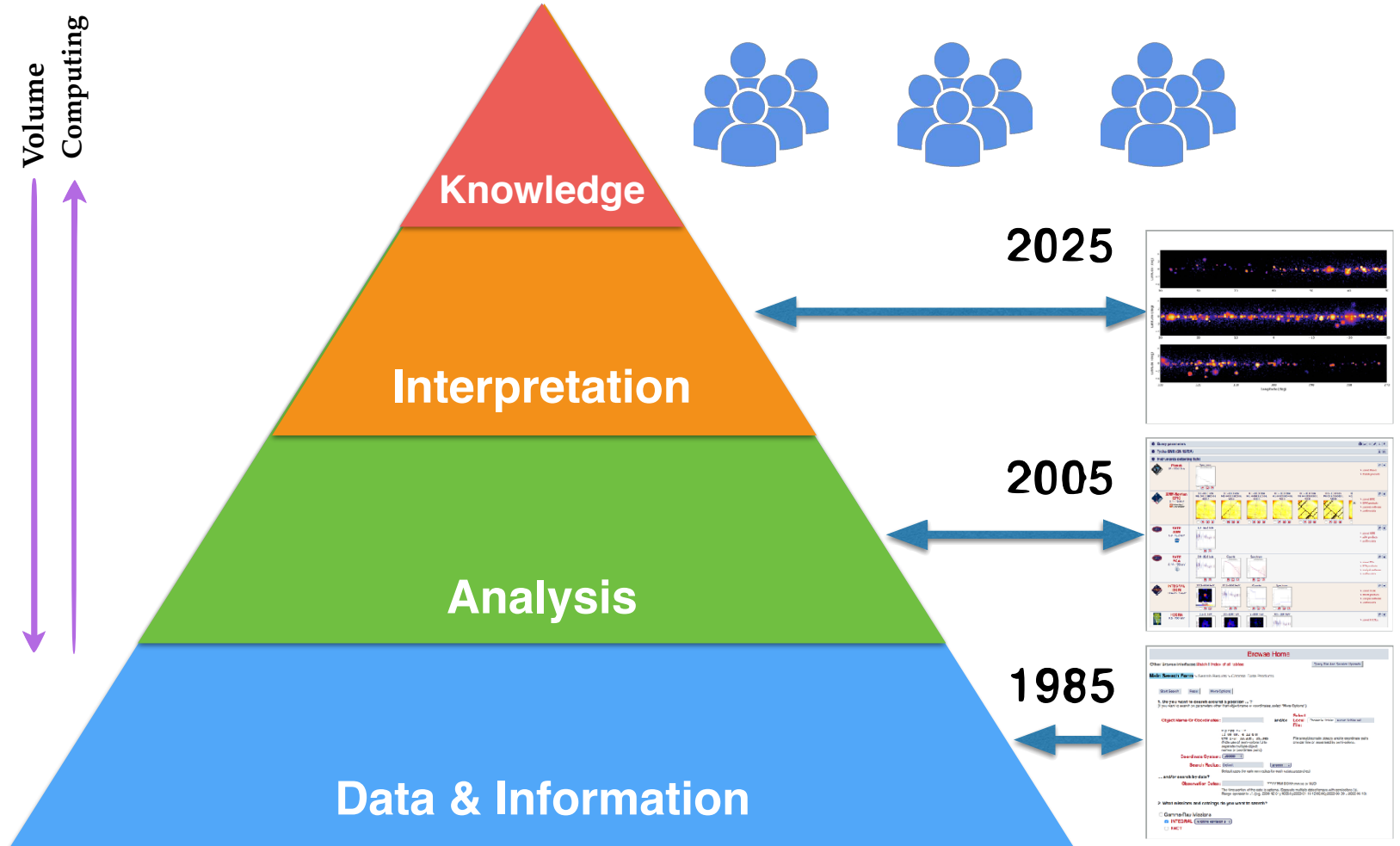
Proposal by Italy

"Open Universe" was originally proposed by Italy as an initiative under the auspices of COPUOS, during the preparations for UNISPACE+50.

- **Main goal is** to dramatically expand the availability and access to space science data, responding to the growing demands of transparency on the use of public resources and of the societal returns of science.

- **Motivated by** (i) from one side, the evidence of the increased rate of production of scientific data in all fields, including space science, and the responsibility to convert such data into effective knowledge; (ii) on the current context in which technological barriers to data sharing and access have been dramatically reduced, opening up new opportunities for knowledge dissemination and inclusion.

DEMOCRATISING KNOWLEDGE



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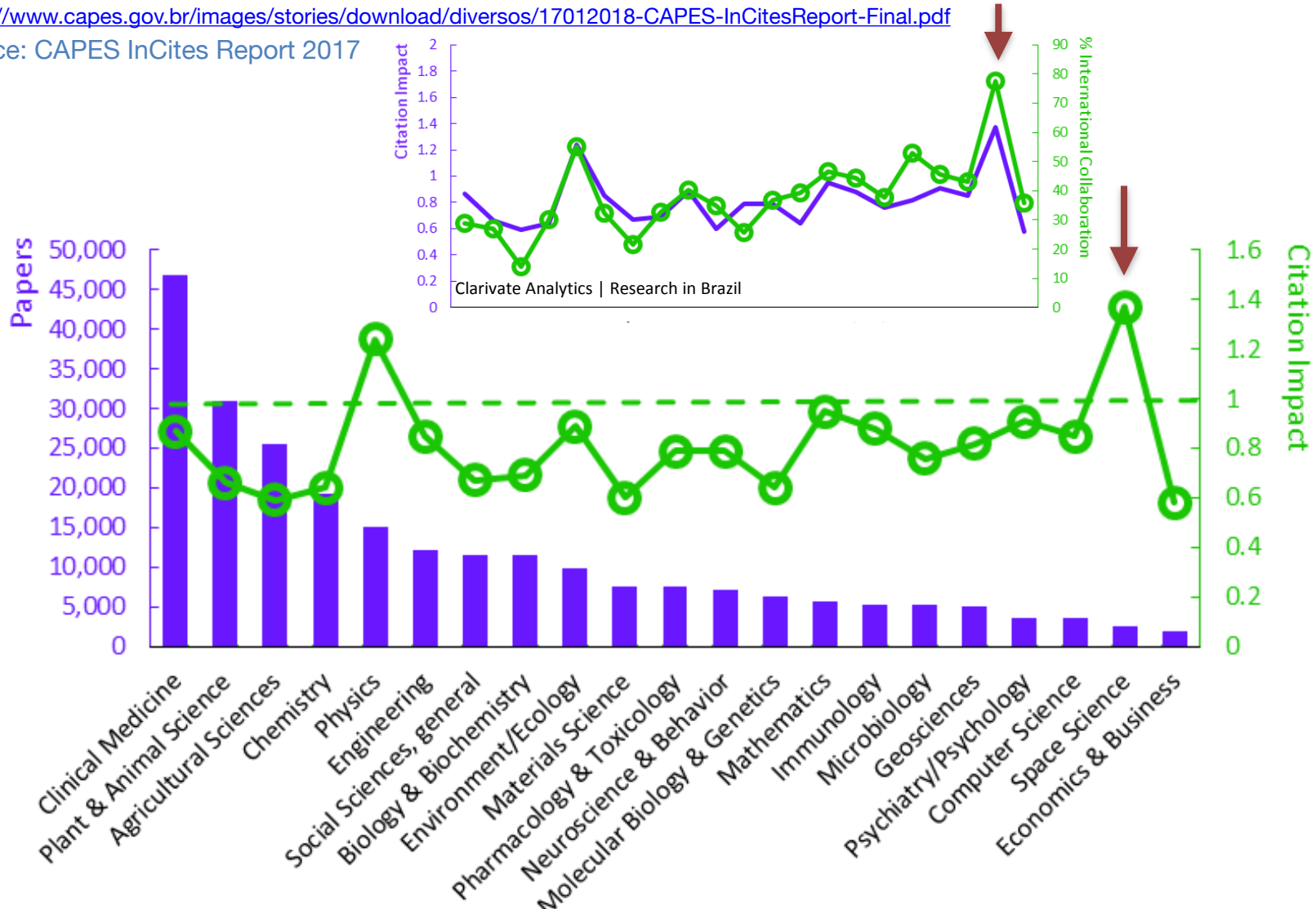
THE APPEAL OF SPACE SCIENCE: STRENGTH OF INTERNATIONAL COOPERATION

https://www.capes.gov.br/images/stories/download/diversos/17012018-CAPES-InCitesReport-Final.pdf

Source: CAPES InCites Report 2017



CONTEXT

Space accessibility is one of the four pillars (others being space economy, space society and space diplomacy) supporting a Space 2030 Agenda, as established after UNISPACE+50.

- The Agenda envisions strategies and activities to strengthen the contribution of the **space sector to the achievement of global targets**, such as the SDGs.

- In particular, **space accessibility** responds to the underlining fundamental goal of sharing the benefits of space exploration amongst all nations.

- Reduction of inequality of opportunities in the growing and diversifying space sector, and enhancement of international cooperation in space, are at the basis of efforts to build a peaceful future of outer space.


TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

DATA AS AN ENTRY DOOR TO SPACE

Data is specially relevant for space accessibility, and the distribution of the benefits of space exploration today.

Among the different avenues for space accessibility, data stands out as

- a most sustainable entry point,
- providing a cheap and secure starting level,
- based on education and capacity building

DATA AS AN ENTRY DOOR TO SPACE

Data is specially relevant for space accessibility, and the distribution of the benefits of space exploration today.

It also offers a

- **cost-effective avenue for international co-operation for development,**
- **whereby local groups and new players can be quickly welcomed into the global arena,**
- **and impactful "south-south" co-operation can quickly be initiated.**

BRAZIL, BACK IN THE 1950's...

Centro Brasileiro de Pesquisas Fisicas

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.

Cesar Lattes and Cecil Powell, in Bristol

Chacaltaya Cosmic-ray Lab

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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!

DEVELOPMENT OF SPACE & SPACE FOR DEVELOPMENT

Centro Brasileiro de Pesquisas Fisicas

The first UNISPACE Conference in 1968

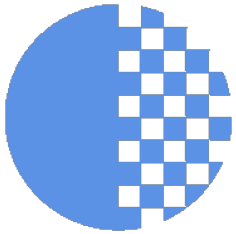
Opening Address by Pope Paul VI

http://w2.vatican.va/content/paul-vi/en/messages/pont-messages/documents/hf_p-vi_mess_19680806_conferenza-onu.html

"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."**

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.

Outcomes from the UN Open Universe Workshop, 2017

A KEY ROLE TO BE PLAYED BY UNOOSA

CBPF

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UNOOSA

UNOOSA, through its mandate from UNISPACE III, to increase scientific knowledge of near and outer space by promoting cooperative activities in astronomy and space sciences, is in a unique position to bring together all relevant stakeholders to achieve these proposed goals.

THE SUSTAINABLE COST OF DATA FOR SPACE ACCESSIBILITY

Centro Brasileiro de Pesquisas Fisicas

- 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.

STEPS TOWARDS THE OPEN UNIVERSE INITIATIVE

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

United Nations Workshop, Nov 2017
http://www.unoosa.org/oosa/en/ourwork/psa/schedule/2017/workshop_italy_openuniverse.html

UNOOSA Report on Open Universe:
http://www.unoosa.org/oosa/oosadoc/data/documents/2018/aac.105/aac.1051175_0.html

"Zero Draft" 2030 Agenda:
http://www.unoosa.org/oosa/oosadoc/data/documents/2019/aac.105c.22019crp/aac.105c.22019crp.24_0.html

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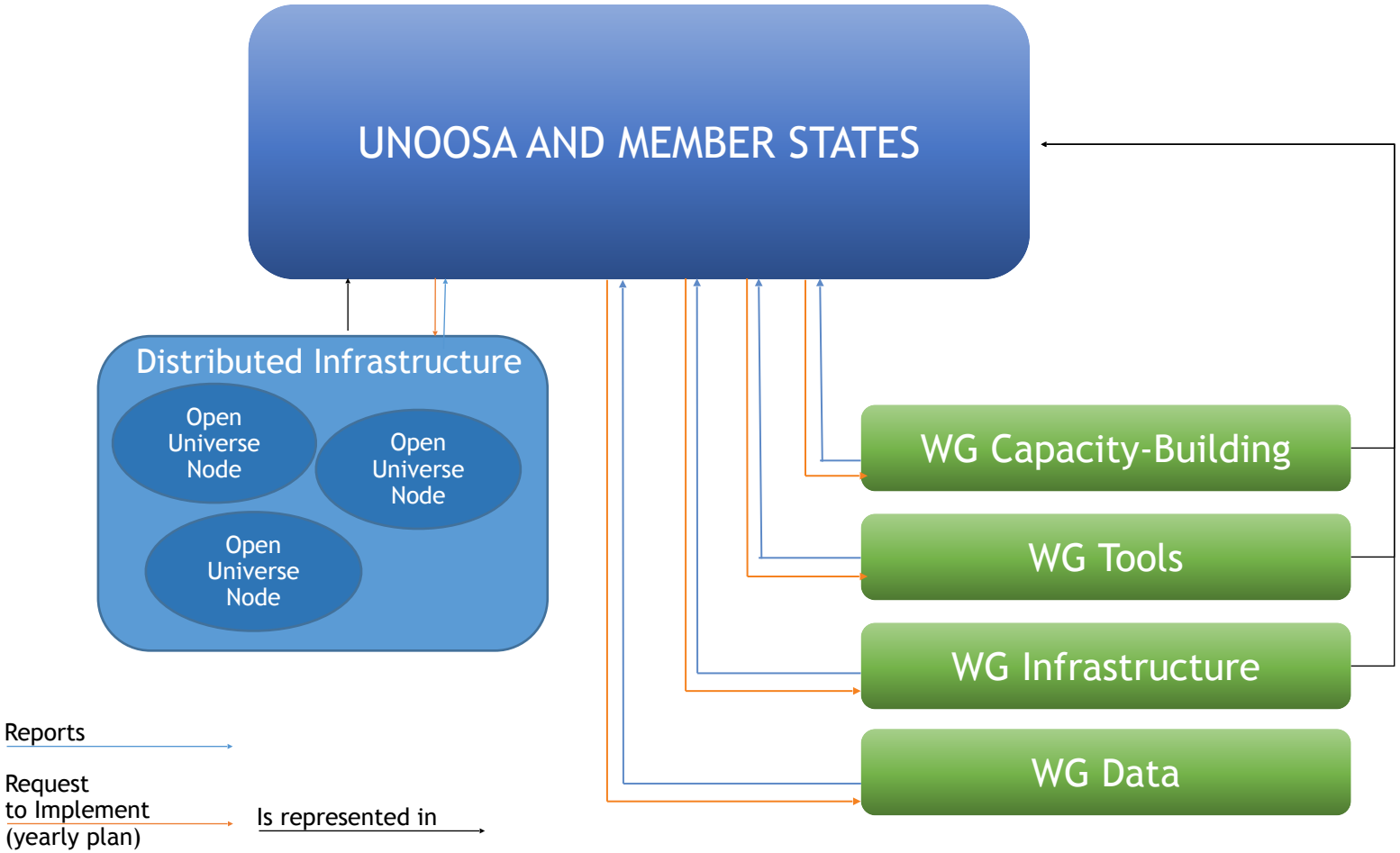
Next steps will involve:

- a kick-off meeting, to happen in 2019, to formally start the initiative within UNOOSA;
- a first meeting of the steering board, already planned to take place in Brazil in 2020, to outline the first activities and goals of the initiative.

PROPOSED STRUCTURE OF THE INITIATIVE

IMPLEMENTATION PHASE



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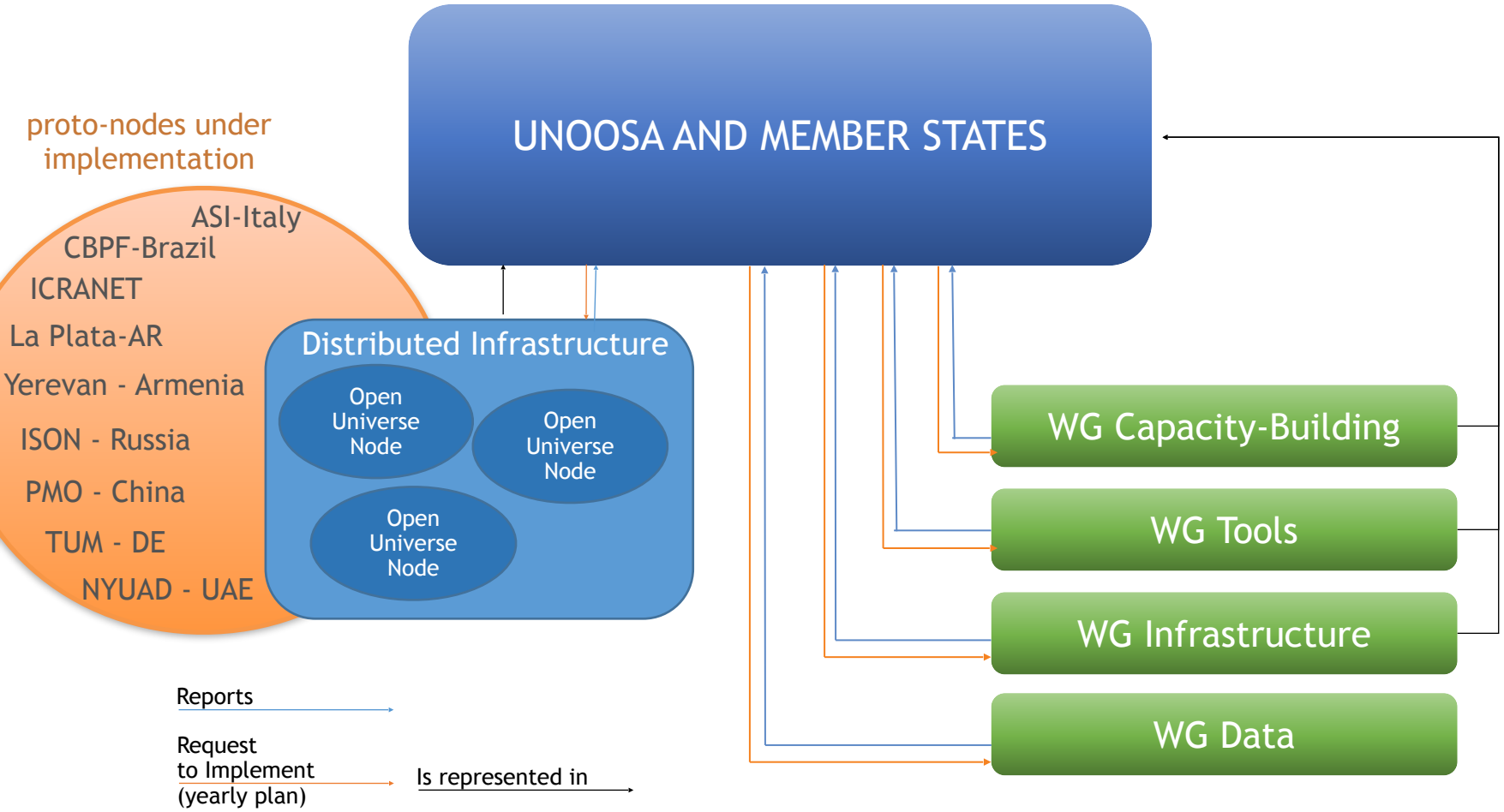
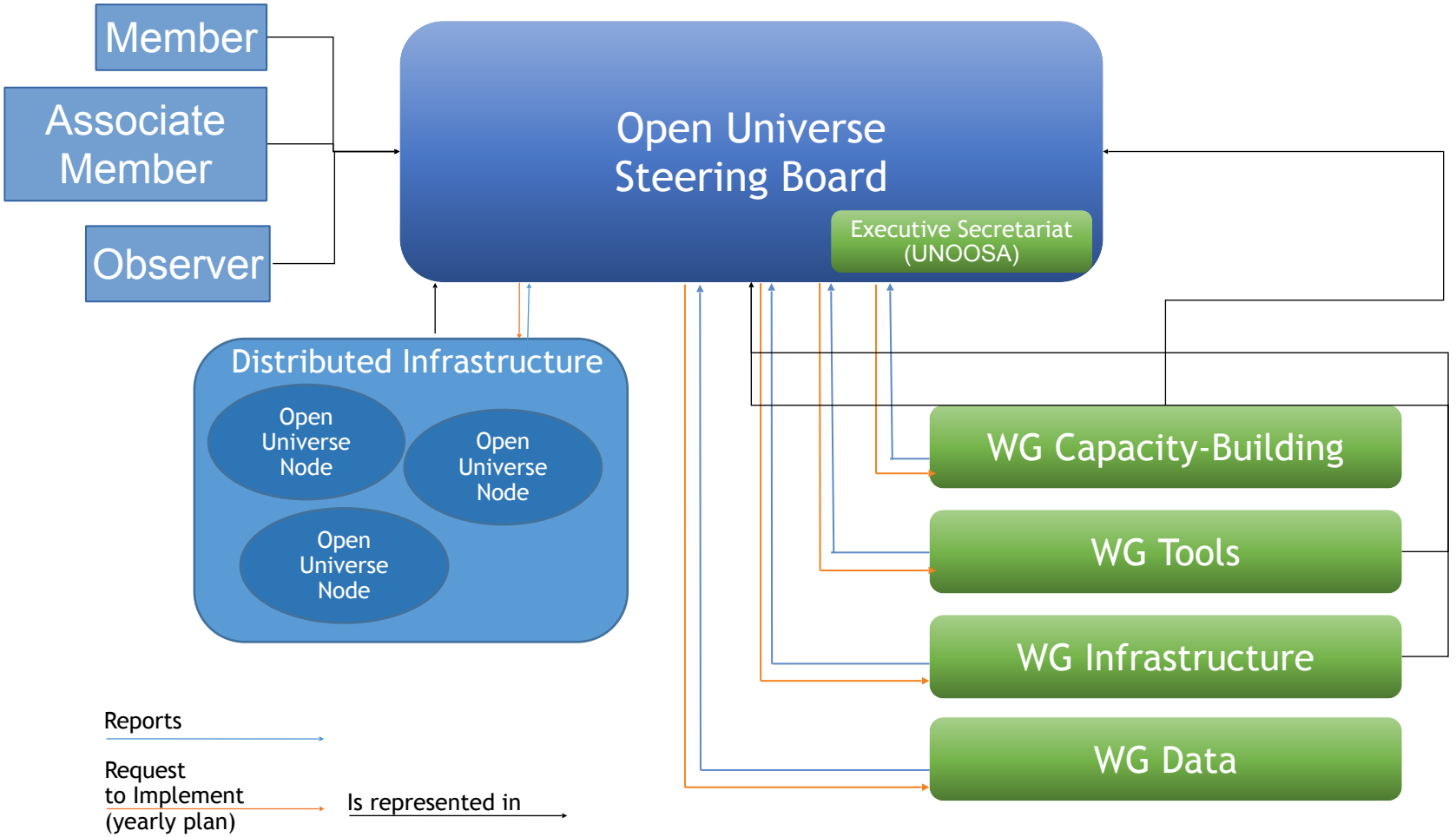
IMPLEMENTATION PHASE



PROPOSED STRUCTURE OF THE INITIATIVE

OPERATIONAL PHASE after the first few years



CURRENT STATUS OF ACTIVITIES

Open Universe is already operational, with the support of UNOOSA, through a number of activities involving the three pillars of the Initiative

- Data transparency : A data portal is maintained by ASI, with support data and software services from the proto-nodes around the world.
- Data accessibility : New software is being developed to produce enhanced data products from satellite missions; data provision from a suit of BRICS observatories is being organised.
- Capacity Building : Schools and training activities using Open Universe resources and services are being organised; e.g. at the New York University in Abu Dhabi.

CURRENT STATUS OF ACTIVITIES

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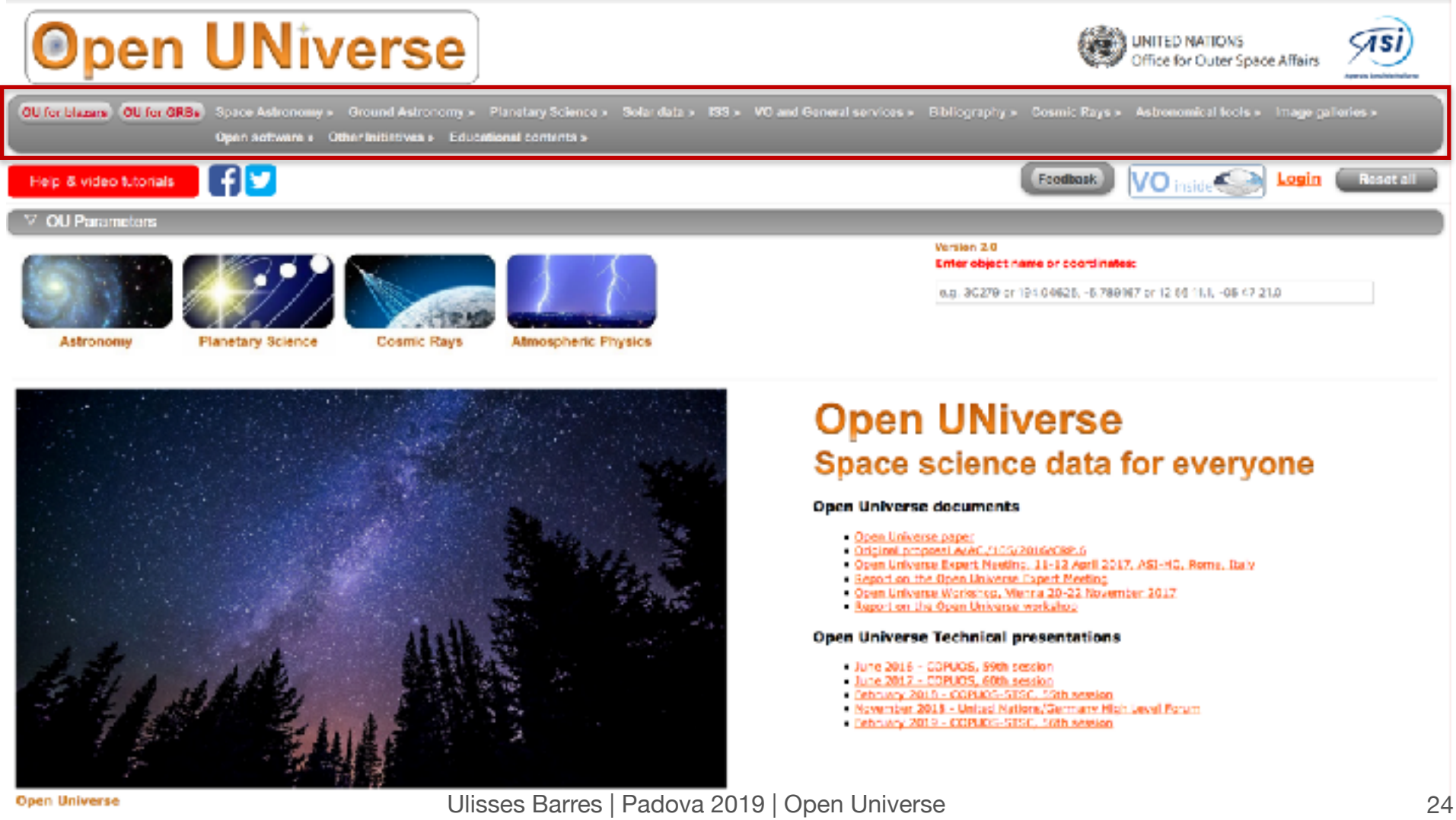
NEW SCIENTIFIC COLLABORATIONS AND CUTTING-EDGE SPACE SCIENCE RESEARCH UNDER DEVELOPMENT AS A RESULT OF THESE ACTIVITIES

THE OPEN UNIVERSE PORTAL

OPENUNIVERSE.ASI.IT



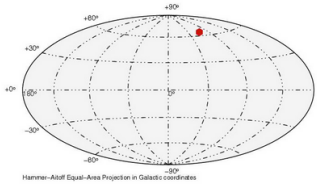
Open UNiverse for astronomy

UNITED NATIONS Office for Outer Space Affairs

Open Universe @ ASI | Space Astronomy » | Ground Astronomy » | Planetary Science » | Solar data » | ISS » | VO and General services » | Bibliography » | Cosmic Rays » | Astronomical tools » | Image galleries » | Open software » | Other Initiatives » | Educational contents »

Help & video tutorials | Feedback | VO inside | Login | Reset all

OU Parameters



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Version 1.5

Object name or coordinates: 3C273 (SSDC)

3C273

W General | W Source | NED | SIMBAD | CDS

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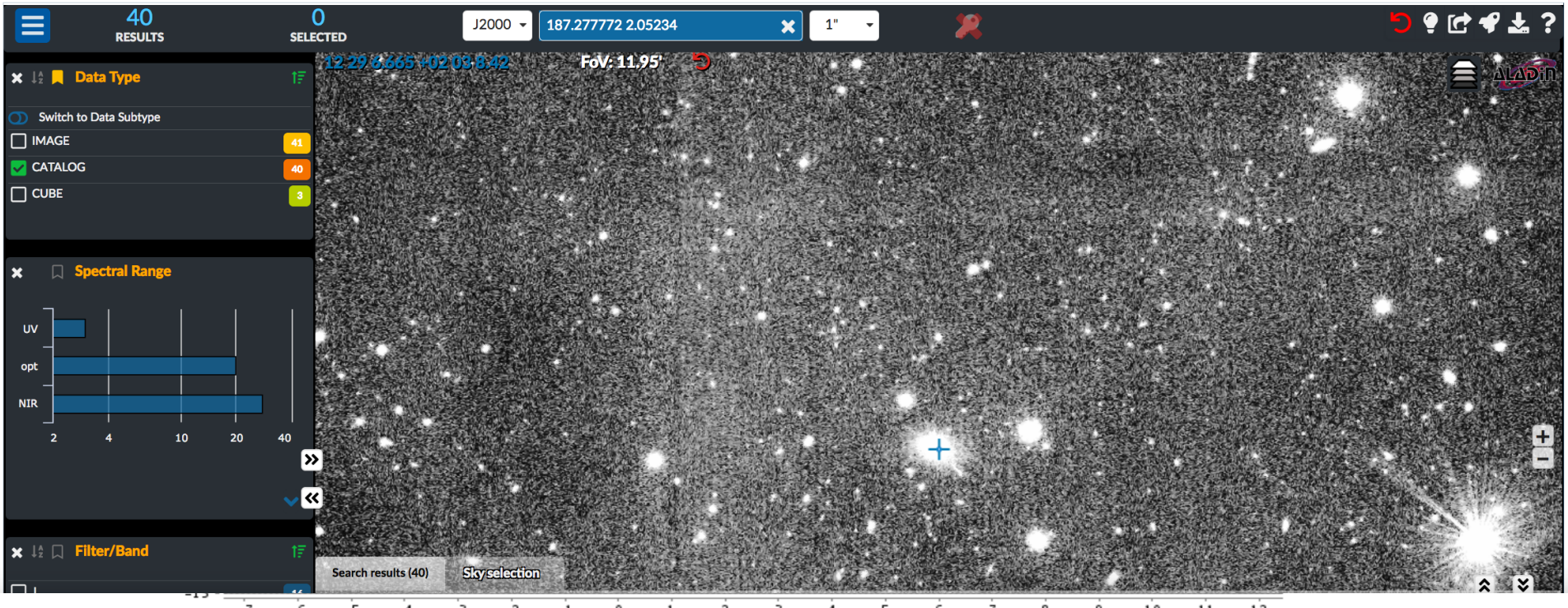
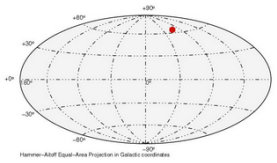
VizieR X-R-G | VizieR IR-Opt | HEASARC Browse | VAO Data Scope | SkyMapper | MAST Archive | CADC Archive | ESO Archive | NOAO Survey Data | NRAO Archive | ALMA Archive

ISDC HEAVENS | SSDC Archive | Radio Telescope DC | INAF IA2 | Multi-freq. Explorer | VOU-Blazars | VOU SED | SED Builder | SED Movie | ADS Bibliography | NED Bibliography

CDS Bibliography





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Version 2.0
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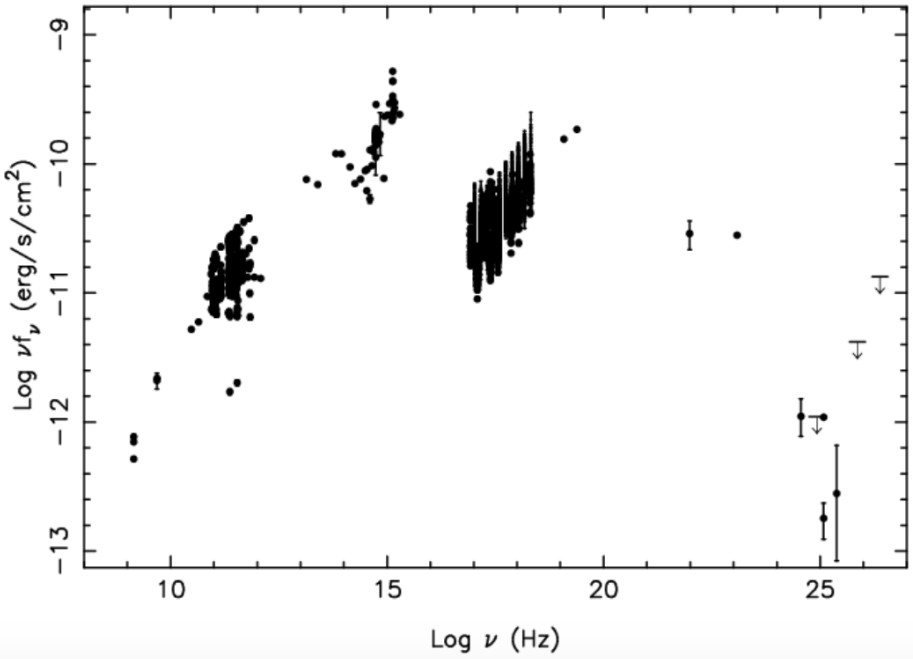
3C273.0

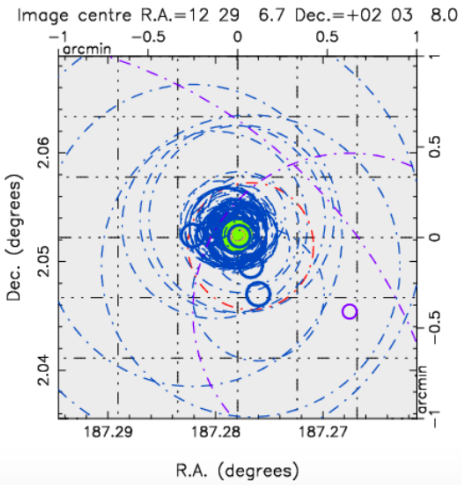
W General W Source NED SIMBAD CDS

ESASky | SKY-MAP.ORG | Google Sky | SDSS SkyServer | Aladin Light | ESO Products | Legacy Surveys | Super Cosmos | Radio Surveys | SSDC Catalogs | SSDC R-X-O
VizieR X-R-G | VizieR IR-Opt | HEASARC Browse | VAO Data Scope | SkyMapper | MAST Archive | CADC Archive | ESO Archive | NOAO Survey Data | NRAO Archive | ALMA Archive
ISDC HEAVENS | SSDC Archive | Radio TelescopeDC | INAF IA2 | Multi-freq. Explorer | VOU-Blazars | VOU SED | SED Builder | SED Movie | ADS Bibliography | NED Bibliography
CDS Bibliography

VOU SED

Source position: 12 29 6.7 , 02 03 8.0





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1.144E+11	6.817E-12	7.158E-12	6.476E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
1.144E+11	6.817E-12	7.158E-12	6.476E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
2.352E+11	6.599E-12	6.929E-12	6.269E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
3.394E+11	6.992E-12	7.342E-12	6.643E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
2.218E+11	6.849E-12	7.191E-12	6.506E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
2.218E+11	6.875E-12	7.219E-12	6.531E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
3.478E+11	7.564E-12	7.942E-12	7.186E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
3.478E+11	7.552E-12	7.929E-12	7.174E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
3.440E+11	7.618E-12	7.999E-12	7.237E-12	ALMA	Bonato et al. 2018, MNRAS, 478, 1512
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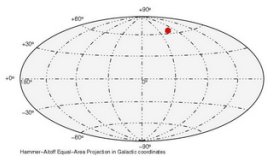


Aitoff coordinates type: **Galactic** - *Equatorial*

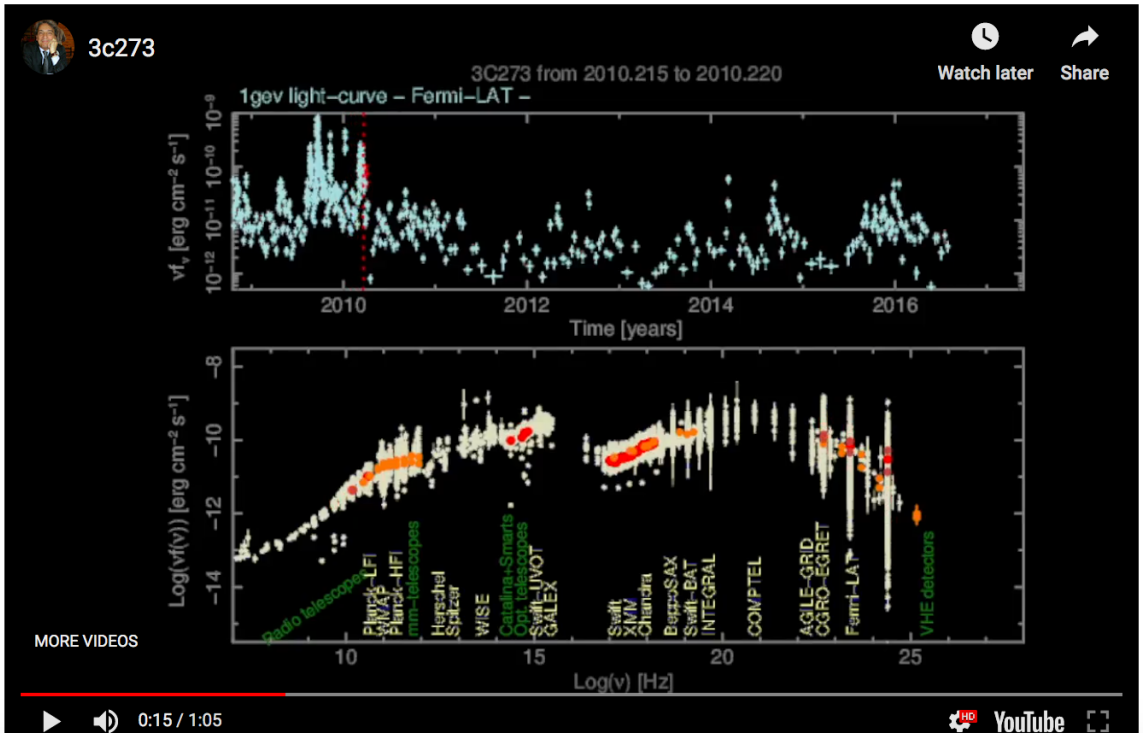
Source Name(s) : **3C273.0**
R.A.(J2000) = **12 29 06.7 (187.277917 deg)**
Dec.(J2000) = **+02 03 07.99 (2.052222 deg)**
GLON = **289.95** GLAT = **64.35**

Version 2.0
Object name or coordinates: 3C273.0 (SSDC)

3C273.0

W General W Source NED SIMBAD CDS

ESASky | SKY-MAP.ORG | Google Sky | SDSS SkyServer | Aladin Light | ESO Products | Legacy Surveys | Super Cosmos | Radio Surveys | SSDC Catalogs | SSDC R-X-O
VizieR X-R-G | VizieR IR-Opt | HEASARC Browse | VAO Data Scope | SkyMapper | MAST Archive | CADC Archive | ESO Archive | NOAO Survey Data | NRAO Archive | ALMA Archive
ISDC HEAVENS | SSDC Archive | Radio TelescopeDC | INAF IA2 | Multi-freq. Explorer | VOU-Blazars | VOU SED | SED Builder | SED Movie | ADS Bibliography | NED Bibliography
CDS Bibliography



Open Universe for blazars is a programme developed as part of the Open Universe Initiative (Giommi et al. 2018) to support multi-frequency/multi-temporal blazar science by creating source catalogues and high-transparency data products that are ready for use or enable anyone interested in astronomy, with or without data analysis expertise, to do the same using innovative analysis methods.

The OU master list of blazars

Scientific publications

- A new generation of astronomical products based on 14 years of Swift-XRT data
- The Open Universe VOU-Blazars tool
- Swift-XRT spectra and light-curves of blazars observed more than 100 times.
- Fermi-LAT adaptive-bin light-curves of bright blazars

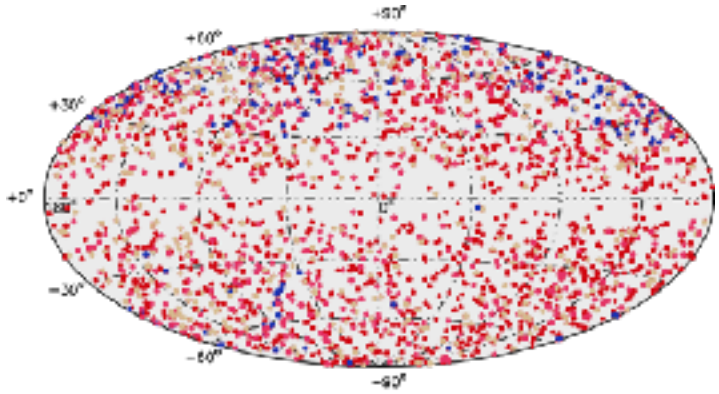
NEW SOFTWARE AND DATA PRODUCTS

"SWIFT DEEP SKY"

REMOVING THE NEED FOR DATA ANALYSIS EXPERTISE IN X-RAY SATELLITE MISSIONS

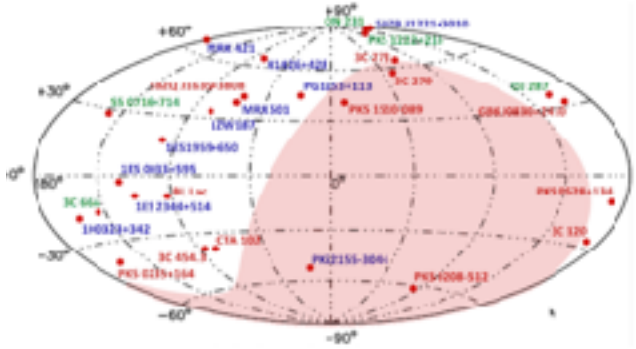
Open Universe for Blazars: a new generation of astronomical products based on 14 years of Swift-XRT data.

P. Giommi[1,2,3], C.H. Brandt[3,4], U. Barres de Almeida[4,5], A.M.T. Pollock[6], F. Arneodo[7], Y. L. Chang[8], D. Civitarese[3,5], M. De Angelis[1], V. D'Elia[10,12], J. Del Rio Vera[11], S. Di Pippo[11], R. Middei[13], A. V. Penacchioni[6], M. Perri[10,12], R. Ruffini[9], N. Sahakyan[14], and S. Turriziani[15]



Swift_deepsky run on a11,000
Swift-XRT observations of blazars

Spectral information on dozens of sources with over 100 pointings by Swift



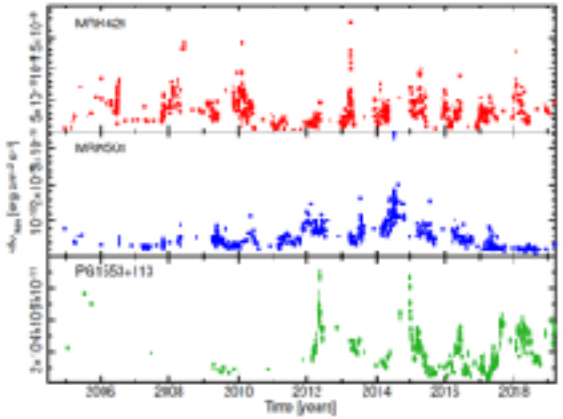


Fig. 5. Examples of 1 KeV light curves of HBL blazars built

Detailed time-variability information for tens of sources regularly monitored

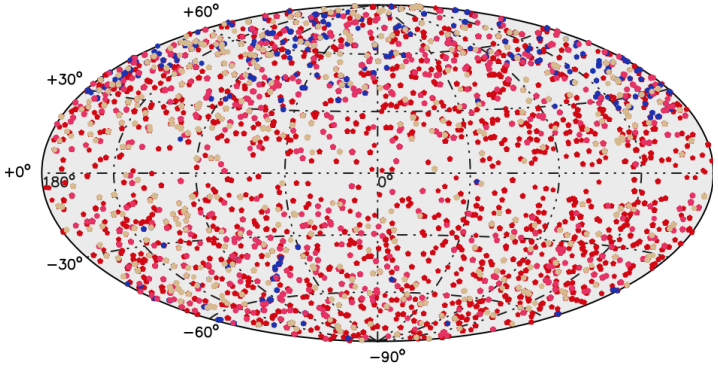
Open UNiverse for blazars

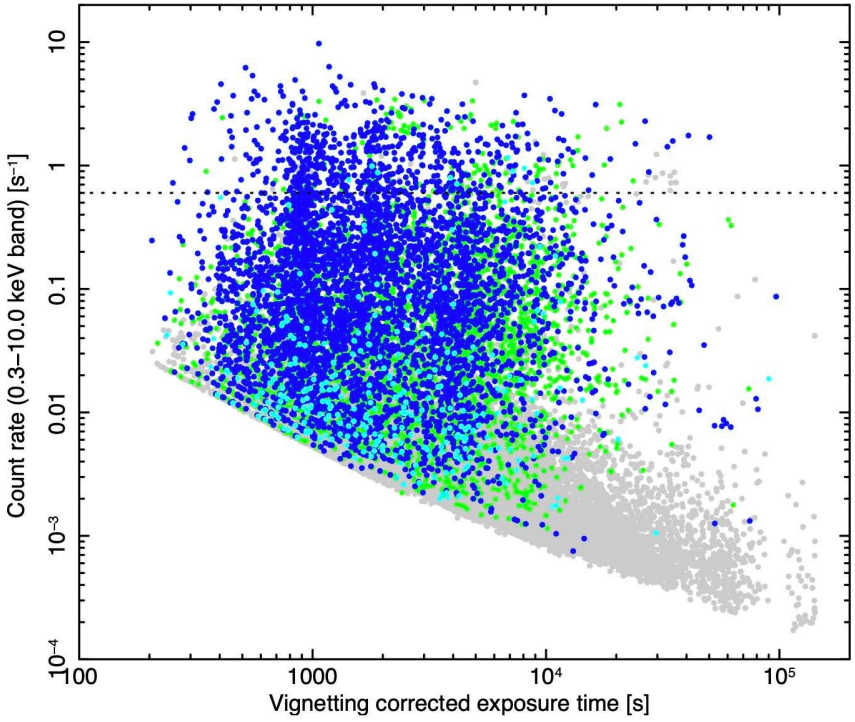
Open Universe for Blazars: a new generation of astronomical products based on 14 years of Swift-XRT data.

P. Giommi[1,2,3], C.H. Brandt[3,4], U. Barres de Almeida[5,3], A.M.T. Pollock[6], F. Arneodo[7], Y. L. Chang[3], O. Civitarese[8,9], M. De Angelis[1], V. D'Elia[10,12], J. Del Rio Vera[11], S. Di Pippo[11], R. Middei[13], A. V. Penacchioni[8], M. Perri[10,12], R. Ruffini[3], N. Sahakyan[14], and S. Turriziani[15]

Accepted for publication on Astronomy & Astrophysics
arXiv:1904.06043

Swift_deepsky run on a11,000 Swift-XRT observations of blazars



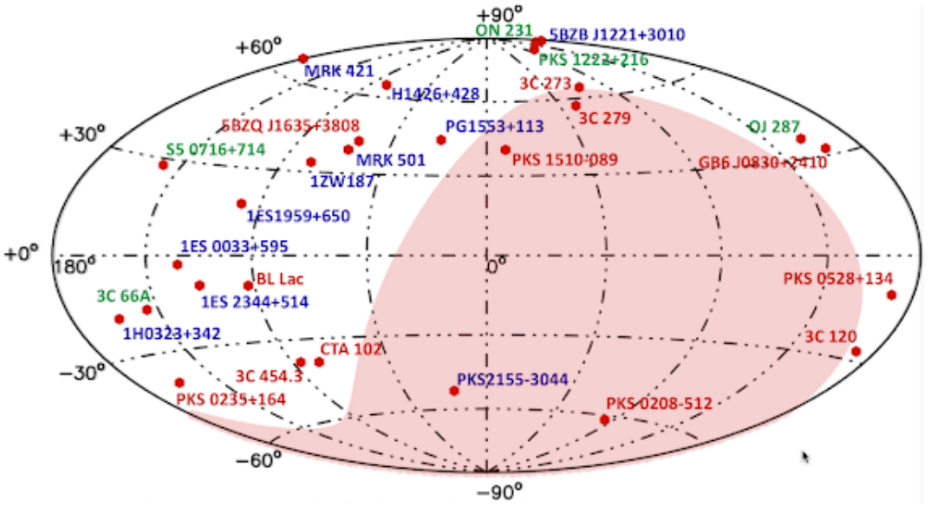


Swift-XRT spectra and light-curves of blazars observed more than 100 times.

Giommi, Perri, Capalbi et al., in preparation

This paper presents a detailed X-ray spectral analysis of all the Swift observations (in PC and WT mode) of the 28 blazars that have been observed with XRT more than 100 times during the mission. X-ray light curves have been constructed using both the fluxes from the spectral best fits, when the sources are bright enough for a detailed spectral analysis and for the fainter sources, using the image analysis presented in Paper I. See Giommi (2015) for a description and some preliminary results.

Results of the spectral analysis (password protected)



Hammer-Aitoff plot of the sky in Galactic coordinates showing the position of the 28 sources in the sample. The names of HBL sources appear in blue color, while those of IBLs and LBLs are green and red respectively. The darker area highlights the part of the sky south of the equator, illustrating how most of the blazars best observed by Swift are in the northern hemisphere.

Open Universe for Blazars: user-ready Swift-XRT spectral and timing data of blazars observed more than 100 times

P. Giommi[1,2,3], M. Perri[4,5], V. D'Elia[4,5], M. Capalbi[6], U. Barres de Almeida[5,3], C.H. Brandt[3,4], A.M.T. Pollock[6], F. Arneodo[7], Y. L. Chang[3], O. Civitarese[8,9], M. De Angelis[1], J. Del Rio Vera[11], S. Di Pippo[11], R. Middei[13], A. V. Penacchioni[8], R. Ruffini[3], N. Sahakyan[14], and S. Turriziani[15]

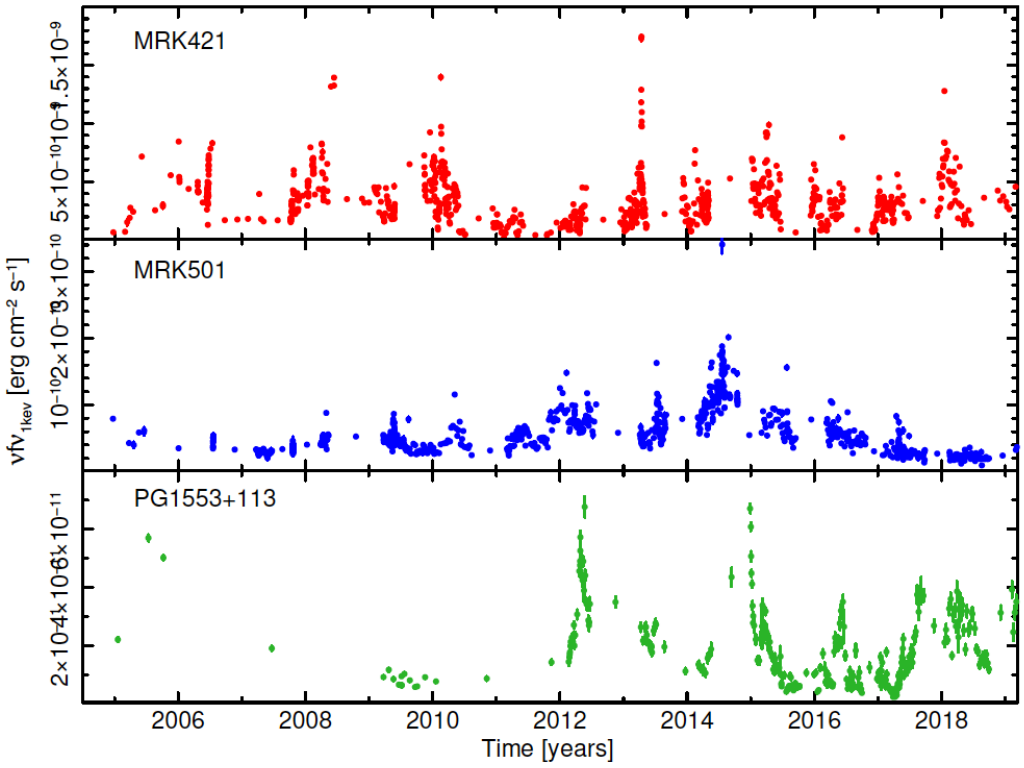
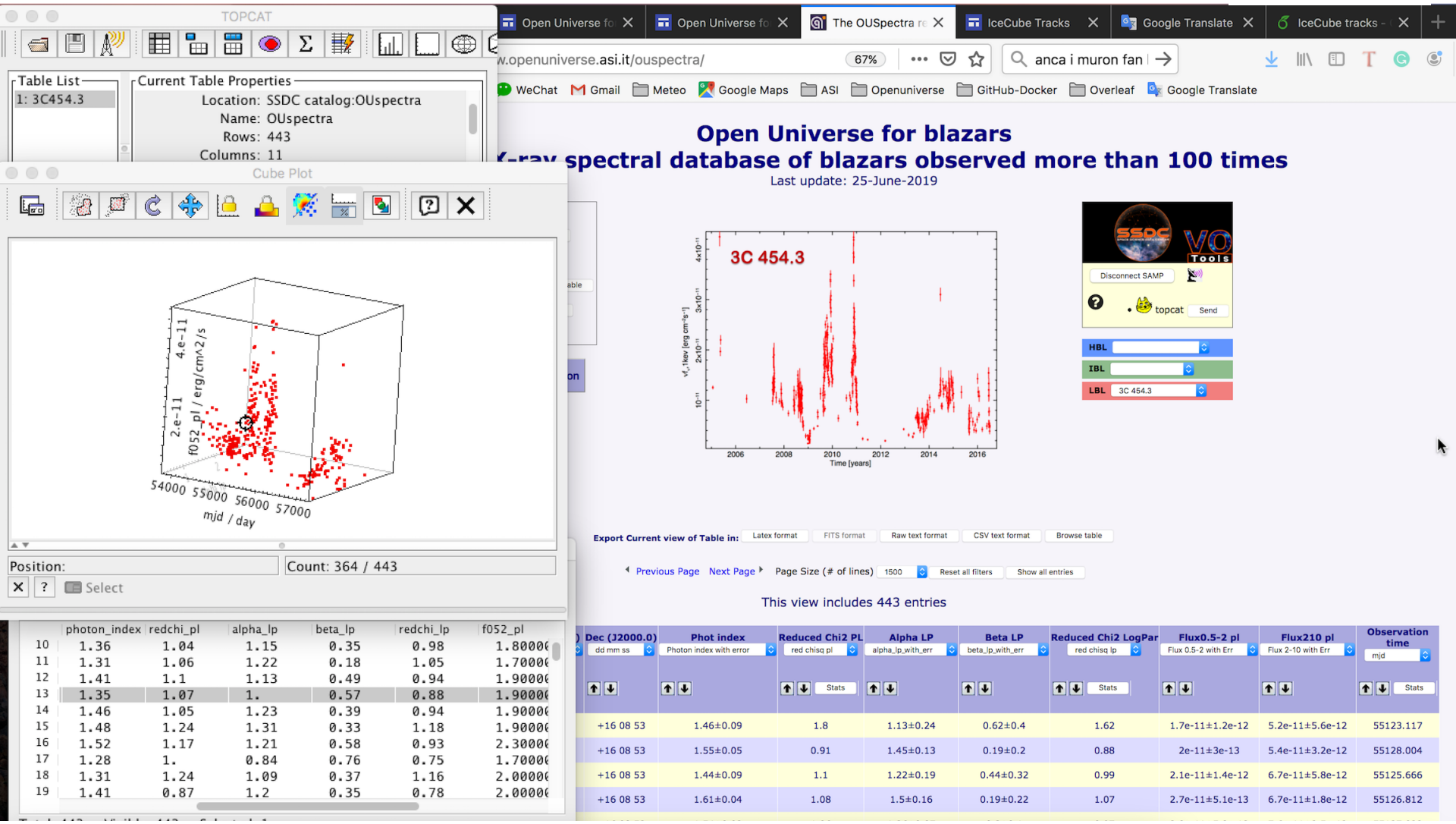


Fig. 5. Examples of 1KeV light curves of HBL blazars built

Blazar name	no. of XRT observations[a]
MRK 421	1066
MRK 501	659
OJ 287	540
BL Lac	511
3C 454.3	449
1ES1959+650	436
3C 279	427
3C 273	313
S5 0716+714	313
PG 1553+113	290
PKS 1510-089	264
PKS 2155-304	244
PKS 0235+164	190
3C120	184
H1426+428	165
1ES 2344+514	154
1ZW187	152
PKS 0208-512	151
BZQJ1635+3808	149
CTA 102	141
1H 0323+342	139
PKS 0528+134	136
ON 231	118
1ES 0033+595	114
PKS 1222+216	114
GB6 J0830+2410	106
5BZB J1221+3010	104
3C 66A	101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16 1.52 1.17 1.21 0.58 0.93 2.30000
17 1.28 1. 0.84 0.76 0.75 1.70000
18 1.31 1.24 1.09 0.37 1.16 2.00000
19 1.41 0.87 1.2 0.35 0.78 2.00000
Open Universe for blazars
X-ray spectral database of blazars observed more than 100 times
Last update: 25-June-2019
3C 454.3
Time [years]
Disconnect SAMP
topcat
Send
HBL
IBL
LBL
3C 454.3
Export Current view of Table in:
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FITS format
Raw text format
CSV text format
Browse table
Previous Page
Next Page
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Reset all filters
Show all entries
This view includes 443 entries
Dec (J2000.0)
Phot index
Reduced Chi2 PL
Alpha LP
Beta LP
Reduced Chi2 LogPar
Flux0.5-2 pl
Flux210 pl
Observation time
+16 08 53 1.46±0.09 1.8 1.13±0.24 0.62±0.4 1.62 1.7e-11±1.2e-12 5.2e-11±5.6e-12 55123.117
+16 08 53 1.55±0.05 0.91 1.45±0.13 0.19±0.2 0.88 2e-11±3e-13 5.4e-11±3.2e-12 55128.004
+16 08 53 1.44±0.09 1.1 1.22±0.19 0.44±0.32 0.99 2.1e-11±1.4e-12 6.7e-11±5.8e-12 55125.666
+16 08 53 1.61±0.04 1.08 1.5±0.16 0.19±0.22 1.07 2.7e-11±5.1e-13 6.7e-11±1.8e-12 55126.812

Fermi-LAT adaptive-bin light-curves of bright blazars

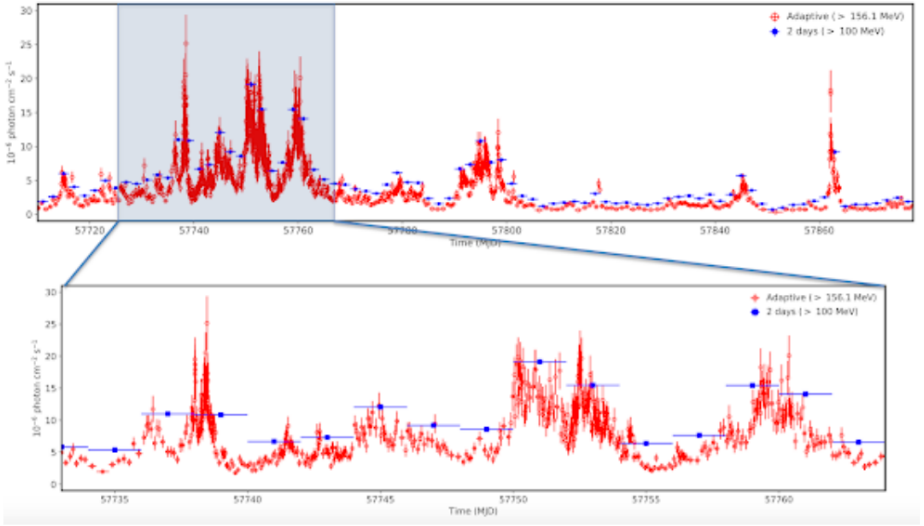
Sahakyan et al., in preparation

The emission from blazars is variable in all parts of the electromagnetic spectrum. The most rapid and the highest amplitude flux changes are observed in the gamma-ray band (> 100 MeV). When the gamma-ray light curves with regular (fixed) time bins are generated, the use of long bins will smooth out the fast variations during bright periods, while using short bins might result in many upper limits during the low- activity periods, which prevents variability studies.

This paper presents detailed gamma-ray light curves of 30 bright blazars generated using the adaptive binning method. In this method, the bin width is adjusted by requiring a constant relative flux uncertainty, which produces longer time intervals during lower flux levels and narrower bins when the source is in a high state.

The figure shows the remarkable improvement in the level of detail that the adaptive bin light-curve (red points) can provide compared to a two-day fixed time bin (blue points) for the case of the bright blazar CTA102.

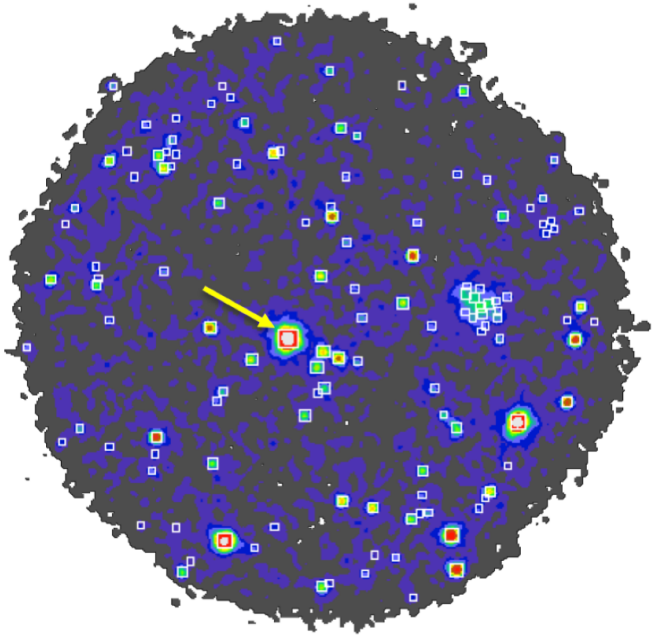
Fermi Adaptive bin and fixed bin (2 day) light-curve of the blazar CTA 102. For more details see Gasparyan, Sahakyan, V. Baghmanyan and D. Zargaryan, 2018 ApJ ...863..114G



Click here for an example of interactive gamma-ray lightcurve of PKS1...

The Open Universe Swift-XRT survey: a large-area, medium-deep survey of the random X-ray sky from stacked GRB fields

P. Giommi[1,2,3], A. V. Penacchioni[8], O. Civitarese[8,9], C. Leto[4], M. Perri[4,5], S. Puccetti[1], V. D'Elia[4,5], M. Capalbi[6], U. Barres de Almeida[5,3], C.H. Brandt[3,4], A.M.T. Pollock[6], F. Arneodo[7], Y. L. Chang[3], M. De Angelis[1], J. Del Rio Vera[11], S. Di Pippo[11], R. Middei[13], R. Ruffini[3], N. Sahakyan[14], and S. Turriziani[15]



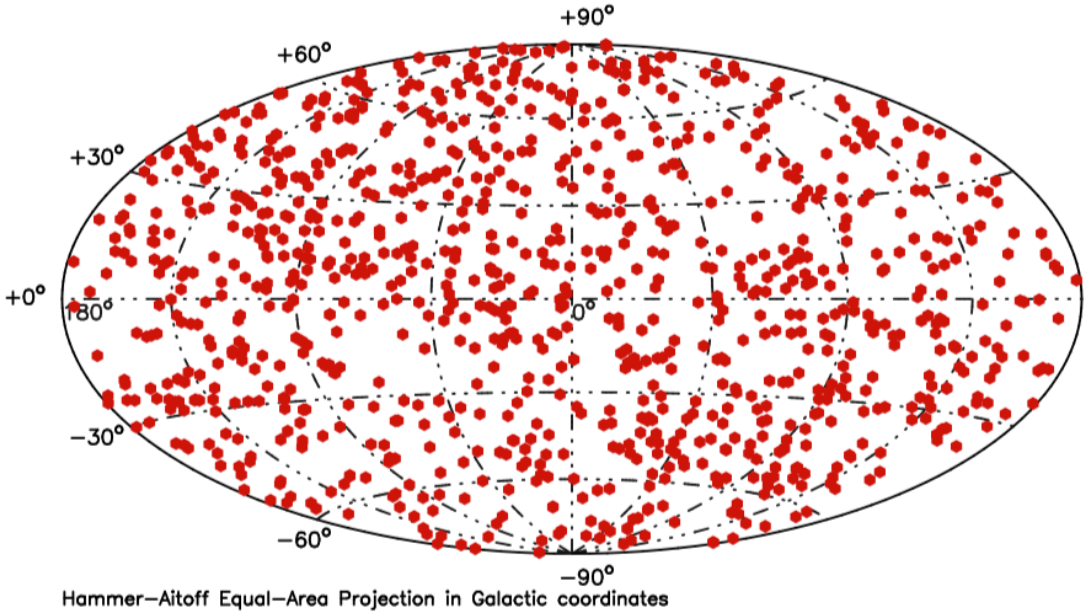
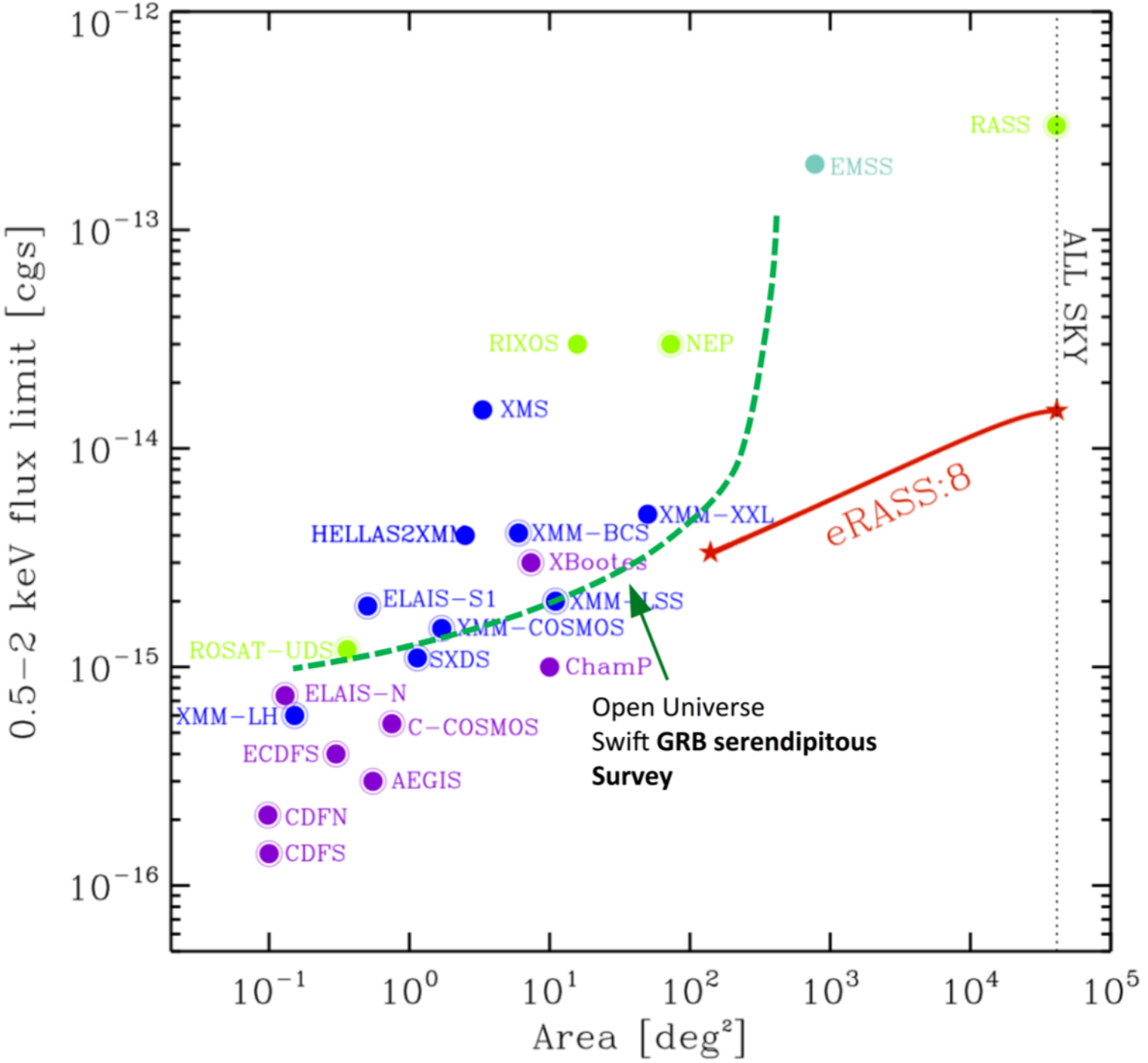


Fig. 2. Hammer-Aitoff plot in Galactic coordinates of the 986 fields centred in as many GRBs observed by Swift used for the survey


0.5−2 keV flux limit [cgs]
Area [deg²]
RASS
EMSS
ALL SKY
RIXOS
NEP
XMS
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XBootes
ELAIS−S1
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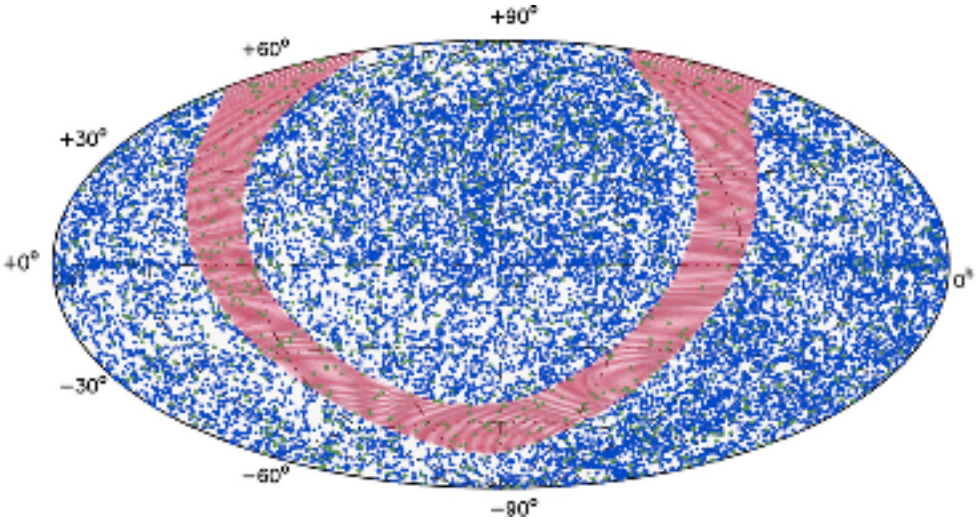
XMM−COSMOS
ROSAT−UDS
SXDS
ChamP
ELAIS−N
XMM−LH
C−COSMOS
ECDFS
AEGIS
CDFN
CDFS
eRASS:8
Open Universe
Swift **GRB serendipitous**
Survey

… AND APPLICATIONS IN TRAINING SCHOOLS

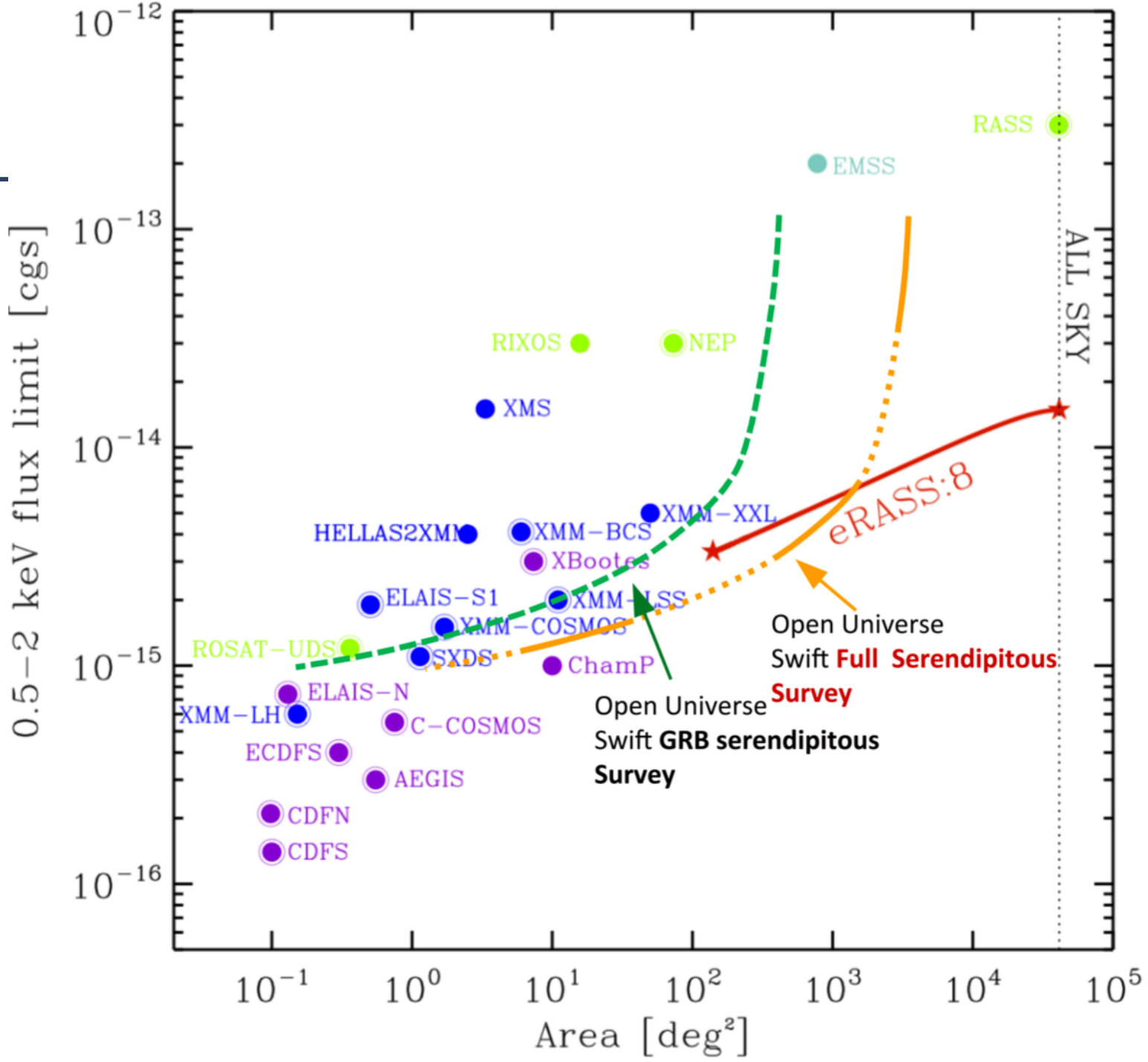
First Open Universe Training School for undergraduate students of NYU - AD



Full-sky survey in X-rays performed at NYU-AD using the data tools developed for Open Universe:

enabling top level research to be carried out by non-experts;

high-level data science training for space sciences.


0.5−2 keV flux limit [cgs]
Area [deg²]
RASS
EMSS
ALL SKY
RIXOS
NEP
XMS
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XMM−BCS
XMM−XXL
XBootes
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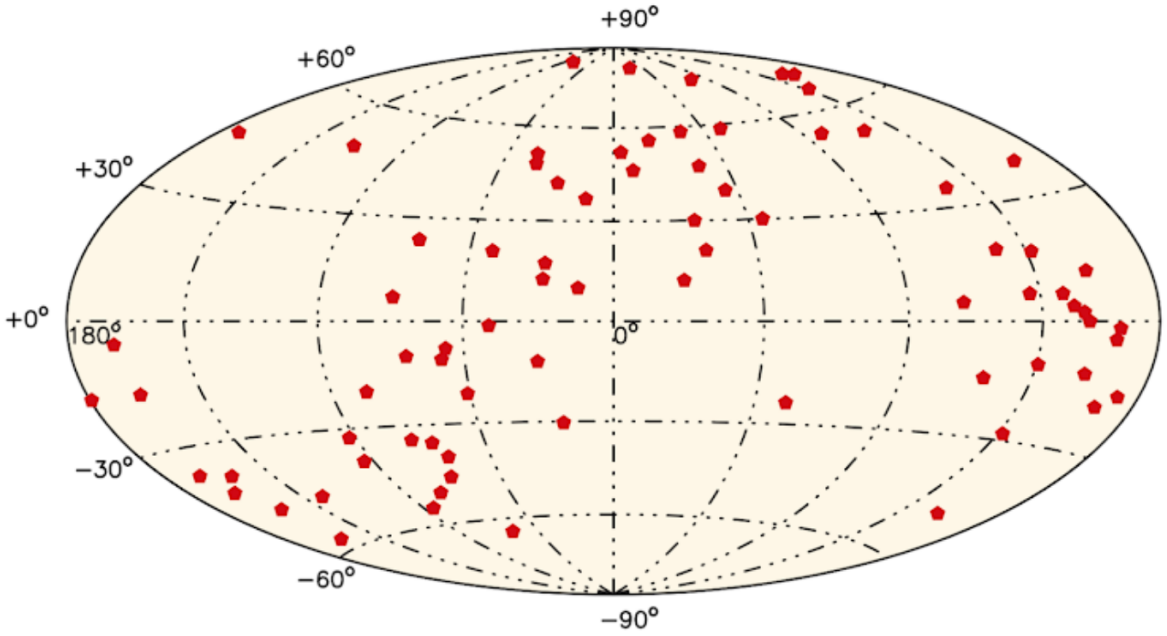
ICECUBE NEUTRINO TRACKS



Dissecting the region around IC131014

T. Glauch (IAS-TUM) , P. Giommi (IAS), others

The page provides a brief summary of the main results

The complete report for this track event, including a description of the analysis, is available here

VOU-Blazars results

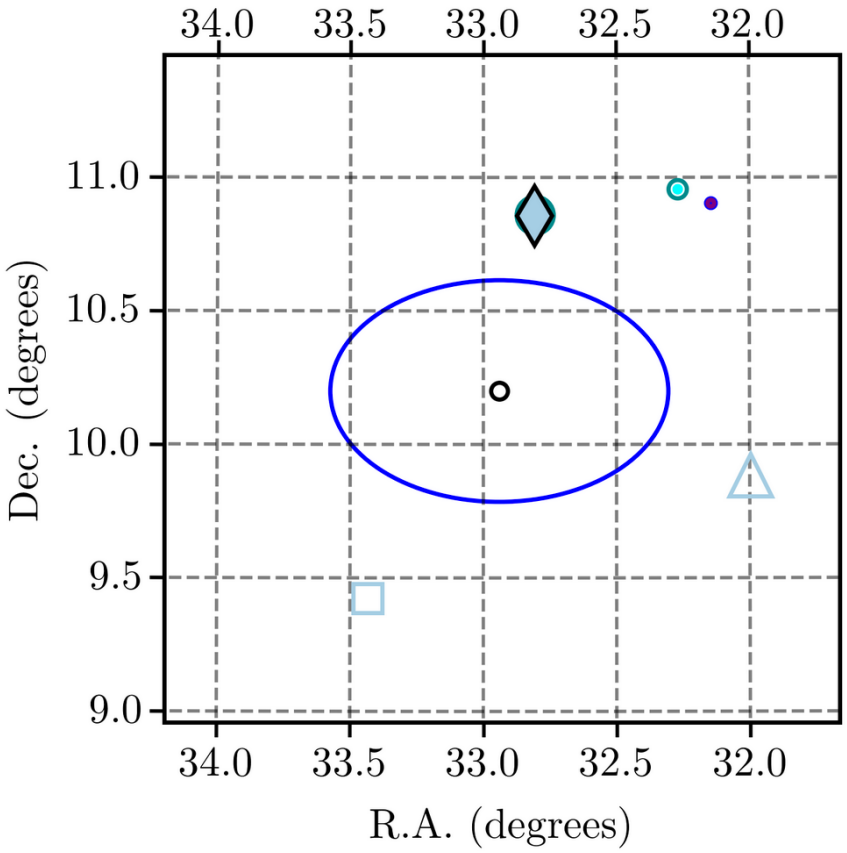
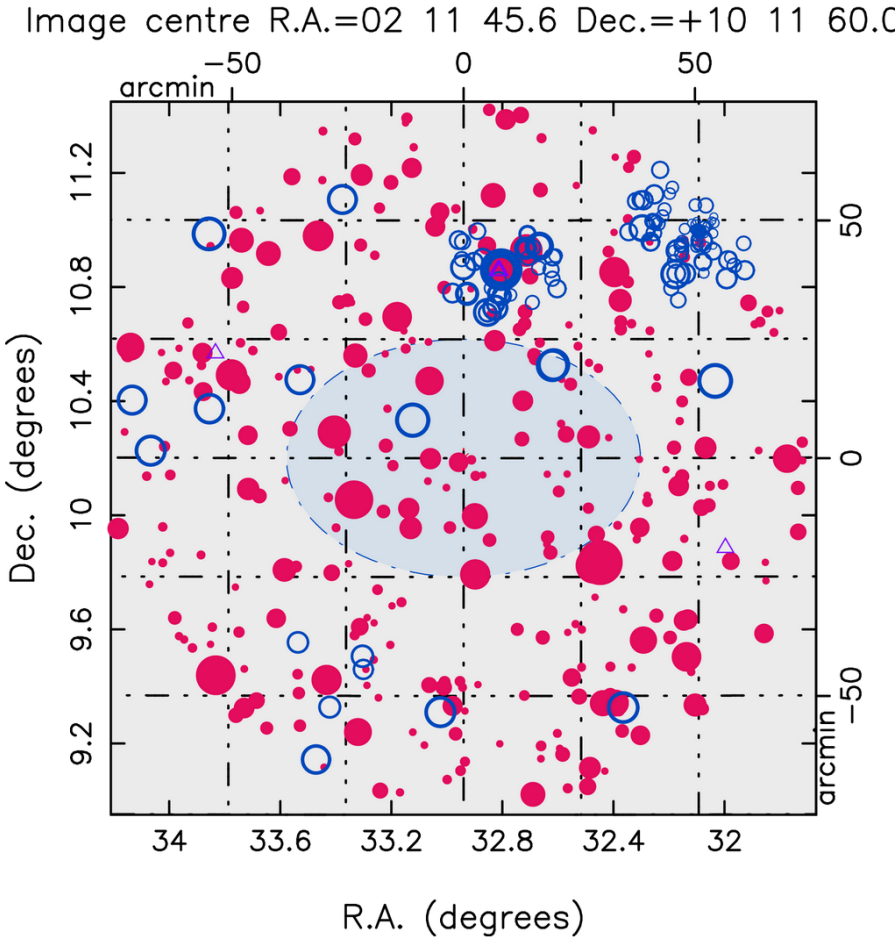
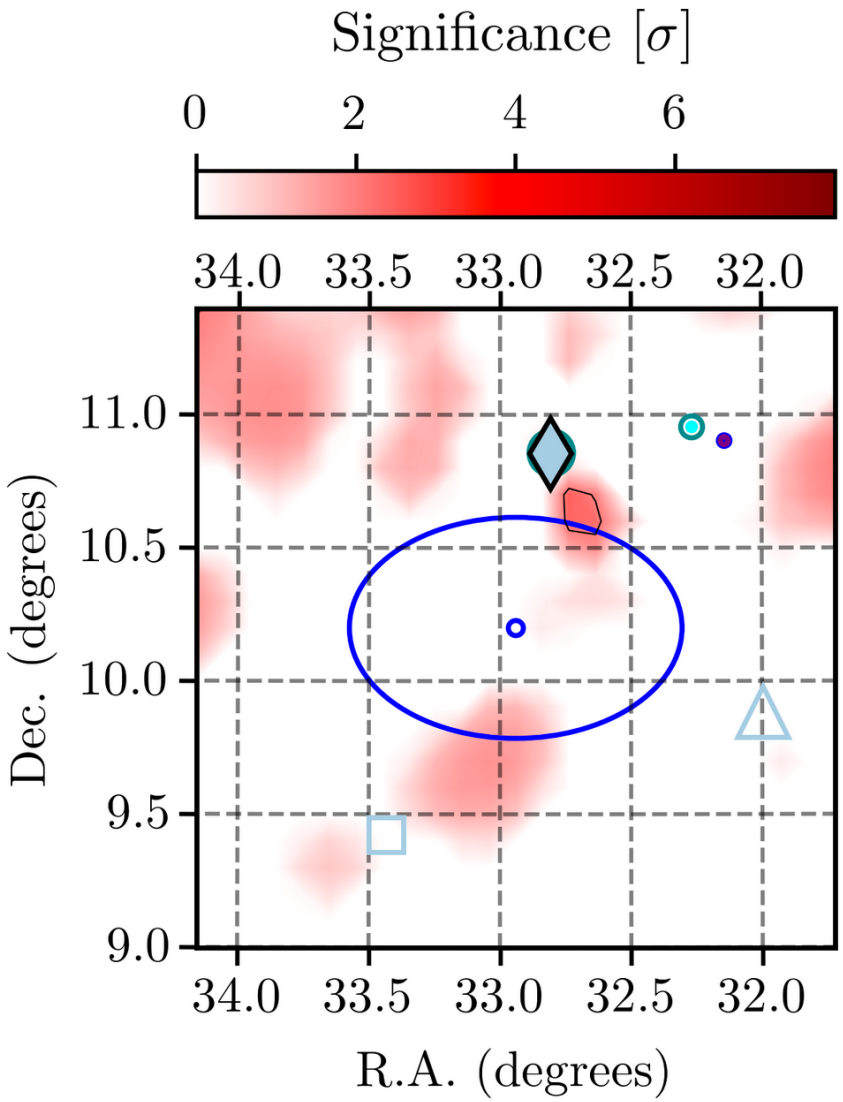


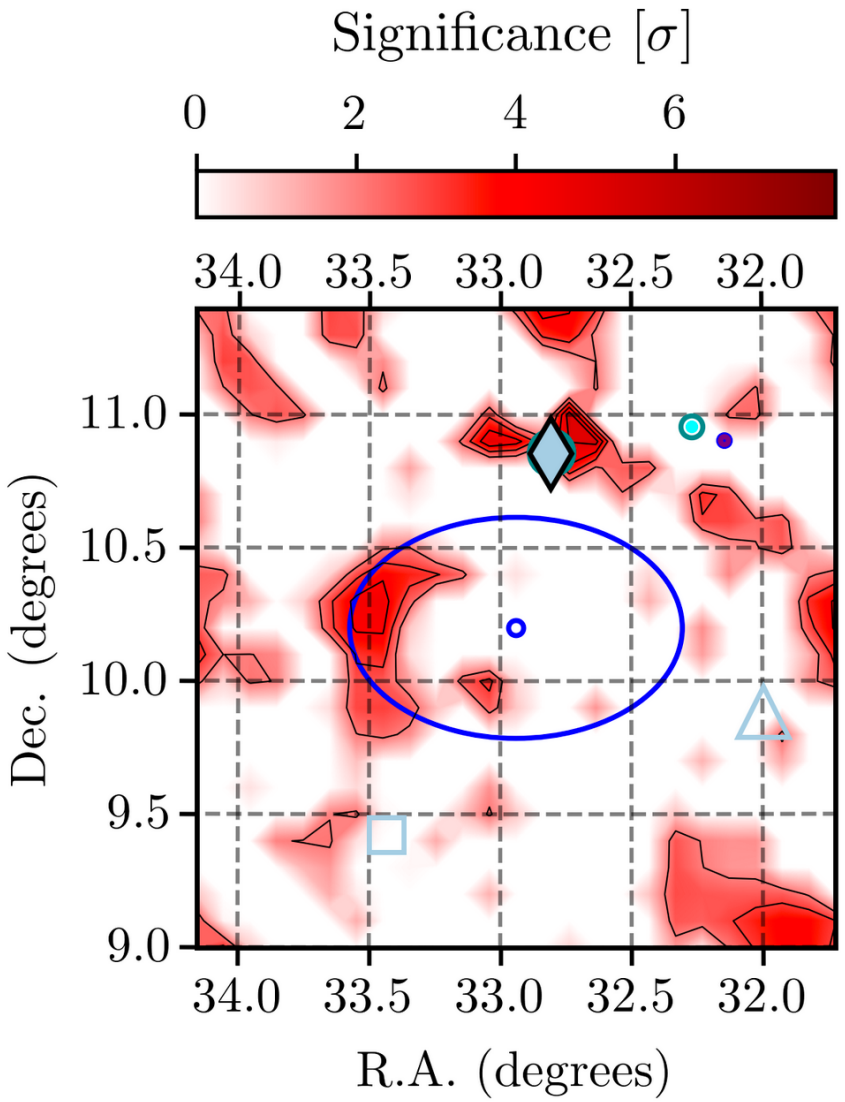
Chart of the area around the error region of IC131014 showing candidate blazars (based on radio to X-ray flux ratio), objects from selected catalogues (5BZCat, 3HSP, PSR), and flat-spectrum radio sources, and gamma-ray sources. Blazar types are color coded as follows: orange for HBLs, cyan for IBLs and dark blue for LBLs. Catalogued sources appear as: yellow diamonds for BZCAT blazars , yellow stars for 3HSP blazars, and blue pentagons for pulsars. Flat spectrum radio sources with no X-ray counterpart appear as red filled circles with an open blue square superposed.



Radio, X-ray and gamma-ray sources in thearea including the error region of IC131014. Radio sources appear as red filled circles, X-ray sources as open blue circles, and gamma-ray sources as purple open triangles. Symbol size is proportional to source intensity.

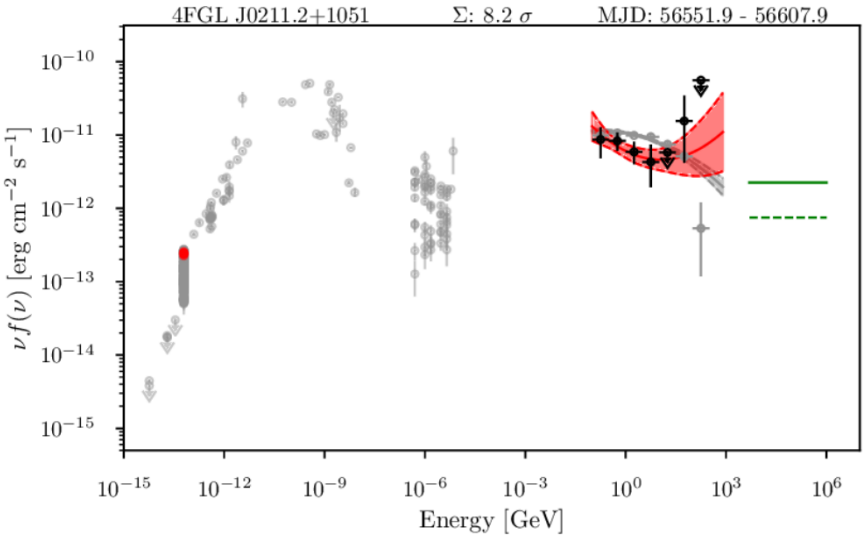


Fermi-LAT TS map of the region built with photons with energy larger than 1 GeV detected over a period of 200 days prior to the neutrino detection. Note that all catalogued (4FGL) gamma-ray sources in the area have been subtracted.

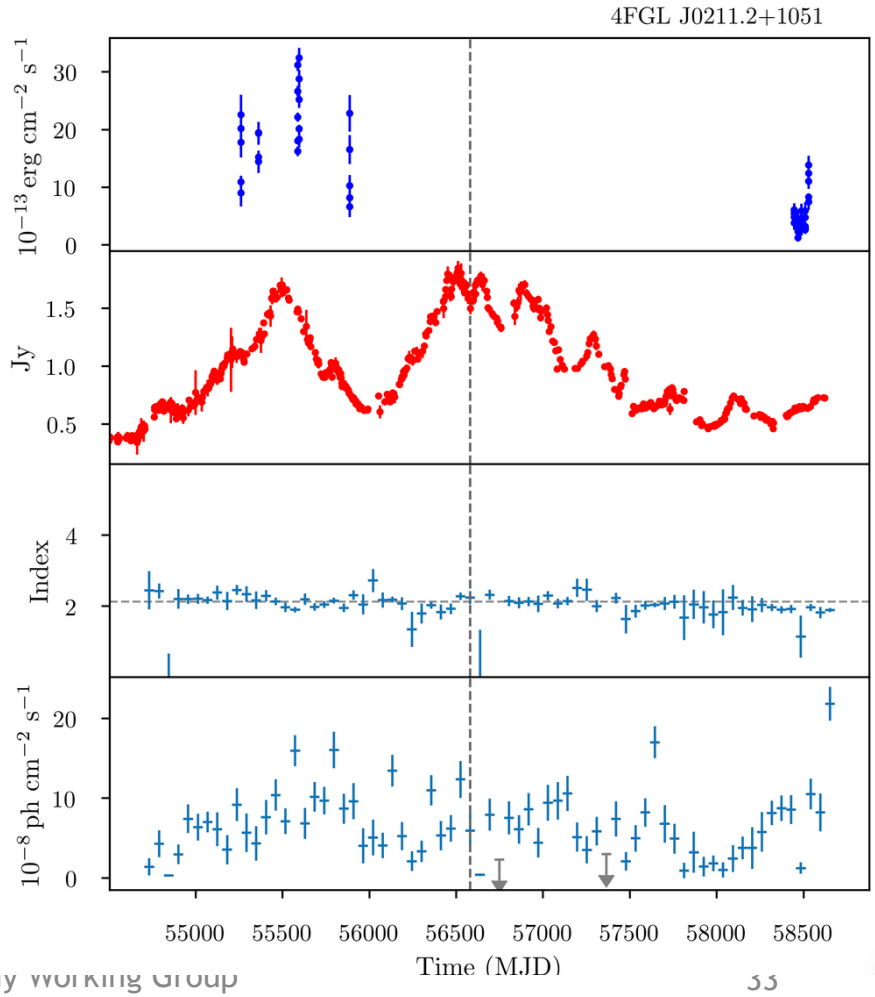


Fermi-LAT TS map of the region built with photons with energy larger than 1 GeV integrated over the entire Fermi mission, up to the neutrino arrival.
As in the previous TS map all catalogued (4FGL) sources in the area have been subtracted.

Candidate 1



The SED of candidate 1



BRICS flagship project launched to create a BRICS Optical Telescope Network

The network is to be virtually enabled by data science technology provided by the Open Universe Initiative, where the data would also be available for scientific and capacity building activities.

PROTOTYPE NETWORK TO BE STARTED WITH CONTRIBUTIONS FROM THE ISON NETWORK IN RUSSIA AND THE PMO TELESCOPE NETWORK FROM CHINA

FOR ASTROPHYSICAL TRANSIENTS, SPACE DEBRIS AND SMALL SOLAR SYSTEM BODIES

LNAPADRAO.LNA.BR/EVENTOS/BRICS-ASTRONOMY-WORKING-GROUP-2019


BRICS
ASTRONOMY
2019
BRICS
ASTRONOMY
2019
Multi-messenger and
Multi-wavelength Astronomy
RIO
Brasil
29 Sept.

CONCLUSIONS

THE OPEN UNIVERSE INITIATIVE, ORIGINALLY PROPOSED IN 2016 HAS UNDERGONE A NUMBER OF FORMAL AND DISCUSSION STEPS WITHIN THE UN AND IN THE BROADER ACADEMIC COMMUNITY

A number of preparatory activities have been carried out in all fronts of the initiative to demonstrate its potentials and prepare its structure, with generally great success.

Through its mandate from UNISPACE III the UN-OOSA is ready to welcome the initiative to its formal start in the coming months.

Various countries and groups / institutions have manifested support and are already active in building the initiative, with new collaborations shaping up around Open Universe.

OPEN UNIVERSE WILL LAUNCH SOON!

THANK YOU!

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES MCTIC

CBPF

serrapilheira

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Paolo Giommi
giommipaolo@gmail.com

Jorge Del Rio Vera
jorge.delriovera@un.org