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MS21 – PROGRESS AND PRIORITIES AT IVOA (2)

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Disclaimer

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Project Summary

ESCAPE (European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures) addresses the Open Science challenges shared by ESFRI facilities (SKA, CTA, KM3Net, EST, ELT, HL-LHC, FAIR) as well as other pan-European research infrastructures (CERN, ESO, JIVE) in astronomy and particle physics. ESCAPE actions are focused on developing solutions for the large data sets handled by the ESFRI facilities. These solutions shall: i) connect ESFRI projects to EOSC ensuring integration of data and tools; ii) foster common approaches to implement open-data stewardship; iii) establish interoperability within EOSC as an integrated multi-messenger facility for fundamental science. To accomplish these objectives ESCAPE aims to unite astrophysics and particle physics communities with proven expertise in computing and data management by setting up a data infrastructure beyond the current state-of-the-art in support of the FAIR principles. These joint efforts are expected result into a data-lake infrastructure as cloud open-science analysis facility linked with the EOSC. ESCAPE supports already existing infrastructure such as astronomy Virtual Observatory to connect with the EOSC. With the commitment from various ESFRI projects in the cluster, ESCAPE will develop and integrate the EOSC catalogue with a dedicated catalogue of open source analysis software. This catalogue will provide researchers across the disciplines with new software tools and services developed by astronomy and particle physics community. Through this catalogue ESCAPE will strive to cater researchers with consistent access to an integrated open-science platform for data-analysis workflows. As a result, a large community “foundation” approach for cross-fertilization and continuous development will be strengthened. ESCAPE has the ambition to be a flagship for scientific and societal impact that the EOSC can deliver.

1. Introduction: IVOA Interoperability Meeting

The International Virtual Observatory Alliance (IVOA) interoperability meeting held in Groningen, Netherlands 9-11 October 2019 was a formal milestone for the ESCAPE CEVO Work Package (ESCAPE Milestone 21 – Progress and priorities at IVOA(2)). It was the second IVOA meeting during the ESCAPE project, and was an important focal point for the CEVO Work Package with the first results being presented, and with European priorities being brought into the international context of the IVOA.

In this report we outline the progress of the CEVO Work Package activities that have been presented at the IVOA meeting, and we track the participation of ESCAPE partners (and also the wider European contributions) in IVOA. The means of verification for these milestones are the IVOA meeting website and the record of ESCAPE participation in the meeting.

The Groningen Interoperability meeting gathered 125 participants for the 2.5 day meeting. This meeting was held after the annual Astronomy Data Analysis and Software Systems (ADASS) conference continuing the well established practice of co-locating ADASS and the shorter (2.5 day) of the two annual IVOA meetings. The web pages, including the detailed schedule of the meeting and the list of participants is available at the links in the table below.

Meeting Page (hosted via ADASS)	https://www.adass2019.nl/ivoa/ivoa-programme/
Detailed IVOA Schedule Page	https://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpOct2019
Social Media	<i>Hash-tag : #ivoa19nl, Twitter :</i> https://twitter.com/IVOAastro

1. ESCAPE CEVO and European participation

European participation in this meeting was strong, and there was a very good level of representation of the ESCAPE CEVO partners. The list of European contributions, with a link to the slides presented, is tabulated in Appendix A of this report, with the ESCAPE CEVO contributions indicated.

Significant contributions were made to the overall motivation and organisation of the meeting by members of ESCAPE CEVO. The lead of the CEVO work package (M. Allen, CNRS-ObAS) served as the Chair of the Executive Board of the IVOA, with his 18-month term as Chair ending at this meeting, but continuing as the representative of Euro-VO. A number of the IVOA WG and IG Chairs come from ESCAPE CEVO partners as listed in the previous milestone report (MS20).

All of the ESCAPE CEVO partners were encouraged to participate. Four of the five “VO-expert” partners have participated. The ESCAPE partners who are connected to the ESFRI and other research infrastructures were also well represented, with CTA, ESO/ELT, SKA, LOFAR, JIVE participating. The Groningen location facilitated a strong participation by radio astronomy colleagues due to the meeting being co-hosted by ASTRON. As in the previous meeting, we have also benefitted a lot from the participation of a representative from EUDAT (C. Martens, DKRZ). We also note the participation by ESCAPE WP5, and this enabled a cross-WP activities at the meeting.

An article summarising the IVOA meeting has been submitted by M. Allen and IVOA colleagues as part of the ADASS proceedings.

2. State of the IVOA and Scientific Priorities

CEVO partners contributed to the organisation of a “Focus Session on Radio Astronomy and VO”, and this enabled the ESCAPE partner radio/mm astronomy priorities to be addressed in the international context of the IVOA. The session was led by the IVOA Committee for Science Priorities (CSP, B. Merin – Chair) and involved other international radio astronomy infrastructures (VLA, US ALMA, ASKAP, MWA) and data centres with interests in radio astronomy (CDS, CADC, CASDA). This session explored the global top-level needs for interoperability of radio astronomy data and services, and the significant challenges ahead for very large data volumes. The introductory overview presentation was provided by F. Bonnarel (CNRS-ObAS) which outlined the status of the relevant VO standards, and the CEVO (and ASTERICS) discussions that have been held. M. Kettenis (JIVE) presented the specific aspects and data products of VLBI. The discussion focused on proposals for small things that would yield improvements to the discoverability of radio astronomy data in the VO. (A follow-up IVOA Videocon was planned).

Other ESCAPE CEVO priorities represented at the meeting include: finalisation of Provenance Data Model, time domain metadata and the combination of spatial-temporal metadata, HiPS for simulation data, IVOA registry interoperability with EUDAT/B2FIND – which is part to CEVO plans to interface the VO interoperability framework with the EOSC, and general tools for data discovery and interoperability as mapped out in the CEVO detailed work plan.

3. Highlights from the IVOA Working- and Interest Groups relevant to ESCAPE CEVO

The Applications Working Group sessions highlighted a number of tools and prototypes that show the latest developments, which build on the whole Virtual Observatory system and provide new capabilities for scientific users. In terms of priorities, it was decided to develop ST-MOC further as a standard for combining spatial and temporal indexing of astronomy data. Many of these developments use the python language, with examples shown of python access to data and metadata, and advances in the python libraries for use of MOC and prototypes for its extension to ST-MOC (supported strongly by CEVO). Following the Astropy and VO event at the previous meeting, many discussion topics were about pyVO, and the way to coordinate VO development with Astropy.

Other highlights about scientific tools include updates to CASSIS (spectroscopy), TOPCAT (tables, plotting and VO access), Aladin (VO portal), and tool interoperability with the IVOA protocol called SAMP. We note the importance of these applications for their potential use in the “Science with interoperable data” school (D4.3, May 2020).

Science platforms continues to be a hot topic at IVOA, and this was also the subject of a well-attended “Birds of a Feather” session at the preceding ADASS conference. Some relevant contributions were made in the applications sessions (e.g. pyESASky), but also in the Data Access Layer sessions (hips2fits and mocpy). G. Taffoni (INAF) made a detailed summary of the ADASS science platform discussion in the Grid and Web Services session, including the input from ESCAPE partners (UEDIN, INAF, CDS/CNRS-ObAS) and ASTRON for ESCAPE WP5.

Authentication is important for these science platforms, and test implementations in the pyVO TAP client was presented (Demleitner, UHEI), and other data centres (e.g. ESAC) also shared their experience from the GAIA archive (Gonzales, ESA).

The Operations IG session included various VO “weather reports” which are done as a shared effort, with ESA, Paris Observatory making contributions that monitor the VO framework from an operational point of view. Other types of effort to foster compliance were also presented, such as FITS ObsCore validators (Landais, CNRS-ObAS) and registry compliance (Vrioni, ESA).

The Data Model WG session included presentations of implementations of the Provenance DM standard, including its use for HiPS data, and a way to query provenance information via TAP (Bonnarel, CNRS-ObAS). Progress on the data models for “coordinates”, “transforms” and “measurements” is expected before the next IVOA meeting, following significant investments over a long development timeline.

The IVOA discussions about the use of DOIs for data were advanced, and the findings are being compiled into an IVOA note led by A. Schaaff (CNRS-ObAS) and T. Jenness (LSST). Data “FAIRness” and the use of machine readable licenses for data were also topics of the meeting. The development of the CEVO/ESCAPE contributions to the discussions on FAIR and Open data at the EOSC level have been pursued for the RDA plenary meeting (Helsinki, October 23-25, 2019) and a contribution to the

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RDA FAIR Data Maturity Model WG, and the EOSC Symposium (Budapest, 26-28 November 2019). They will be reported elsewhere.

C. Martens (DKRZ) attended the meeting, and contributed to the various discussions in the Registry WG with a presentation on “B2FIND Integration / Next Steps”. The progress on this activity since the Paris Interop meeting (MS4.1) is that the transformation of the IVOA registry into B2FIND format has been completed. One of the challenges that has been identified is that while B2FIND can list VO services, it currently does not have a way to represent the VO interfaces on services, i.e. to convey that a particular service can be queried as a TAP service.

In terms of the overall development of standards in IVOA, this meeting saw the approval of 5 IVOA Recommendations. Four of them have at least a European editor, and all have European authors. These are listed in Appendix B with links to the documents, and DOIs for these will soon be assigned by ADS as for all IVOA standards. There are 4 more standards in the final stages of preparation according to the reports of the Technical Coordination Group.

4. Conclusions and next steps

The IVOA interoperability meeting was a successful second milestone for CEVO. The ESCAPE project was very visible at this international interoperability meeting, and progress was made in a number of priority areas for the ESFRI and other research infrastructures, in particular in relation to radio astronomy.

The next IVOA interoperability meeting will be held in Sydney, Australia May 4-8, 2020. A CEVO Technology Forum event (Feb 4-6, 2020) will prepare for the ESCAPE input to this next meeting. We expect that the ESCAPE Progress Meeting (February 2020), and other CEVO specific meetings will also provide important input for the preparation of the next IVOA meeting milestone.

Appendix A. – Presentations

The table below contains a list of all the contributions at the IVOA interoperability meeting that are relevant to CEVO. Presentations made by members of CEVO partner institutes are indicated, and we also identify the European contributions. A link to the presentations files on the IVOA interoperability meeting web pages are provided for each contribution. Additionally a repository of the presentations has been created with the original presentation files (with the filenames prefixed with the presentation number in the table).

Opening plenary sessions	
01. Opening Plenary Presentation: State of the IVOA Link to presentation	M. Allen (CNRS-ObAS) <i>ESCAPE-CEVO</i>
01b. State of the Technical Coordination Group Link to presentation	P. Dowler (CADC), J. Evans (CXC, Harvard)
02. Committee for Science Priorities Status Link to presentation	B. Merin (ESA) and CSP [incl. M. Allen (CNRS-ObAS) - <i>ESCAPE-CEVO</i>]
Focus Session on Radio Astronomy and VO	
03. Introduction to previous VO work on Radio Astronomy Link to presentation	F. Bonnarel (CNRS-ObAS) <i>ESCAPE-CEVO</i>
04. CSIRO Radio Archives and the VO Link to presentation	J. Dempsey (CSIRO, Australia) (related to SKA via ASKAP pathfinder)
05. VLBI Specific aspects and data products Link to presentation	M. Kettenis (JIVE) <i>ESCAPE-CEVO</i>

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Data Model Sessions	
06. Annotating ZTF data (time series) Link to presentation	F. Bonnarel (CNRS-ObAS) <i>ESCAPE-CEVO</i>
07. Provenance Data Model Status Link to presentation	M.Louys (CDS/iCube), F. Bonnarel (CNRS-ObAS), M. Servillat (ObsParis/LUTH) <i>ASTERICS overlap with ESCAPE-CEVO</i>
Grid and Web Services Session	
08. Introduction and Science Platform ADASS Bof Session summary Link to presentation Link to session summary presentation	G. Taffoni (INAF) <i>ESCAPE-CEVO</i>
Data Access Layer and Applications joint session	
09. VO Implementation at Observatorio Javalambre Link to presentation	Tamara Civera & Javier Hernández (CEFCA, Spain) <i>European contribution</i>
10. ProvTAP and ProvHiPS Link to presentation	F. Bonnarel (CNRS-ObAS) <i>ESCAPE-CEVO</i>
Data Access Layer and GWS joint session	
11. Interoperable Authentication: Lessons learned from pvVO's TAP client Link to presentation	M. Demleitner (UHEI) <i>ESCAPE-CEVO</i>



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12. Cookie authentication in the GAIA archive Link to presentation	J. Gonzales (ESA) <i>European contribution</i>
Data Access Layer Session	
13. Retrieving Complex data in TAP services Link to presentation	L.Michel (ObAS), A. Oberto, G. Mantelet (CNRS-ObAS) <i>European contribution</i>
14. Feedback report on the implementation of ADQL 2.1 Link to presentation	G.Mantelet (CNRS-ObAS) <i>European contribution</i>
15. Simple cone search extension to time search Link to presentation	A. Nebot (CNRS-ObAS) <i>ESCAPE-CEVO + European contribution</i>
16. Towards DataLink 1.1 Link to presentation	F. Bonnarel (CNRS-ObAS) <i>ESCAPE-CEVO</i>
Data Curation and Preservation session	
17. DCP Introduction and minutes of DOI discussion Link to presentation Minutes	A. Schaaff (CNRS-ObAS), T. Jenness (LSST) <i>ESCAPE-CEVO</i>
18. Data FAIRness through Open Science Link to presentation	S. Bertocco, M. Molinaro, G. Taffoni (INAF) <i>ESCAPE-CEVO</i>



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19. Machine readable license attached to data Link to presentation	A. Schaaff and F. Genova (CNRS-ObAS) <i>ESCAPE-CEVO</i>
20. DOI handling at AIP Link to presentation	A. Galkin, O. Streicher, H. Enke (AIP, Potsdam) <i>European contribution</i>
Applications Sessions	
21. CASSIS, functionalities and evolution plan Link to presentation	J.-M. Glorian (IRAP, France) <i>European contribution</i>
22. pyESASky – bi-directional communication in Jupyter Lab Link to presentation	M. Wångblad (ESA) <i>European contribution</i>
23. Embedding and controlling ESASky in your app with an iframe + TAP interoperability Link to presentation	F. Giodano (ESA) <i>European contribution</i>
24. Visualization – Building and using HiPS in distributed data storage Link to presentation	S. Singh (Kapteyn astronomical institute, Groningen NL) <i>European contribution</i>
25. Visualising VO data in digital planetariums – in theory and practice Link to presentation	R. Williams (Univ. Groningen, NL) <i>European contribution</i>
26. Discussion on Web SAMP and HTTPS Link to presentation	M. Taylor (Univ. Bristol) <i>European contribution</i>
27. HiPS: 2 years after the IVOA standard	P. Fernique (CNRS-ObAS)



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Link to presentation	<i>ESCAPE-CEVO, ASTERICS, European contribution</i>
28. hips2fits : fast generation of FITS cutouts from HiPS datasets Link to presentation	T. Boch (CNRS-ObAS) <i>ESCAPE-CEVO, ASTERICS, European contribution</i>
29. Recent STMOC developments at CDS Link to presentation	M. Baumann (CNRS-ObAS) <i>ESCAPE-CEVO</i>
30. ST-MOC discussion Link to presentation	P. Fernique, A. Nebot (CNRS-ObAS) <i>ESCAPE-CEVO</i>
Operations Interest Group sessions	
31. PADC VO weather report Link to presentation	R. Savalle, P. Le Sidaner (PADC, ObsParis, FRANCE) <i>European contribution</i>
32. Euro-VO Resources Validation Link to presentation	C. Vrioni (ESA) <i>European contribution</i>
33. The VizieR ObsCore FITS validator for images and spectra Link to presentation	G. Landais, L. Michel (CNRS-ObAS) <i>European contribution</i>
34. Operational identification of server software Link to presentation	M. Demleitner (UHEI) <i>ESCAPE-CEVO</i>
Semantics WG sessions	
35. Vocabularies in ProvDM	M. Louys (CNRS-ObAS, iCube)



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Link to presentation	ESCAPE-CEVO
Registries Working Group Session	
36. Euro-VO Registry Ecosystem Health Report Link to presentation	C. Vrioni (ESA) <i>European contribution</i>
37. STC Metadata and Discoverable Data Collections: State of Play Link to presentation	P. Le Sidaner, R. Savalle (ObsParis) <i>European contribution</i>
38. B2FIND Integration / Next Steps Link to presentation	C. Maartens (DKRZ) <i>European contribution</i>
39. Simple DAL Registry Extensions status Link to presentation	M. Demleitner (UHEI) <i>ESCAPE-CEVO</i>
Closing Plenary Session	
40. Technical Coordination Group closing remarks Link to presentation	P. Dowler (CADC), J. Evans (CXC Harvard)
41. IVOA Executive closing remarks Link to presentation	M. Allen (CNRS-ObAS) <i>ESCAPE-CEVO</i>



Appendix B. – IVOA Standards Approved

IVOA Standards Approved at the meeting

Acronym for standard	IVOA Standard and link to document
MOC 1.1	MOC – HEALPix Multi-Order Coverage Maps, Version 1.1 Link to document
RegTAP 1.1	IVOA Registry Relational Schema, Version 1.1 Link to document
TAP 1.1	Table Access Protocol, Version 1.1 Link to document
UCD List Maintenance 2.0	Maintenance of the list of UCD words, Version 2.0 Link to document
VOTable 1.4	VOTable Format Definition, Version 1.4 Link to document