

Provision of improved access to near-real time and archival multi-messenger data

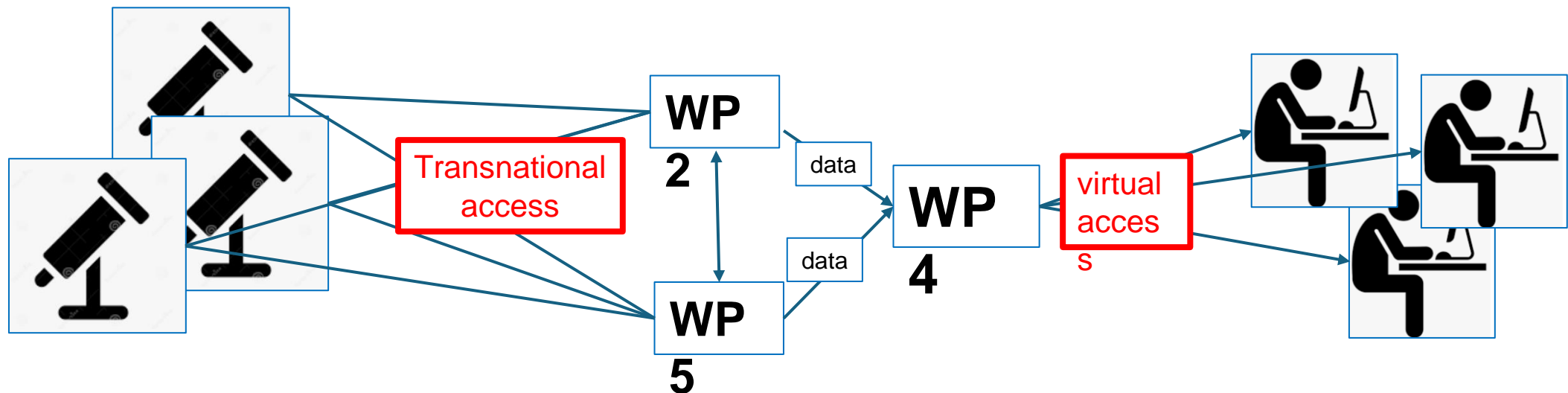
WP4

WP leaders: A.Neronov,
L.Wyrzykowski

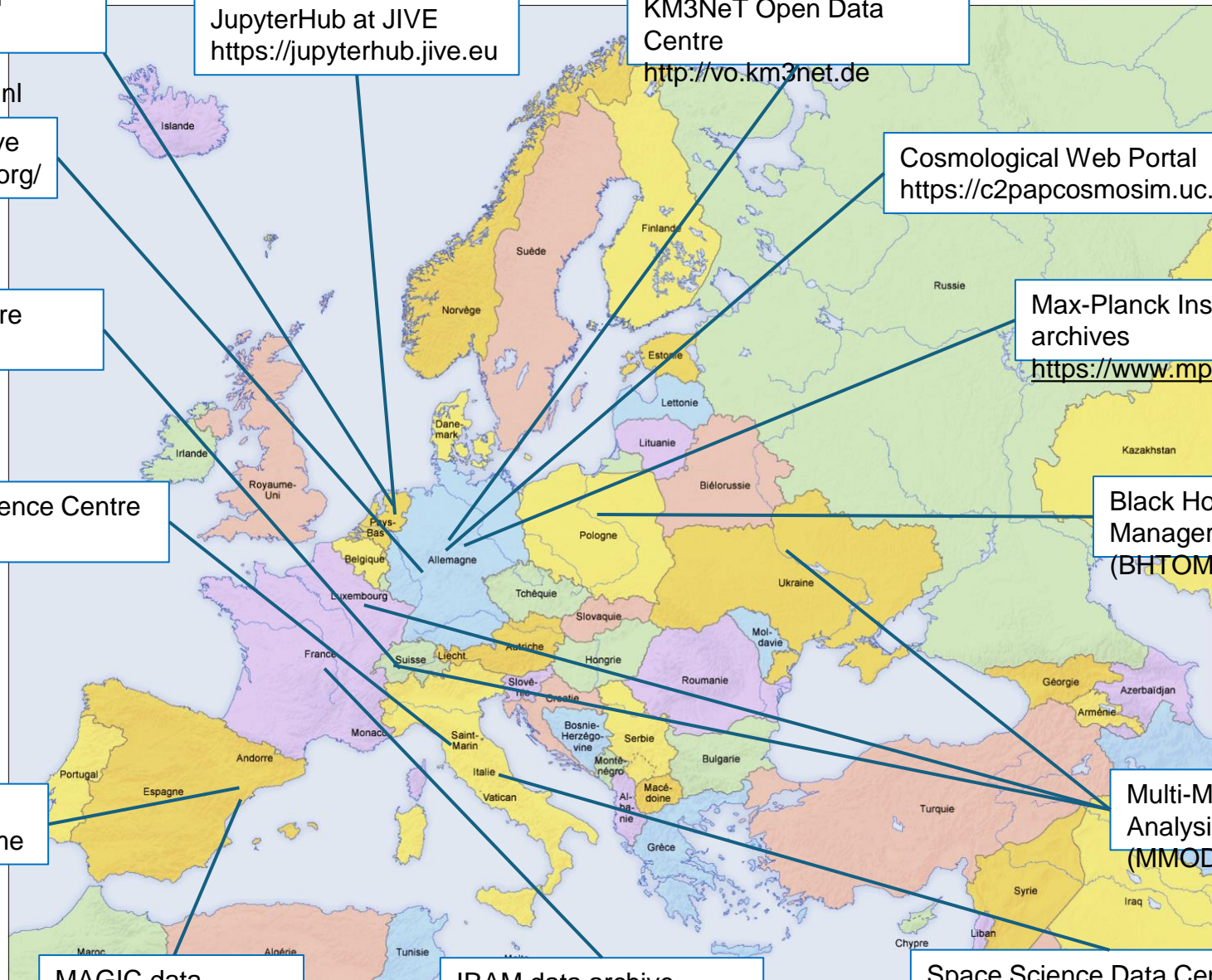
Task 4.1 Harmonisation of standards for multi-messenger data and analysis tools exchange

Task 4.2 Provision of access to telescope and detector data archives

Task 4.3 Provision of access to services for data analysis and modeling



Infrastructures involved



LOFAR Long-Term Archive (LTA)
<https://www.astron.nl>

JupyterHub at JIVE
<https://jupyterhub.jive.eu>

KM3NeT Open Data Centre
<http://vo.km3net.de>

Auger Open data Archive
<https://opendata.auger.org/>

Cosmological Web Portal
<https://c2papcosmosim.uc.lrz.de/>

INTEGRAL Science Data Centre (ISDC)
<https://www.isdc.unige.ch/>

Max-Planck Institute for Radioastronomy data archives
<https://www.mpifr-bonn.mpg.de/>

Gravitational Waves Open Science Centre (GWOSC)
<https://www.gw-openscience.org/>

Black Hole Target and Observation Manager (BHTOM)
<https://bhtom.space>

CosmoHub
<https://cosmohub.pic.es/home>

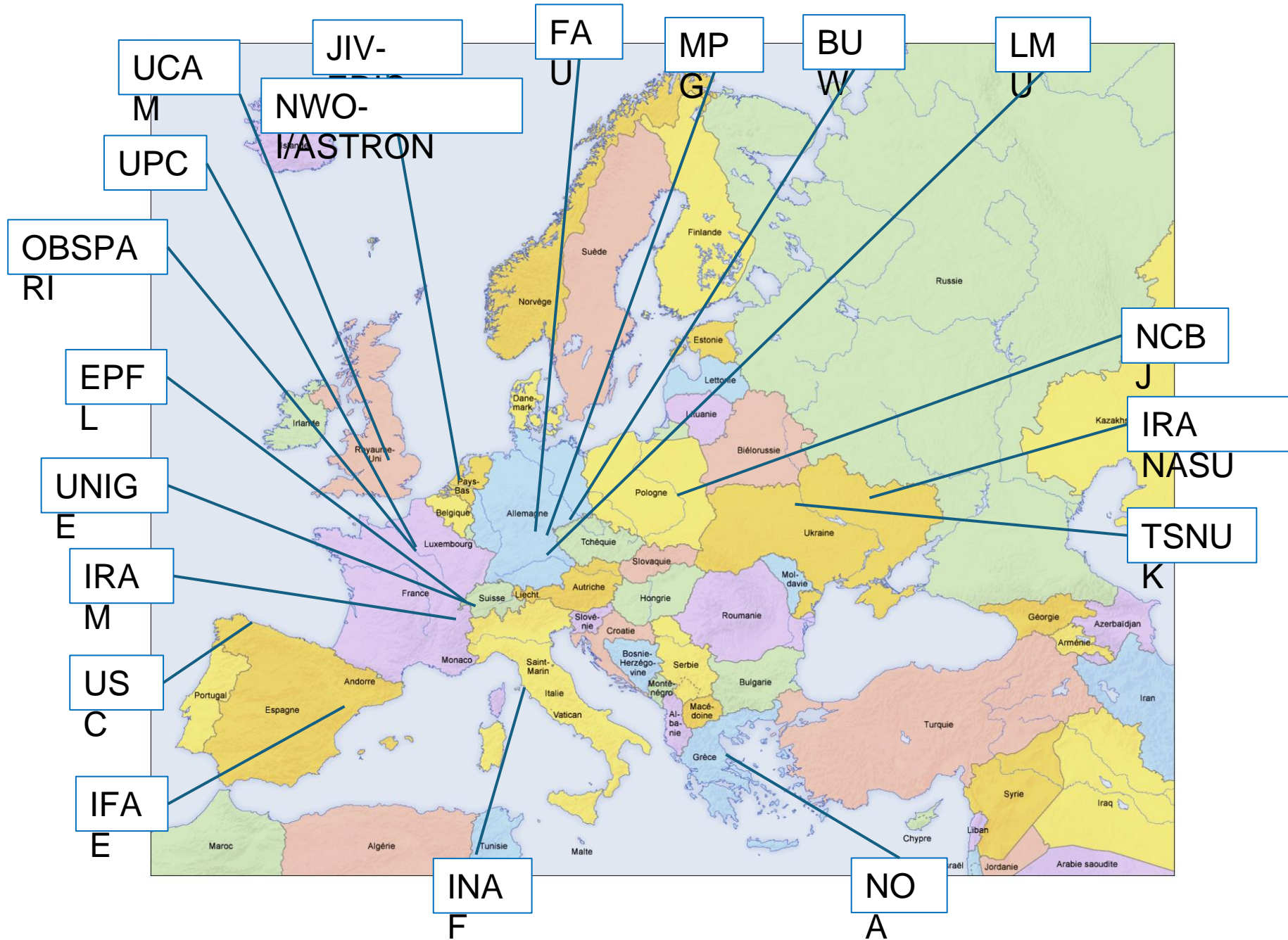
Multi-Messenger Online Data Analysis (MMODA)
<https://mmoda.io>

MAGIC data archive
<https://magic.pic.es>

IRAM data archive
<https://iram-institute.org>

Space Science Data Centre (SSDC)
<https://www.ssdsc.asi.it/>

Institutions involved



Work to do

- **harmonize**, aggregate and orchestrate the Virtual Access (VA) to **data archives**
- harmonize, aggregate and orchestrate the VA to online **data analysis services**

- harmonized Federated Authentication and Authorization Infrastructure (FAAI),
- web front-ends
- Application Programming Interface (API),
- FAIR standards

- **existing** domain-specific services for individual telescopes and detectors
- **new services** to enable **multi-messenger** combinations of data and analysis tools.

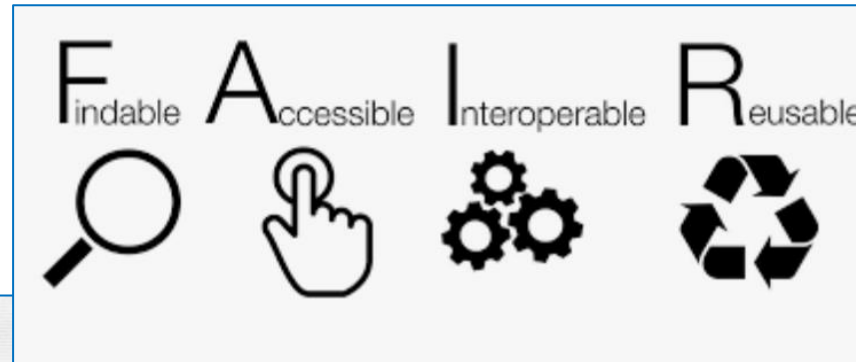
Task 4.1 Harmonisation of standards for multi-messenger data and analysis tools

exchange [UPC, OBSPARI, FAU, JIV-ERIC, EPFL, UNIGE, TS

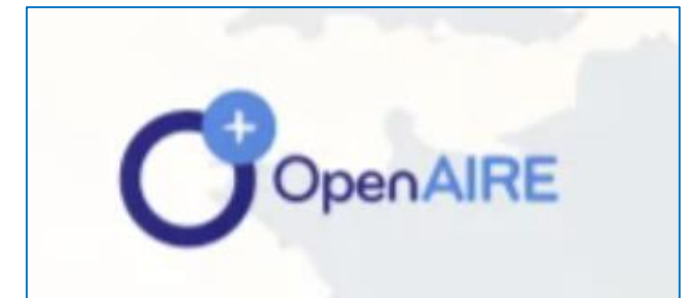
4.1.1. Virtual Observatory (VO) tools and standards.

4.1.2. Open domain-specific and multi-messenger data formats.

4.1.3. Harmonization of access methods.



A screenshot of the IVOA website. The top left corner shows the IVOA logo. Below it, there is a navigation menu with "IVOA" selected. To the right of the menu, there is a breadcrumb trail: "TWiki > IVOA Web > WebPreferences > IvoaRadio (2024-07-02, MarkKettenis)". Below the breadcrumb trail, the text "Radio astronomy Interest Group" is displayed in a dark red font. On the left side of the page, there is a "Log in or Register" button.



A screenshot of an arXiv abstract page. The top bar is red and contains the arXiv logo and the text "astro-ph > arXiv:2308.13385". Below this, the text "Astrophysics > Instrumentation and Methods for Astrophysics" is displayed. The abstract title is "The Very-high-energy Open Data Format: towards a shared, open data format in very-high-energy astronomy". Below the title, the authors are listed: "B. Khélifi, R. Zanin, K. Kosack, L. Olivera-Nieto, J. Schnabel (for the VODF Steering Committee)".



Task 4.2 Provision of access to telescope and detector data archives

NWO-I/ASTRON, IRAM, IRA NASU, TSNUK, IFAE, NCBJ, UNIGE, UPC, MPG , FAU, UCAM, INAF, USC, BUW

- 4.2.1. Access to LOFAR radio telescope data.
- 4.2.2. Access to IRAM radio telescope data.
- 4.2.3. Access to UTR-2 radio telescope data.
- 4.2.4. Access to European VLBI Network (EVN) archive.
- 4.2.5 . Access to the Effelsberg and APEX telescope data.

radio



- 4.2.6. Optical data access through BHTOM service.

visible

- 4.2.7. Hard X-ray / soft gamma-ray data access (INTEGRAL, POLAR-2 SVOM).

gamma-rays

- 4.2.8. MAGIC data archive.

- 4.2.12. ASTRI telescope archive access.

gravitational waves

- 4.2.9. Gravitational wave data access through GWOSC.

neutrinos

- 4.2.10. Access to neutrino data of ANTARES telescope.

- 4.2.11. Access to neutrino data of KM3NeT telescope.

cosmic rays

- 4.2.13. Auger Open Data archive access.

Task 4.3 Provision of access to services for data analysis and modeling

JIV-ERIC, UPC, FAU, UNIGE, EPFL, TSNUK, LMU, OBSPARI, NWO-I/SRON, NOA

4.3.1. Radio telescope data analysis services.

radio

4.3.7. X-ray transient source analysis service.

X-ray

4.3.2. ANTARES and KM3NET neutrino telescope data analysis services.

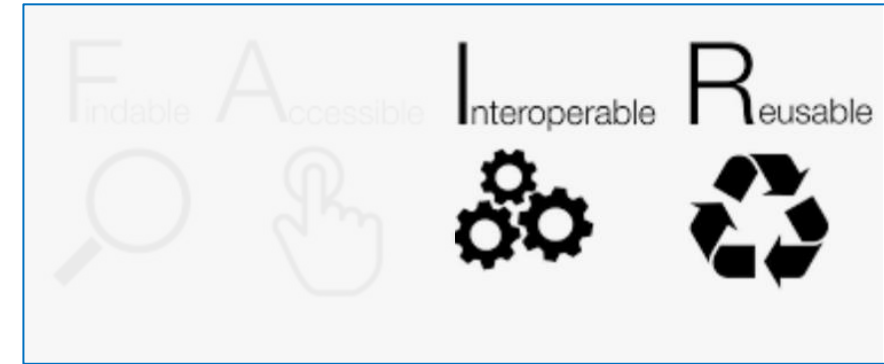
neutrinos

4.3.4. European Unified Atomic Database (EUAD).

4.3.5. Simulated Local Web (SLOW) data access.

4.3.6. MM-CosmoHub service access.

Multi-messenger



4.3.8. MMODA services

The screenshot shows the MMODA (Multi-Messenger Online Data Analysis) web interface. At the top, there are logos for MMODA, Université de Genève, ISDC, EPFL, and KAU. The main content area has a search form with the following fields: 'Object name *' (containing '1E 1740.7-2942'), 'RA' (containing '265.97845833'), 'Dec' (containing '-29.74516667'), 'Start time *' (containing '2017-03-06T13:26:48.0'), and 'End time *' (containing '2017-03-06T15:32:27.0'). There are 'Resolve' and 'Explore' buttons. At the bottom, there is a navigation bar with various astronomical data categories: Hard X-rays (INTEGRAL ISGRI), X-rays (INTEGRAL JEM-X), Gamma-rays (INTEGRAL SPI-ACS), Gamma-rays (Polar), Neutrino (Antares), Gravitational waves (LIGO/VIRGO), IR/Visible (DESI Legacy Survey), gravitational waves (SGWB), neutrino (IceCube), Gamma-rays (HESS), GRB detection, and Gamma-rays (CTA).

The screenshot shows the Galaxy for Astronomy web interface. The browser address bar shows 'usegalaxy.eu'. The page title is 'Galaxy for Astronomy'. The main content area has a 'Hello, Galaxy is running!' message and a 'Tools' sidebar on the left. The 'Tools' sidebar lists various tool categories: Upload, Tools, Get Data, Send Data, Collection Operations, Text Manipulation, Filter and Sort, Astro tools (staging), Astro Tools, Join, Subtract and Group, Statistics, and Scatterplot with ggplot2. The main content area has a 'History' sidebar on the right. The footer has 'News' and 'Events' buttons.