Asterics
Astronomy ESFRI & Research Infrastructure Cluster

Open Science in the framework of the ASTERICS Astronomy ESFRI cluster

Mark G. Allen

Centre de Données astronomiques de Strasbourg (CDS)

Astronomy

- ***Individuals, Projects, Big Science collabs.***
- Multi-λ science using data from many telescopes
- Era of big surveys already here (all-sky, 100s TB)
- Emerging now:
  - Time domain - transient source astronomy
  - Multi-messenger: $\boldsymbol{\nu}$, grav. waves, VHE$\boldsymbol{\gamma}$, CRs

Openness

- Many observatories open to international proposals
- Common for data to be available after 1-2 year proprietary period *– e.g. Observatory Archives*
- Sharing of reference data *– e.g. CDS*
- Long term use of compatible formats
  – e.g. FITS, VOTable
- Publications – *increasing openness, arXiv*

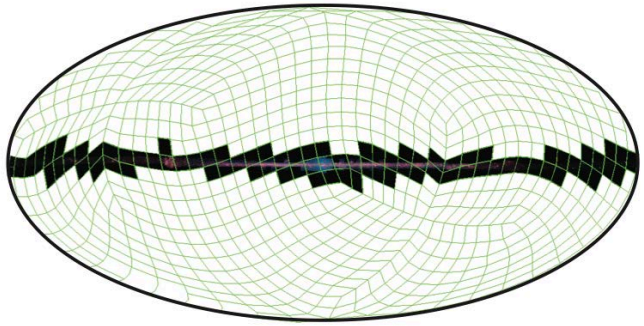
Virtual Observatory

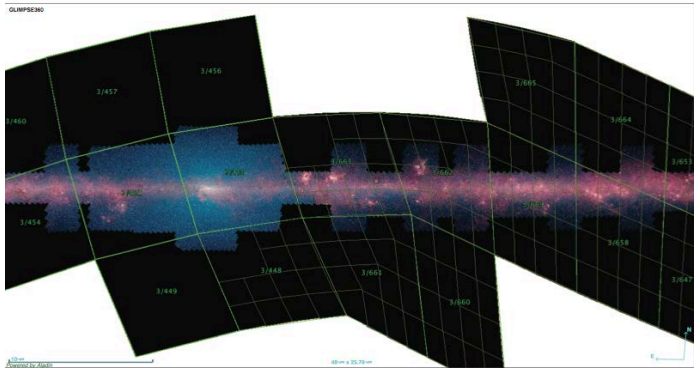
- Archives and databases form a ‘digital sky’
- New possibilities via data discovery, efficient data access and interoperability
- Driven by:
  - Exploding data rates
  - Multi-wavelength, Time Domain & Survey science
  - Benefits of being open and interoperable

Virtual Observatory

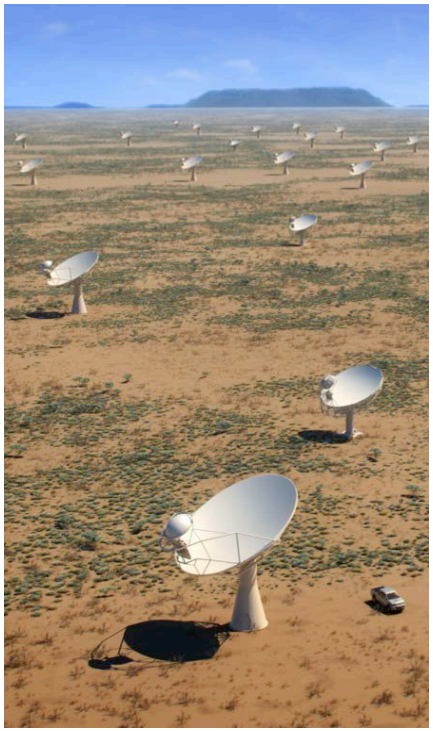
- Framework for interoperable access to data and services
- Astronomy e-Science
- Open standards
  - Co-ordination by IVOA
  - Science Priorities
  - Connection to generic e-Infrastructures
    - *e.g. IVOA registry to be available in EUDAT B2FIND*
- *EC funded Euro-VO projects (2001-2014)*

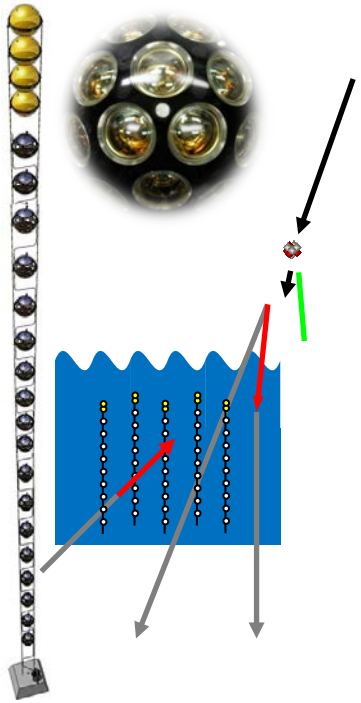
- **Open Standards** and interoperable **Tools**
- **Domain specific** aspects and innovations
  - *Sky coordinates*
  - *Astro metadata*
  - ***Matched to the community***
- Big data and small data
- ***Big Data*** including the long tail

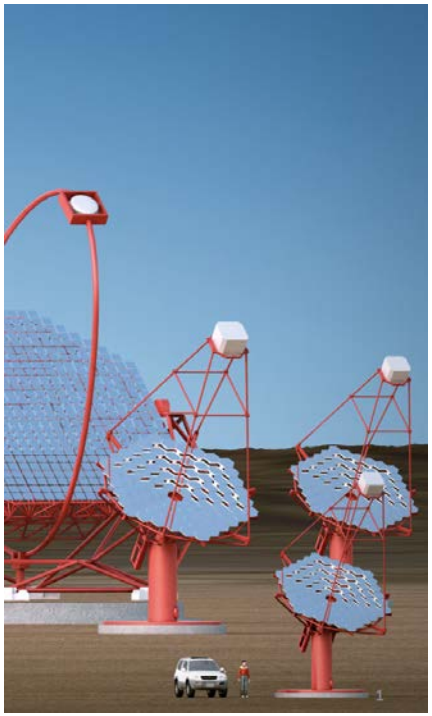


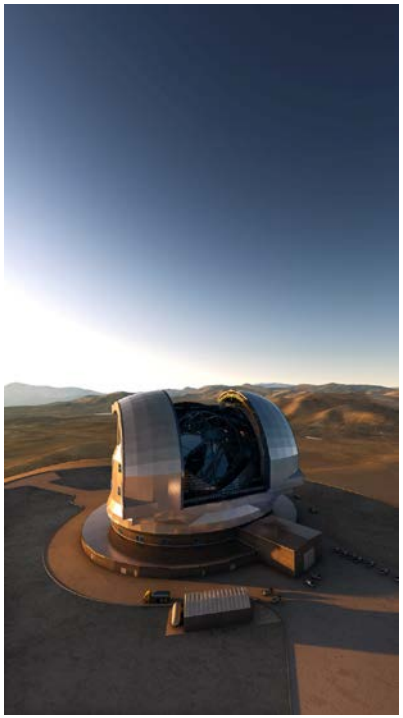


Engagement with big Astronomy and Astro-particle infrastructures









Cluster of ESFRI projects and their pathfinders, and relevant research infrastructures

ASTERICS

- **Astronomy ESFRI & Research Infrastructure Cluster**
  - (INFRADEV-4-2015/2015)
  - 4 years, 15 M€, 22 partners, 5 WPs, Co-ordinator: Michael Garrett

ESFRI

Astronomy ***Astro-particle physics***

Virtual Observatory ***Big Data***

Science 2.0 ***Citizen Science***

Data Access and Data Interoperability

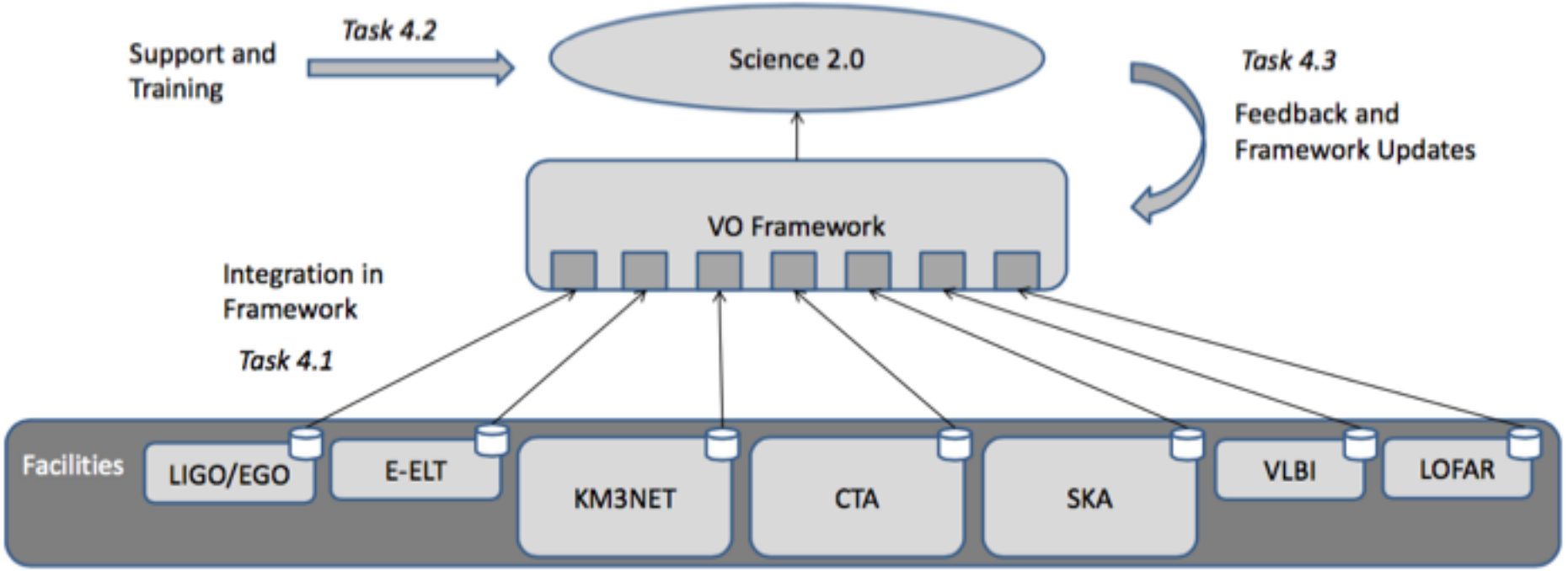
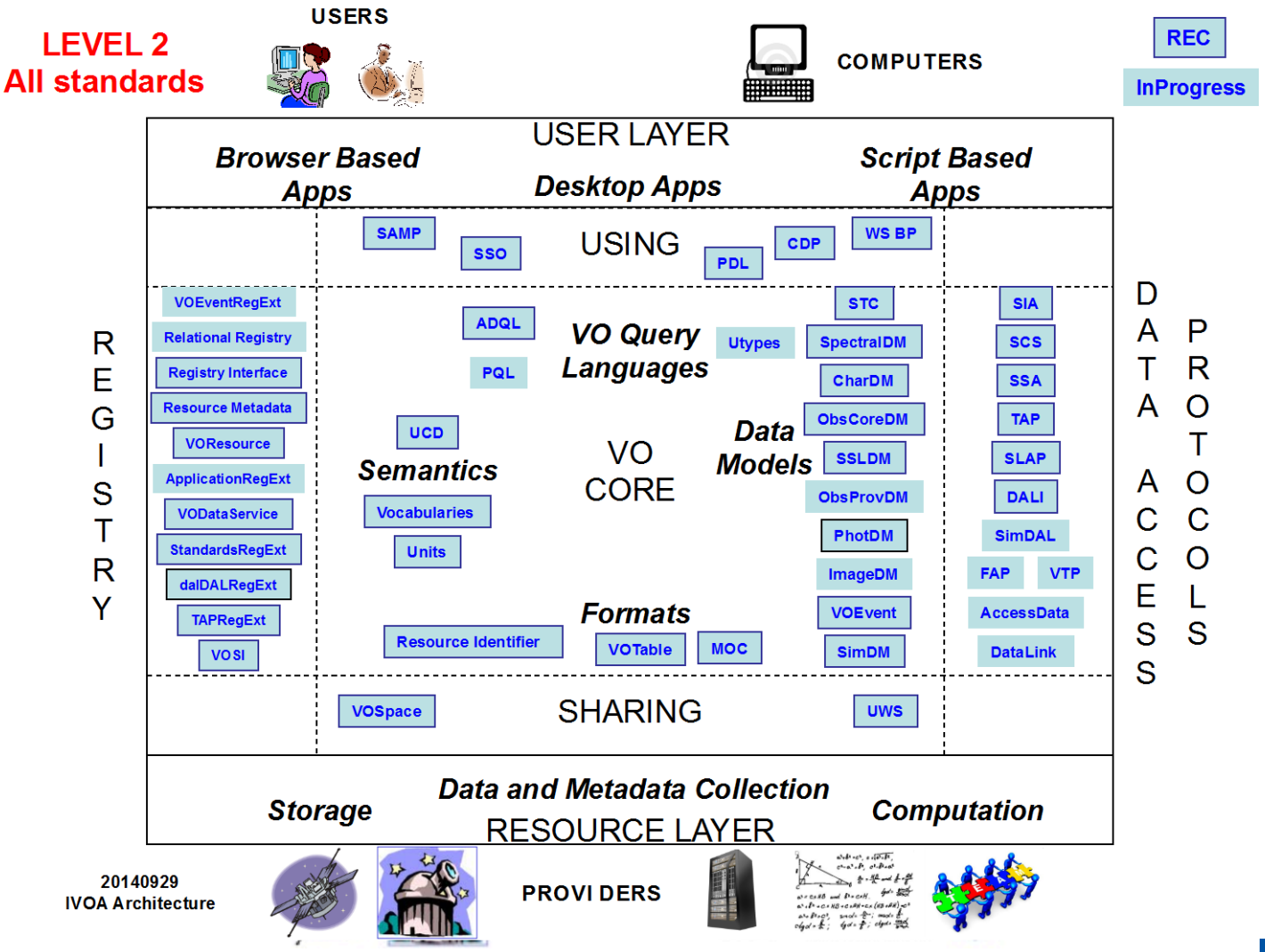
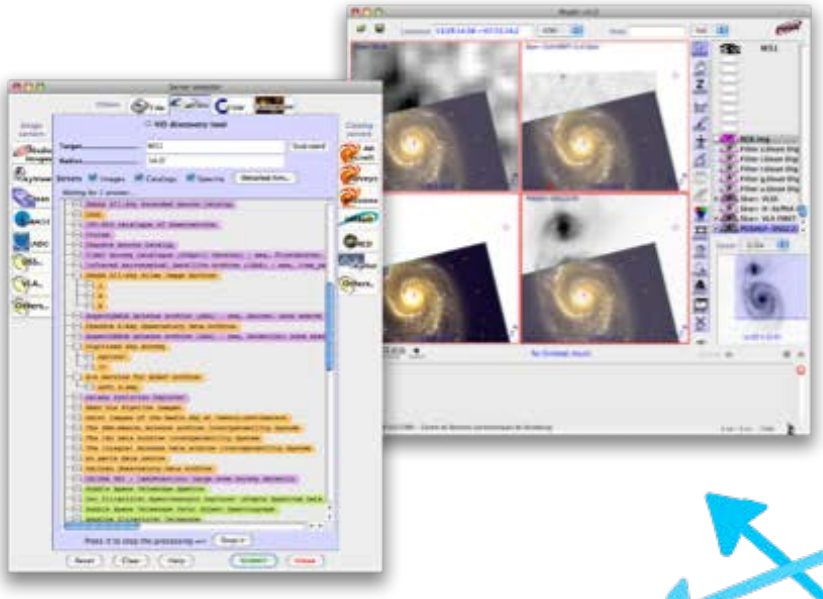
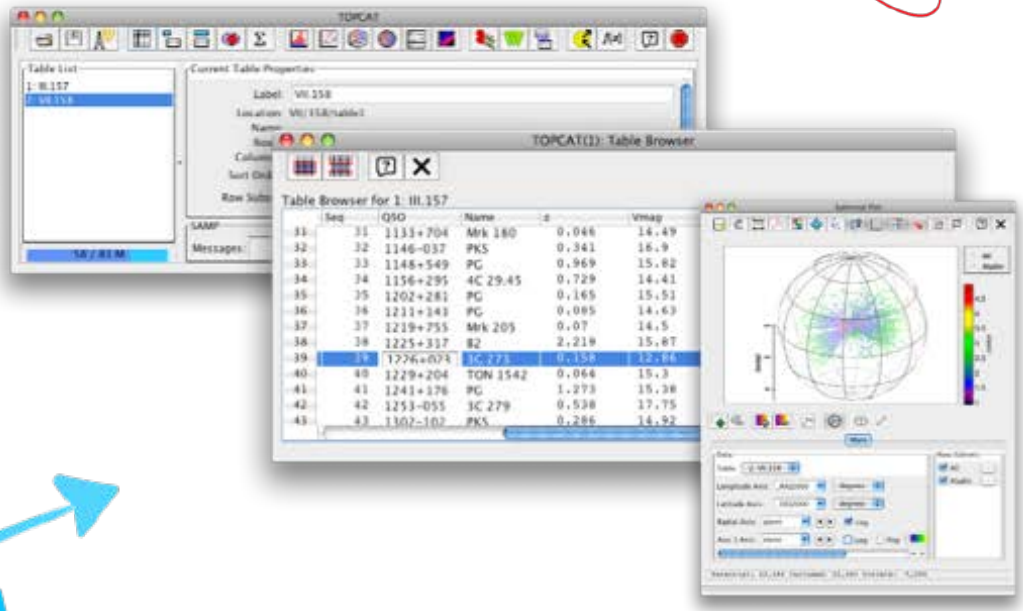


Figure 6: The ESFRI projects integrated in the VO Framework offers users uniform access.

The VO Technical Framework






TOPCAT
TOPCAT(1): Table Browser
Table Browser for 1: III.157


VOSpec
ISO PHT
ISO LWS
HUT
IUE

+ your tools

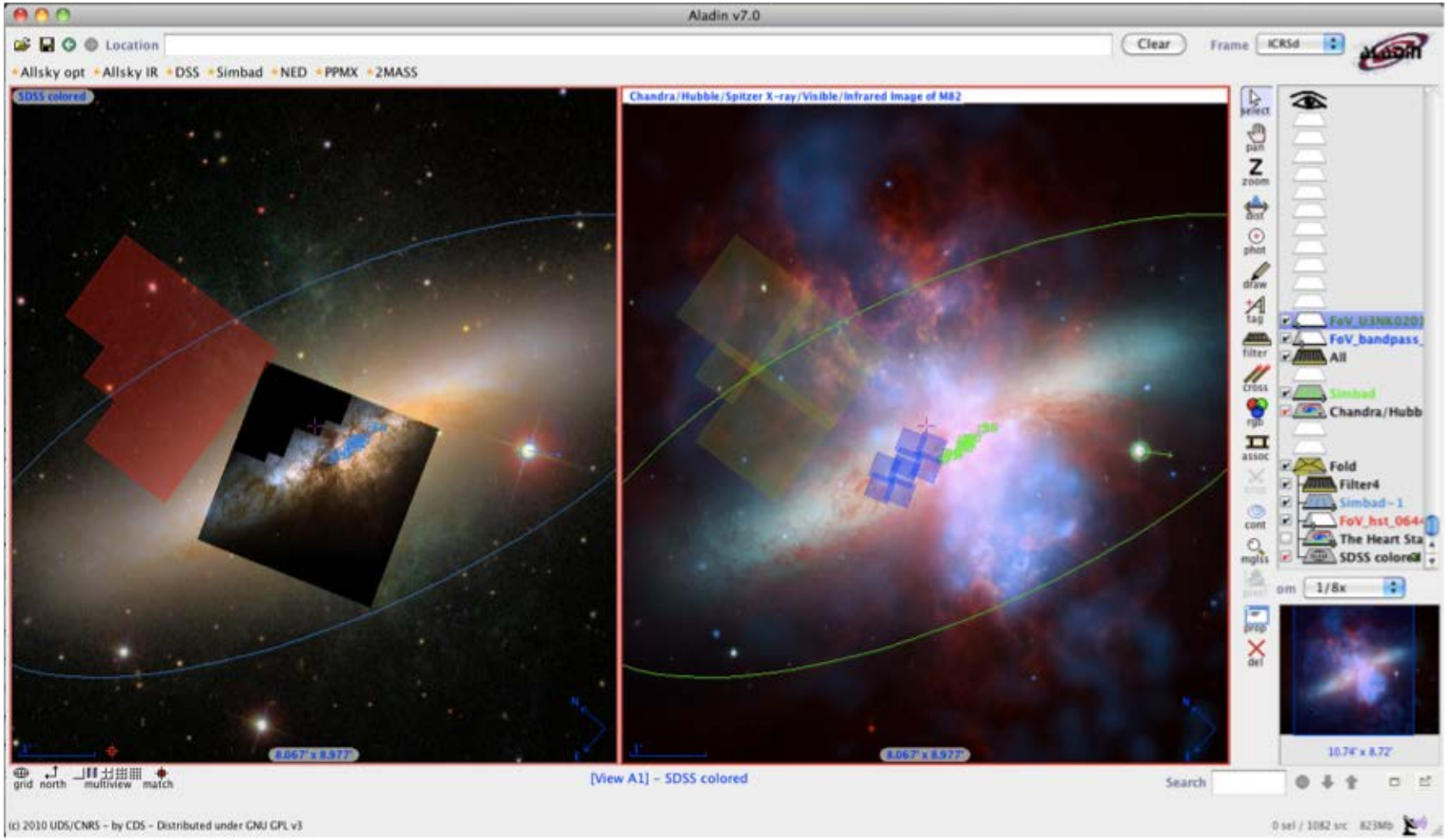

Broadcast

Science 2.0

- Transition in the way Astronomy is done
  - Opening up the research process
  - Access, Interoperability
  - Engagement – scientists, data providers, citizens
- Our approach:
  - Leading the way with biggest infrastructures as participants in defining the VO framework

Challenges

- Sustainability
- Support for openness
- Keeping things simple while enabling complex capabilities
- Interface between domain-specific & generic infrastructure
- Community awareness, visibility, recognition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Location
Clear
Frame
ICRSd
Allsky opt
Allsky IR
DSS
Simbad
NED
PPMX
2MASS
SDSS colored
Chandra/Hubble/Spitzer X-ray/Visible/Infrared Image of M82
FoV_bandpass_
All
Chandra/Hubb
Fold
Filter4
Simbad - 1
The Heart Sta
SDSS colored
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grid
north
multiview
match
[View A1] - SDSS colored
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