

Science Priorities

Mark Allen

CSP:

Enrique Solano

David Ciardi

Bruno Merin

Kai Polsterer

Brian Glendenning

Pepi Fabbiano

Matthew Graham

Pat Dowler

lots of help from: Janet Evans (Exec Secretary)

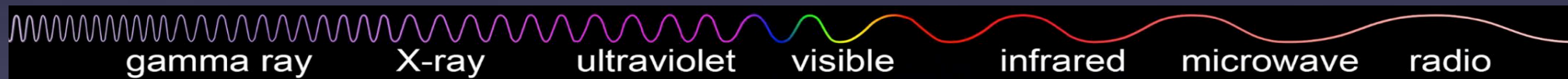


Reflections

- Steady progress on integration of VO into science archive/data-centres/tools
 - Returns on long term investments:
 - e.g. TAP services (Gaia DR1)
 - e.g. HiPS network promoted by group of data centres is growing rapidly
- Mode of IVOA development evolving- including more and more contributions of working components.
 - Integration, consistency essential - but IVOA doesn't need to develop everything from scratch

Reflections

- VO now addressing wider communities
 - Planetary and Solar System
 - Multi-wavelength, multi-messenger...



messengers: photons, ν , grav. waves, VHE γ

- High potential for VO contributions to AstroPy
 - e.g. ESASky python layers on top of TAP services



Science Priority Areas

Multi-dimensional Data

Radio astronomy, Integral Field Spectroscopy, high energy, polarization, simulation, data mining datasets + ...

Time Domain Astronomy

Time Series, light curves, transient event reports, +...

- Important progress made on these, time to move into next phases

Multi-d Minimal requirements

- **Data Discovery (Query)**
 - A service shall be able to receive queries regarding its data collection(s) from a client, with the client placing one or more of the following constraints:
 - RA,Dec
 - Frequency/wavelength
 - Polarization states
 - Spatial size
 - Angular resolution
 - Integration time
 - Time of observation
 - A service shall return to the client a list of observations, and the corresponding metadata for each observation, meeting the user-imposed constraints. In the event that the user places no constraints, the entire list of observations, and the corresponding metadata for each data set, shall be returned. In the event that no data meet the user's constraints, the service shall indicate the absence of any matches.
- **Data Access**
 - Once a user has the list of observations that satisfy the constraints, they select all or a subset of the observations and:
 - Download the complete science data for each of the selected observations (the service shall return the complete multi-dimensional science data and metadata for each selected observation) or;
 - Download simple cutouts of the science data for each of the selected observations (the service shall be able to extract and return a user-specified subset of the complete multi-dimensional science data and metadata for each selected observation).
- **Simple Cutout**
 - For a simple cutout, the user-specified subset is restricted to be a contiguous interval within each dimension of the multi-dimensional science data. The user should **not** be allowed to specify subsets with "gaps" or resampling or anything like that.
 - Spatial: (a coordinate and a radius)
 - Energy: one interval (from energy1 to energy2)
 - Time: one interval (from time1 to time2)
 - Polarization: a list


Multi-d Data Status

- **Milestone - IVOA multi-d data standards**
 - *First set of standards to address Discovery, Access, Simple cut-out of multi-d data*
 - ***Obscore 1.1, SIA 2.0, DataLink 1.0, SODA 1.0***
- Finished set of standards provides basis for implementations
- **Implementation phase** - and follow-up with feedback sessions

Time Domain Status

- Time Domain Focus Session May 2013
 - LSST, Radio Transients (ASKAP, Meerkat,..), CoRoT, Kepler
- Important activity in Time Domain community (Transient Universe etc.)
 - ▶ Biggest ever Time Domain IG sessions in Cape Town
 - ▶ DM, DAL WGs now more integrated with Time Domain Interest Group
 - ▶ Expect to be driven by engagements with projects e.g. ZTF, LSST, Radio transient projects etc.

Engaging major astronomy projects

- VO = framework for efficient and interoperable access to astronomical data
-  IVOA is an alliance of worldwide VO projects who develop the required standards
- IVOA making dedicated effort to encourage participation of major astronomy projects

Engagement with projects

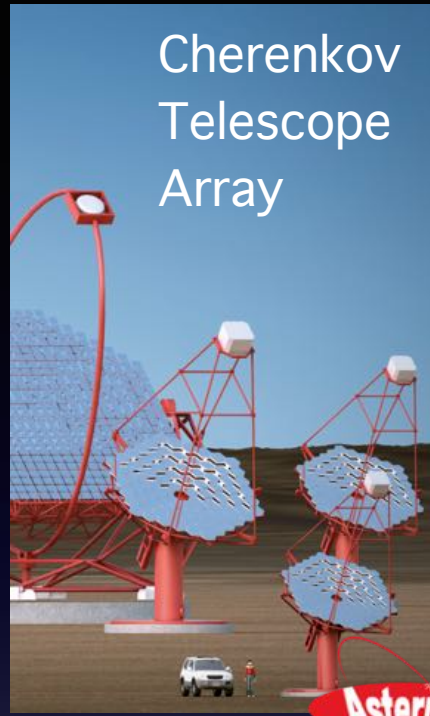
Focus Sessions at May 2016 Interop Meeting:

- Discussion of VO technologies in the **priority** areas of multi-dimensional, and time domain data
- What **practical measures** can be undertaken to facilitate the use of IVOA standards, and to ensure their relevance to major astronomy projects
- Fostering major astronomy projects to become **'participants'** rather than **'customers'** of the VO
 - ***needs support by IVOA members to facilitate contact and work with projects***

LSST



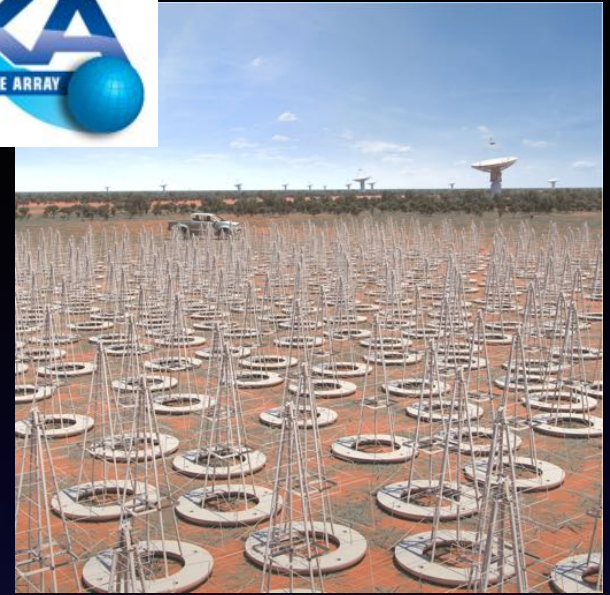
Large Synoptic Survey



Cherenkov Telescope Array



Square Kilometre Array

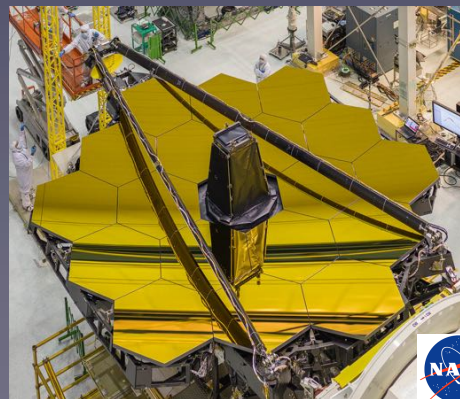


ASKAP



Five-hundred-meter Aperture Spherical Telescope (FAST)

FOCUS SESSIONS 2016



JWST



Gaia & Euclid



European Gravitational Observatory, EGO/VIRGO

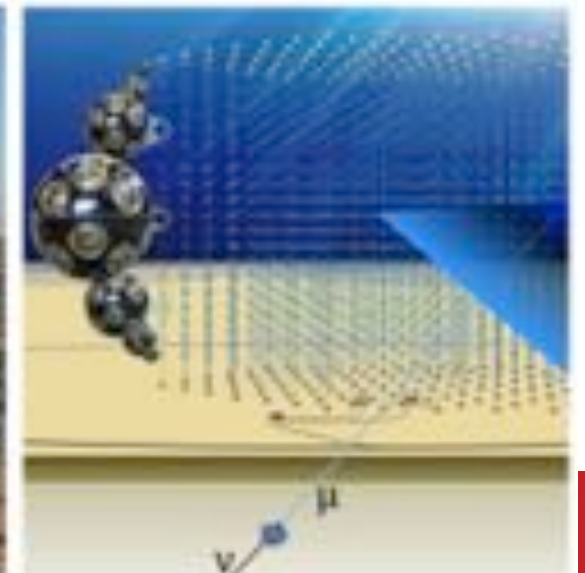
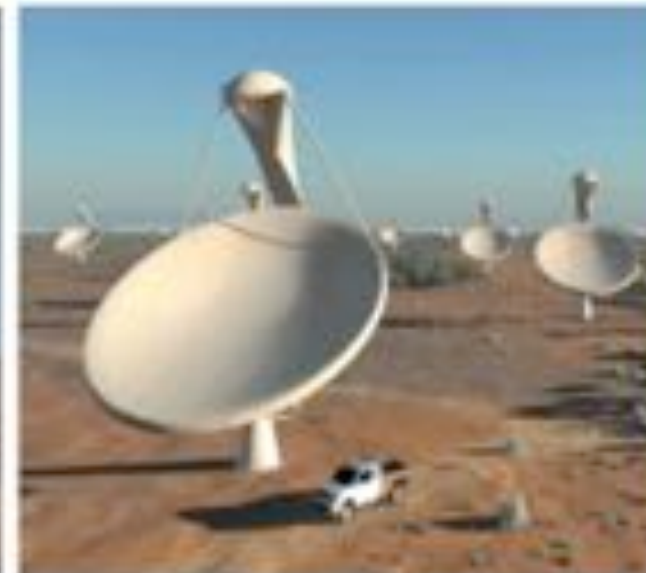
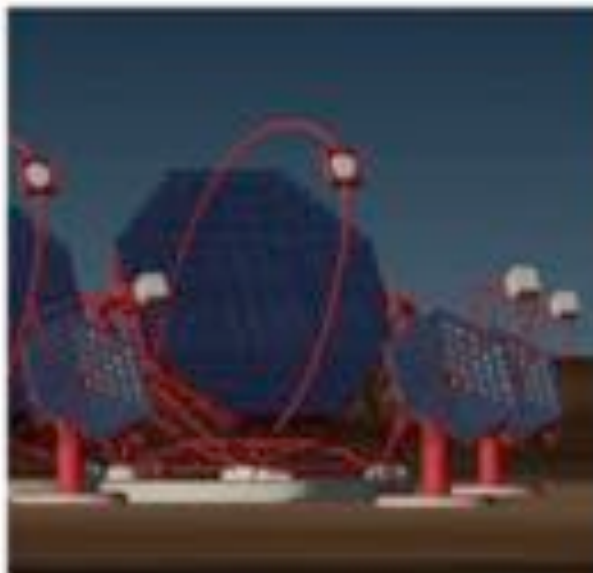
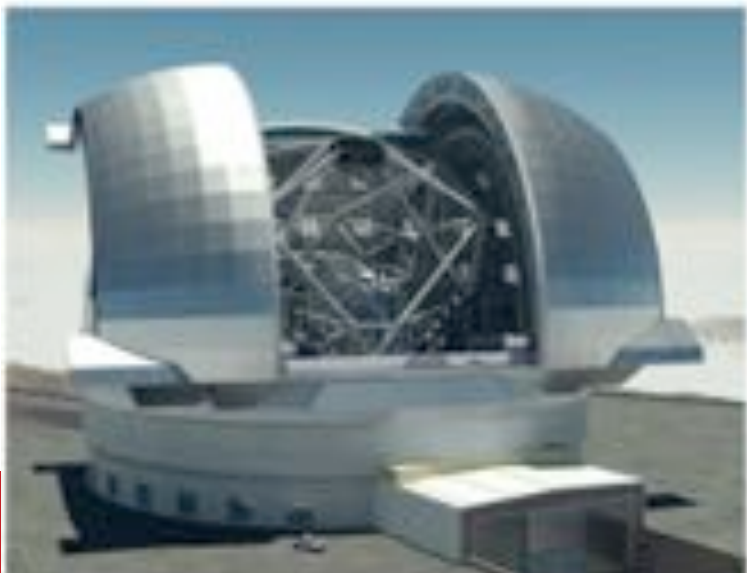


concept and approach

- Supporting the European Strategy Forum on Research Infrastructures (ESFRI)
- Aspiring ESFRI projects + pathfinders
- Other world-class research infrastructures
 - e.g. LOFAR, Euclid, LSST, Virgo

European Strategy Forum
on Research Infrastructures

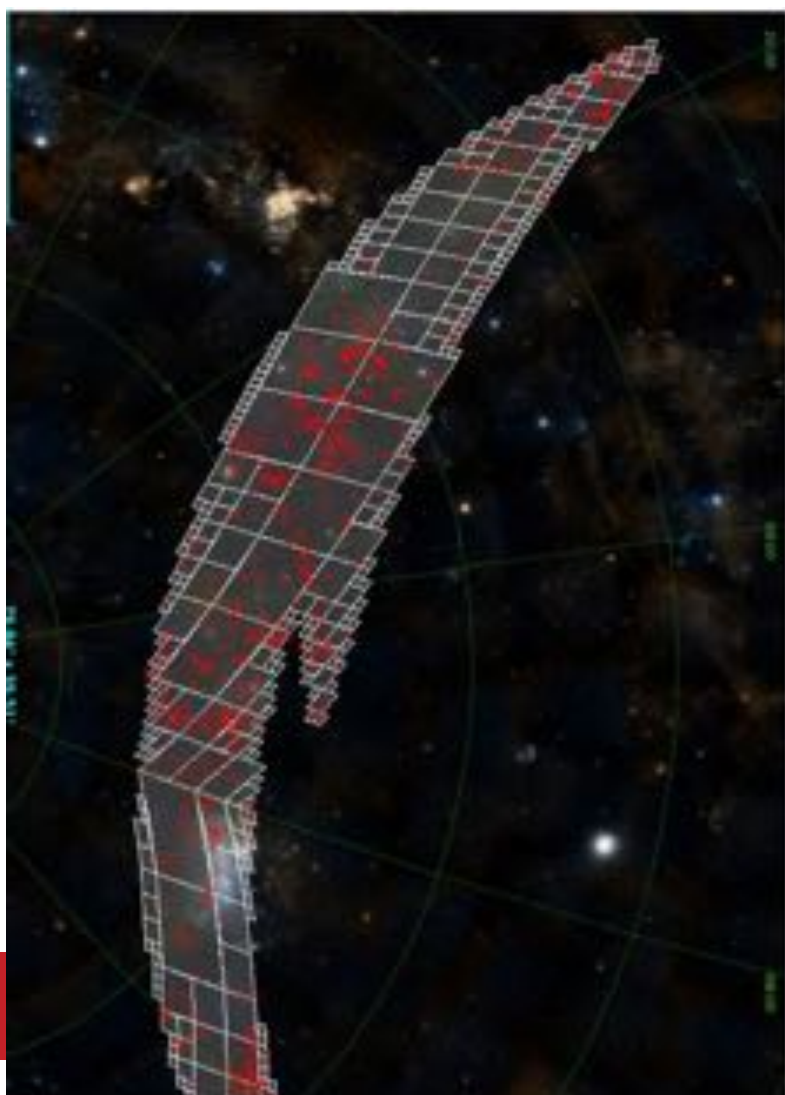
ESFRI





ASTERICS connections: *gravitational waves*

ASTERICS fostered
use of VO for grav
wave EM follow-up



Skymap Viewer
A sky atlas for understanding LIGO-Virgo skymaps. Help [here](#), or watch a video about [Skymap Viewer](#). Plenty simulated skymaps [here](#). If you do not see the big dark sky map, look below and widen your browser. Zoom with the + and - at the right of the sky.

LIGO-Virgo Skymaps

This is skymap
GW150914:LAL1.
50% area = 149.0 sq deg
90% area = 616.4 sq deg

South North

Show Weighted Galaxies (or [table](#)).

Time and Place

Universal time
2015-09-14T09:50:45
E Longitude Latitude

Sun = and = Moon

Catalog Sources

Click the Layers icon to switch on catalogs.
If you click on the sources on the sky, information will appear here with links to Simbad and NED.

Zoomable Multiwavelength Sky

Zoom in on the sky with the mouse or the +/- icons on the right of the sky. To change the image

J2000

FeV: 175.81°

LIGO

Survey

- Basic Identification
- Data Products and Archives
- Data Usage and Interoperability
- VO standards
- *.... follow-up on results at this meeting*

CSP at Shanghai Interop

- Science Session
 - Highlight of local Chinese activities
 - Motivation of VO - Scientists from:
 - IVOA CSP
 - IVOA Interest Groups: Theory, Time-Domain
 - Lightning Talks : “Science with the VO, What I need from the VO, Ideas for the VO”

Science Session program

(Session 9: Plenary, Wed 9h-10h30)

Time	Topic	Speaker
9h05 - 9h20	Data Oriented Astronomy in China	Ming ZHU (NOAC)
9h20 - 9h35	Science visions for the VO	B. Merin (ESA, IVOA CSP)
9h35 - 9h50	Theory and the VO	Franck Le Petit (Obs Paris, IVOA Theory IG)
9h50 - 10h05	Time Domain science user perspective	Ada Nebot (CDS, IVOA Time Domain IG)
10h05 - 10h30	Lightening Talks "Science with the VO, What I need from the VO, Ideas for the VO"	
	1. Astronomical Data Processing & Astronomical Workflow Scheduling in cloud".	Qing Zhao (Tianjin University of Science & Technology)
	2. Gaia-PS1-SDSS (GPS1) proper motion catalog across 3-Pi sky	Haijun Tian
	3.	
	4.	

CSP leadership and membership

- Time for a new Chair!
- CSP is a committee of the Exec
 - see Exec members to make suggestions