INTERNATIONAL VIRTUAL OBSERVATORY ALLIANCE
US National Virtual Observatory

SIA V2.0
Current Status, Issues, Advanced Capabilities

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SIA Version 2.0

- Topics
  - Recent issues
  - GDS connection and ObsTAP
  - Data model role
- Advanced capabilities
  - AccessData
  - Radio data use cases (also event data)
- Plans

Simple Image Access V2.0

- Current status
  - Partial working draft since late 2009
  - Defines basic SIAV2 service interface
  - QueryData method, query response metadata
- Recent Work
  - Focus has been specifying advanced capabilities
    - Cube access, radio data use cases
    - AccessData method
  - SIAV2 high priority for radio community
    - SIAV1 ok for 2D, but not for data cubes!
- Prototyping
  - Limited so far (but we have FB 2D prototype)

SIAV2 Interface (reminder)

- QueryData
  - Data discovery, metadata retrieval, simple virtual data
  - functionally backwards compatible, very similar to SSA
  - POS,SIZE, BAND, TIME, POL, SPATRES, etc.
- AccessData (new)
  - Client-directed advanced data access
  - This is where advanced data cube capabilities go
- StageData
  - Async/UWS front end, scaling up
- GetCapabilities
  - Service capabilities

QueryData

- GDS Linkage
  - Recent SSA discussion of UTYPEs "ssa" vs "spectrum"
    - Spectrum data model describes a Spectrum dataset
    - SSA data model describes a SSA query response
  - Role of GDS (generic dataset)
    - Both SSA QR and Spectrum are derived from GDS
    - SSA QR is virtually all GDS, not specific to Spectra at all

- SIAV2 and GDS
  - There is no formal "Image" model (in VO anyway).
  - Most of SIAV2 QR is the same as SSA - GDS metadata
    - DataID, Curation, Target, Char, etc.
  - Not specific to a Spectrum or an Image
  - Some additional image-oriented metadata is required

QueryData

- Virtual Data
  - Pure GDS query (ObsTAP) essential for global data discovery
  - But downloading whole archival datasets is not enough for VO
    - Modern datasets (eg cubes) are much too large for this
  - Hence OO "typed" DAL interfaces provide virtual data access
    - Superficially looks like GDS query but data may be virtual
- Direct Access
  - SIA QR describes downloadable virtual data product
    - client does not have to specify how, just what
  - QR record can be easily input to StageData/UWS to scale up
- Programmatic Access
  - QR provides sufficient metadata to inform use of AccessData
  - Some issues, e.g. FITS MEF, visibility, event, survey datasets

AccessData (new in SIAV2)

- Concept
  - Explicit access, not a query – tell service what to do
    - like a conventional image i/o data access
  - Requires prior knowledge of dataset, obtained via queryData
  - Permits advanced capabilities without complicating queryData

- AccessData Workflow
  - dataset -> [filter] -> [WCS-proj] -> [section] -> [func] -> image
  - All stages are optional
  - Workflow is logical, does not specify actual processing required

    - dataset(image) -> image (returns whole image)
    - dataset(image) -> section -> image (cutout etc.)
    - dataset(visibility) -> WCS -> image (OTF imaging)

- For already pixelated data WCS-proj and section are most useful
- More fundamental data (visibility, event) is more interesting

Radio Use Cases

- Motivation
  - New instruments and surveys (EVLA, ALMA, LOFAR, Arecibo, etc.)
    - Can be widefield, wideband
    - Resolve spatial, time, spectral, pol axes simultaneously!
    - Routinely produce data cubes
    - Powerful tool for many areas of astrophysics
  - Dataset size is a serious issue
    - Cubes can be tens or hundreds of GB or larger
- Basic Capabilities
  - Simple cube access (subcube, projection, etc.)
    - dataset -> [filter] -> [WCS-proj] -> [section] -> image
  - On the fly imaging to produce images
    - dataset -> [filter] -> [WCS-proj] -> image

Radio Use Cases

- Functions
  - Standard computations often performed on cubes
  - Must be done natively (eg on server) to have full knowledge of data

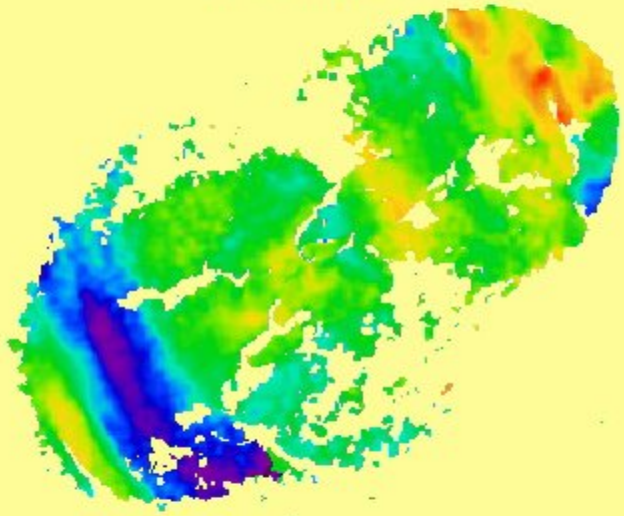
- Typical Cube Functions

– Moments (0,1,2)	eg velocity image
– Spectral index image	type of emission indicator
– Spectral curvature image	variation of SI
– Rotation measure image	magnetic field indicator
– Variability curve	time variability within obs
– Optical depth image	eg HI absorption

http://www.ivoa.net/internal/IVOA/SiaInterface/Anita-InterferometryVO.pdf

Rotation Measure Analysis of Magnetic Fields in and around Radio Galaxies

Riccione, Italy
10-14 May 2010



Organized by: INAF Istituto di Radioastronomia

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Variability Measures

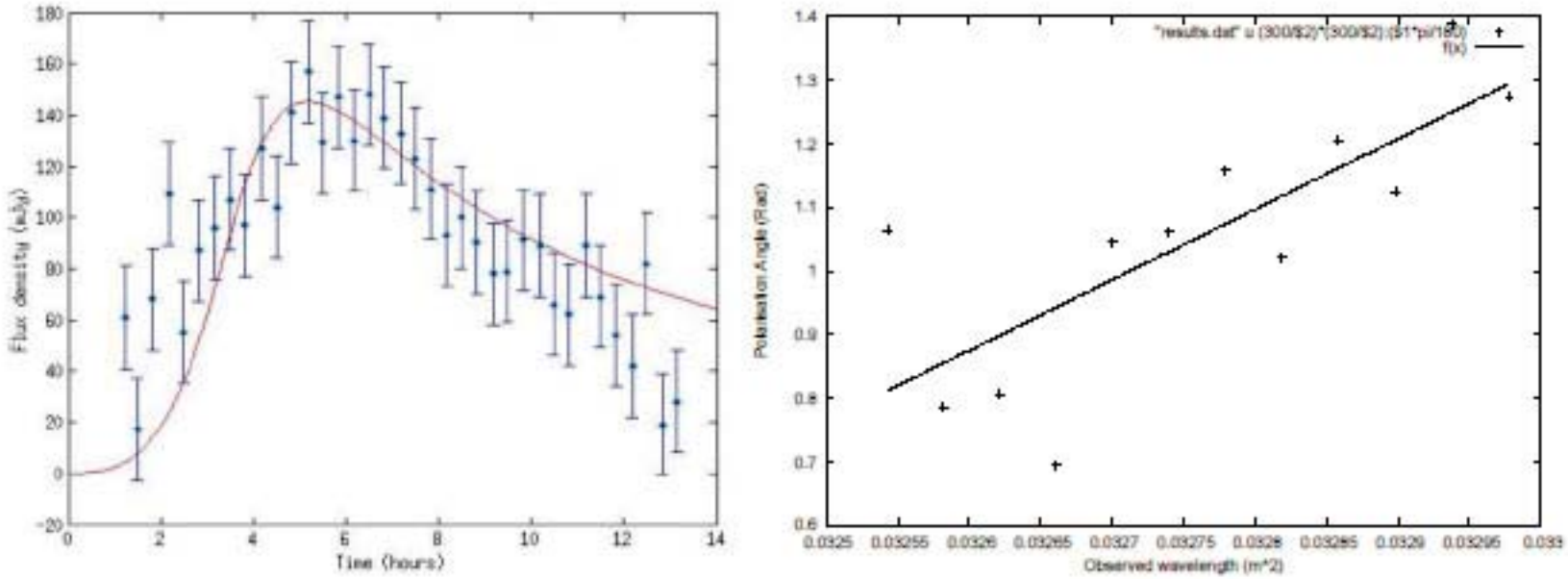

Figure 3: X-ray binary GRS 1915 (courtesy Tony Rushton). *left* Visibility amplitude as a function of time distance. *right* Polarization angle as a function of observing wavelength^2.

Metadata issues

- Issue
  - Imaging from more fundamental data
  - Image computed OTF from visibility (or event) data
  - OTF image from FITS MEF or survey data is similar
- Requirements
  - SIA QR needs to describe data that can be imaged
    - Only of course if the service can do OTF imaging
    - Visibility or event observation, MEF, survey, etc.
    - Can probably use adopt some ObsTAP metadata for this
  - Some special metadata required
    - UV-dist plot/table or upper/lower limits on spatial resolution,
    - nominal field of view, dirty beam, limiting flux, bkg rms, etc.