A VO-driven Astronomical Data Grid in China

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LAMOST

Large Sky Area Multi-Object Fiber Spectroscopic Telescope

- Started in 1997
- First light for engineering in August 2008
- Hardware construction finished in June 2009
- Under calibration and commission currently
MB: 37 sub-mirrors

MA: 24 sub-mirrors
Characteristics of LAMOST

- Effective aperture: 3.6-4.9 meter
- FOV: 5° (1.75m linear)
- Number of optical fiber: 4000
- Observing sky area: -10° ≤ δ ≤ +90°
- Spectral resolution: 1-0.25nm
- Survey capability: taking spectral resolution 1nm,
  integration time 1.5 hours,
  magnitude limit: 20.5m
- Size of fiber: 3.30 arcsec (320 macro linear)
- Site seeing: ~2 arcsec
Instruments

- 4000 Fibers (130km)
- 4000 Fiber positioning units
- 16 Spectrographs
  - 250 fibers per spectrograph
- 32 4k x 4k CCD Cameras

$R_L = 1000/2000$
$R_M = 5000/10000$
Spectroscopic Surveys

- Key projects include
  - extra-Galactic
  - Milky Way
  - cross-identification

- SWG for the Milky Way study
- SWG for extragalactic survey
LAMOST Obs. Mode and Data Size

- 4000 / 250 => 16 spectroscopes => red & blue parts => 32 CCD cameras => 4K*4K pixels => 16 bits color deep
- For each sky area, 3 times exposure, 30 minutes each. 5 sky area (plate) can be observed for a night (7.5~9 hours)
- Scientific data per night:
  - 4K*4K*2*32*5*3 = 15.36 (GB)
- All the collected data is about 20 GB/night
- 20*200 = 4,000 GB per year (ideal condition)
- 4*5 year = 20 TB for the LAMOST 5 years life period
- The whole archive is about 50 to 60TB
Data Products

- Level 1: 2-D multi-fiber spectrum images (private)
- Level 2: 1-D spectra (to the public 18 months later)
- Level 3: Catalogs (to the public 24 months later) and value-added products
Undergoing projects in China

- AST3
- CHINA THIRTY METER TELESCOPE
- YNAO 2.4m
- 40-50m radio telescopes
- 21CMA
- HXMT
- SHAO 65m
- CSTAR
The way to standardization and collectivization

- **VO**: the latest stage of along term trend towards standardization and collectivization in astronomy
  - The first key step was the development of "facility class instrumentation".
  - The next step was the standardization of data formats - FITS, NDF, etc.
  - Rapidly following on this was the production of "facility class" data reduction software - IRAF, MIDAS, Starlink, AIPS etc.
  - The VO is the next step in that process - standardizing data access methods, data exchange formats, and metadata.
  - Finally, a logical next step is the standardization of *data analysis* tools.

-- Andy Lawrence: *Drowning in Data: VO to the rescue*
We are at the starting point >>>

Requirements for astro-informatics are appearing

Starting from the simplest and the basic …
"facility class instrumentation" in China

- Modern observational projects
  - LAMOST, 21CMA, CSTAR, AST3, etc.

- Infrastructures for:
  - Storage
  - Data access
  - Computing
  - Preservation
  - User support
CAS SDB for Astronomy

- A sub-project of Chinese Academy of Sciences Scientific Database system
- Budget: 1.4 m RMB
- Period: 2009 to 2010
- Involved observatories: NAOC, SHAO, PMO (Nanjing)
- Datasets: LAMOST/CSTAR/BATC, SHAO numeral simulations, PMO radio archives
Cosmology simulation

~100TB

Y.P. Jing, et.al
Shanghai Astronomical Observatory
Qinghai Radio Telescope

Diameter: 13.7m
Working band: 3 mm
Data rate: ~1MB/s, ~230K spectra/yr
Simple Dataset Model

- A dataset
  - Metadata
  - Data
  - Attachment
Components

- Basic data access service
  - Catalogs
  - Files
- Online service
  - Spectrum view
  - Image view
  - Cross match
  - Footprint
  - SAMP
  - etc.
- Tools
  - CLI
20 years

20 years later,

Another world-class astronomical datacenter appears?...
Sincerely looking for your:

Collaborations and suggestions

Thank you!