Visualisation and analysis of 3D datasets in the Virtual Observatory

follow-up of the talks at ADASS-2005 and Spec&VO-2007

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Introduction: what VO is

• **Virtual Observatory** is a concept of providing transparent access to astronomical data and data analysis tools.

• The main mission of the VO is to increase scientific output of astronomical data.

• The Rosetta stone of the VO is **interoperability** — that's what IVOA is responsible for.

• The success of the VO will be its entire transparency for scientific users.
3 Cornerstones for 3D data in VO

1. Data Model
2. Data Access Services
3. Client Applications
Characterisation DM

The basic part of the most general data model: Observation DM
Provides a physical characterisation of a dataset

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Characterisation Data Model is an IVOA Recommendation
Characterising IFU datasets (1)

Levels 1 (Location) and 2 (Bounds)
Characterising IFU datasets (2)

Level 4: Spectral Resolution

- Vr 4159 A
- Sig
- h3
- h4

- 4486 A
- 4843 A
- 5690 A

3 Cornerstones for 3D data in VO

1. Data Model

2. Data Access Services

3. Client Applications
Storing 3D Data in FITS

- Pure 3D data cube (for IFP data and for some IFU)
- 2D-image (one spectrum per row) + binary table ⇒

**Euro3D Format**
- FITS binary data table: one row per spectrum
- Binary table describing shape of spatial elements (“spaxels”)
- Some mandatory metadata, including: common spectral WCS for all spectra, common spatial WCS for all spatial elements, meteo parameters during the observations, etc.
3D Data Access Services

- **ASPID-SR @ SAO RAS**
  - ~600 datasets including ~100 MPFS IFU datasets, ~70 IFP data cubes, long slit spectra (the rest)
  - Integration with VO tools using PLASTIC

- **Giraffe Archive @ ObsPM**
  - 700 optical MOS, IFU and multi-IFU datasets coming from FLAMES/Giraffe

- **Canada Galactic Plane Survey (CGPS) @ CADC**
  - Radio data cubes

- **SAURON @ CDS** – coming soon – stay tuned!
3 Cornerstones for 3D data in VO

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VO-Paris Euro3D Client

- Open source tool, Java 5+
- Available as applet and Java WebStart
- I/O of Euro3D FITS (local or URL), Giraffe FITS
- Support for multiple files
- Extraction of spectra for individual fibers
- Export of extracted spectra in the VOTable serialisation of the IVOA Spectral DM 1.0
- Export of the catalogue of fiber positions as VOTable 1.1
- Communication with CDS Aladin and ESA VOSpec using PLASTIC messages for data visualisation

http://vo.obspm.fr/tools/Euro3D/
What is still missing?

- Sophisticated data visualisation tools
  - Easy to interface existing ones using PLASTIC
- Data analysis services (mostly 1D-specific)
  - Standards exist already, VO interfacing takes 1-2 days
  - Voronoi 2D binning (in 3-6 months)
  - PPXF: absorption-line kinematics (in 3-6 months)
  - Line strength indices computation (in 3-6 months)
  - SPIKEr: absorption-line kinematics and stellar populations using the nBursts technique (in 6-12 months)
- other volunteers???
Summary

- VO contains all the infrastructural components (data models, data access protocols) needed to support 3D data
- There are already several operational services
- Simple visualisation tools exist
- Advanced visualisation and data analysis tools/services are still missing

If you are a data owner/service provider and wish to provide an access to your data and/or services within the VO you are welcome to contact us