

# Data management in Astrophysics

Data, Policy, standards and tools

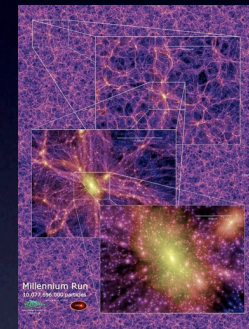
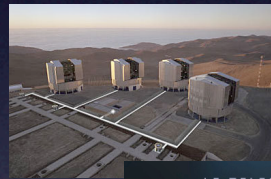
C. Surace

Laboratoire d'Astrophysique de Marseille



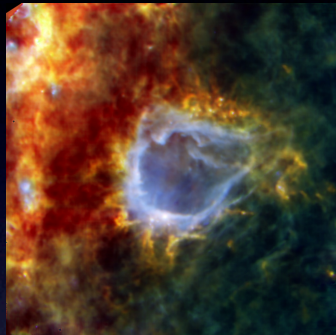
# Data Characteristics

- Different providers
  - Simulators, (Millenium,...)
  - Telescopes,
  - Satellites
- Diversity
  - Different kind of products

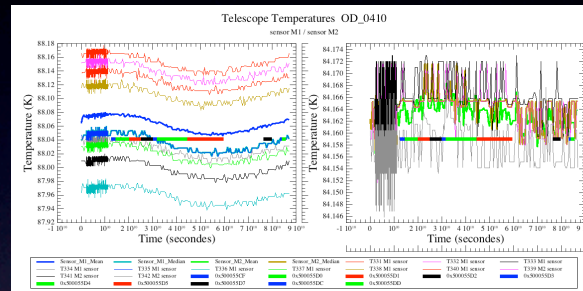


# Data in Astrophysics

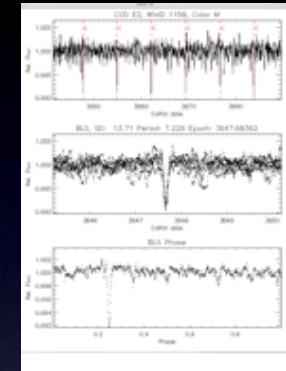
## 2D Images



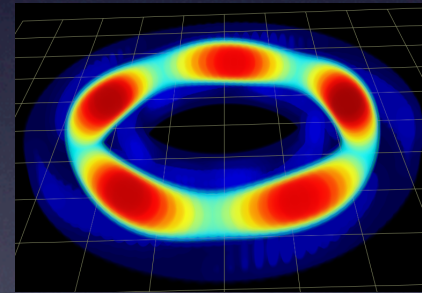
## Spectra



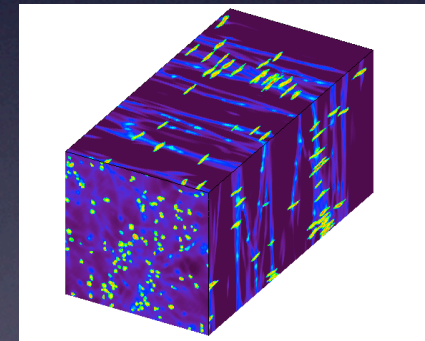
## Time series



## Simulation data



## 3D Cube data



## Tabular data

HeDaM Herschel Database in Marseille

Search result

8 List of data in search result:  
2817 data in 1 table(s)

Dataset GOOD-N\_SCAT250\_v3 (2817 data)

ra	dec	raPosErr	decPosErr	raMidErr	decMidErr	ra	raPosErr	raMidErr
[deg]	[deg]	[deg]	[deg]	[deg]	[deg]	[deg]	[deg]	[deg]
186.61071916638	62.222266372957	0.00070513822064476	0.000532591732924145	0.00070513822064476	0.000532591732924145	186.466969553507	0.89665301747295	0.89665301747295
186.62297891919	62.3011132240157	0.000126381082567129	0.000558745068859117	0.000126381082567129	0.000558745068859117	93.5116612546344	0.840042015009319	0.840042015009319
169.30322256411	62.2264589530278	0.00044450515266456	0.0006959128416109439	0.00044450515266456	0.0006959128416109439	78.7095848126802	0.9155780967213	0.9155780967213
89.79391894465	61.9878917821869	0.00044206114811697	0.00068932227749507	0.00044206114811697	0.00068932227749507	162.373450844415	1.58768754291912	1.58768754291912
189.20970202295	62.4549146014283	0.000148289191046578	0.00067842192024027	0.000148289191046578	0.00067842192024027	84.1150411026009	0.869650739138118	0.869650739138118
189.58862536457	62.1185363130294	0.000152841837748095	0.000714755491431158	0.000152841837748095	0.000714755491431158	84.7398043317093	0.833360169671494	0.833360169671494
186.876255764631	62.5713206778619	0.000161620309961133	0.000744540508162064	0.000161620309961133	0.000744540508162064	108.339923064228	1.28605841639355	1.28605841639355
188.841128242343	62.0448049895109	0.000160995772360429	0.000752842423960788	0.000160995772360429	0.000752842423960788	70.9131948337315	0.91100528295633	0.91100528295633
89.143007013686	62.2116162179628	0.000170325123253824	0.0007784468140814789	0.000170325123253824	0.0007784468140814789	68.1711496566303	0.825374298827697	0.825374298827697
189.36661487871	62.4235901184861	0.000172901851482875	0.00089014098302688	0.000172901851482875	0.00089014098302688	78.84215154186	0.837326474621627	0.837326474621627

# Next data

- LSST (2020) : 3 Billions pixels every 17 seconds.
- 140 petabytes



Pan-Starrs : 6,000 deg<sup>2</sup> per night.

several terabytes per night for the full telescope.  
hundreds of Peta bytes.

Software techniques are therefore being developed to extract the information

LSST : <http://www.lsst.org/lsst/>

Pan-Starrs : <http://pan-starrs.ifa.hawaii.edu/>

# The actors

## the providers and agencies



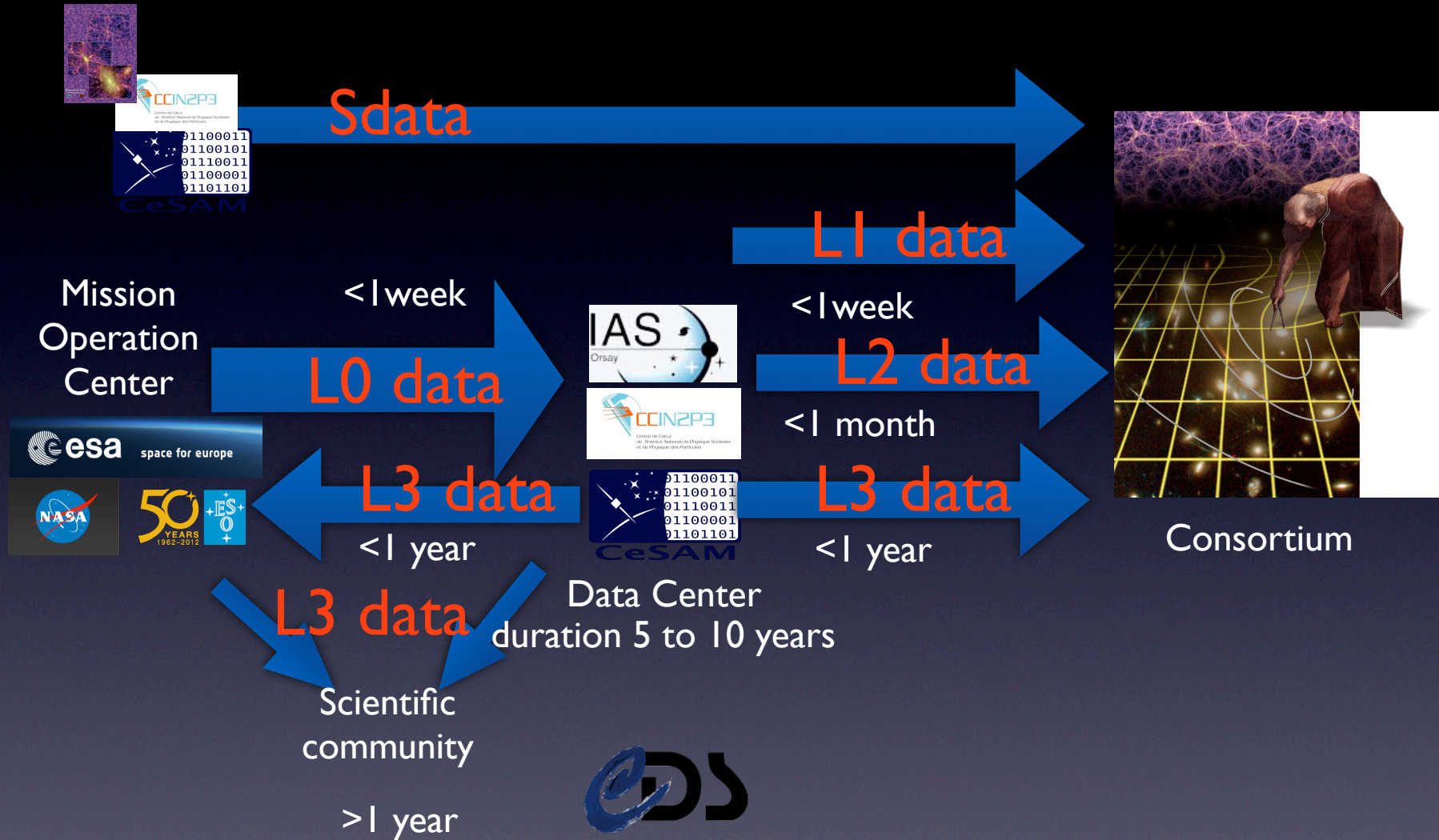
## The international and national collaboration



## The national organisations the SO-5



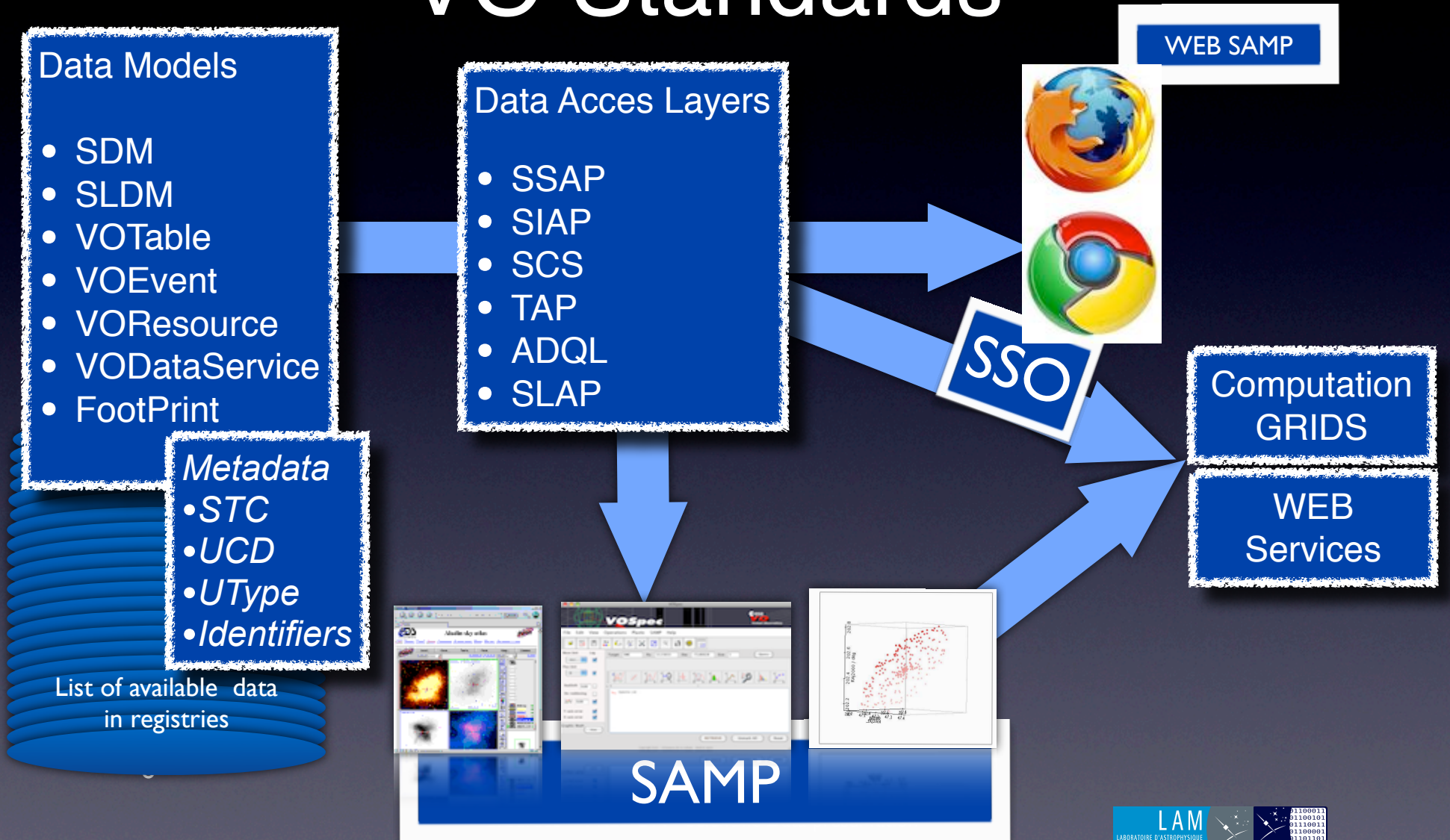
# Data Flux



# Formats and Archives

- FITS : Flexible Image Transport System
  - Initial release 1981 <http://fits.gsfc.nasa.gov>
- VO Format : Virtual Observatory formats
  - Characterisation of metadata <http://www.ivoa.net>
- Simulation formats
  - GADGET (Octree) - RAMSES (AMR) (HDF5) - GASOLINE (SPH)

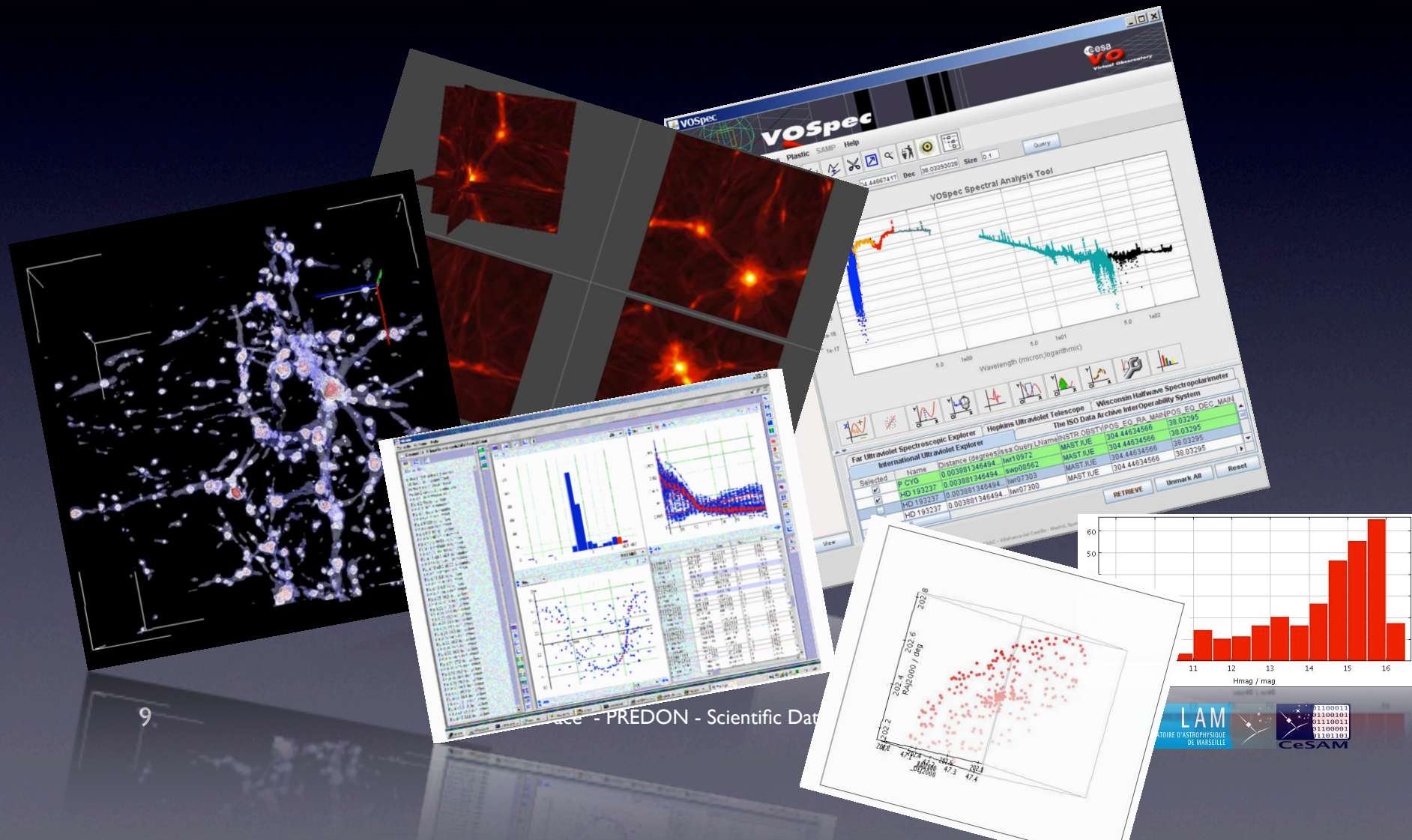
# VO Standards





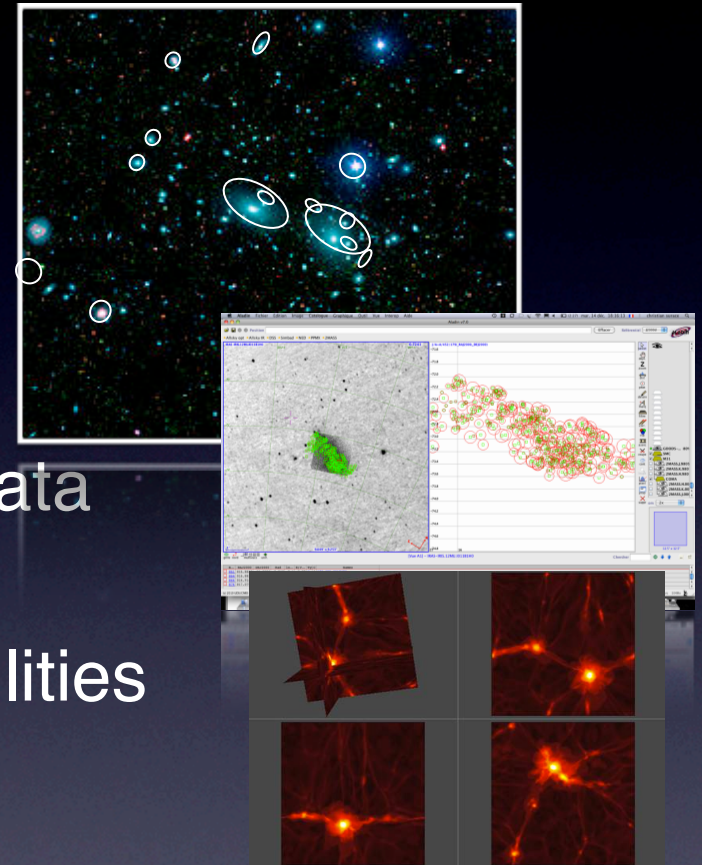
# VO - Tools

The final goal of the VO is to facilitate and foster astronomical research and astronomers are its ultimate users  
 Therefore, scientific requirements should drive the IVOA process



# Preservation Environment

- preservation of data
  - FITs, VO, GADGET,... and Archives
- preservation of accessibility of data
  - VO, Web Services and tools
- preservation of discovery capabilities
  - Data Mining, Data Visualisation
- preservation of knowledge
  - WF4ever (<http://www.wf4ever-project.org/>) / VO Workflow - Patterns



# A non exhaustive list (from IVOA)

- **Portals and queries :**
  - NVO Portal Services US National Virtual Observatory
  - DataScope Broadcast query
  - NOAO NVO Portal NOAO Image Visualization Discovery Tool
  - VODesktop A resource-centered desktop client for VO: includes VOExplorer, Query and Task Runner, Astroscope, Myspace Browser
  - Octet CVO Observation Catalog Exploration Tool
  - VOCat - VOIndia A catalog data interface tool
- **Tabular DATA Analysis**
  - VOPlot - VOIndia A tool for visualizing astronomical data
  - TOPCAT Tool for OPerations on Catalogues And Tables
  - STILTS Command-line tools for table/VOTable manipulation
  - Treeview A viewer for hierarchical structures
  - VOStat - VOIndia A tool for statistical analysis of astronomical data