

Construction of Virtual Observatories through Global Collaboration and Standardization

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Data Resources in NAOJ

- **Subaru** 8.2m Optical-Infrared Telescope
- **Kiso** 105cm Schmidt Camera
- **Okayama** 188cm Optical Telescope
- **Nobeyama 45m** Radio Telescope
- **Nobeyama Millimeter Array**
- **Nobeyama Radioheliograph**
- **VSOP**
- **VERA**
- **ALMA**



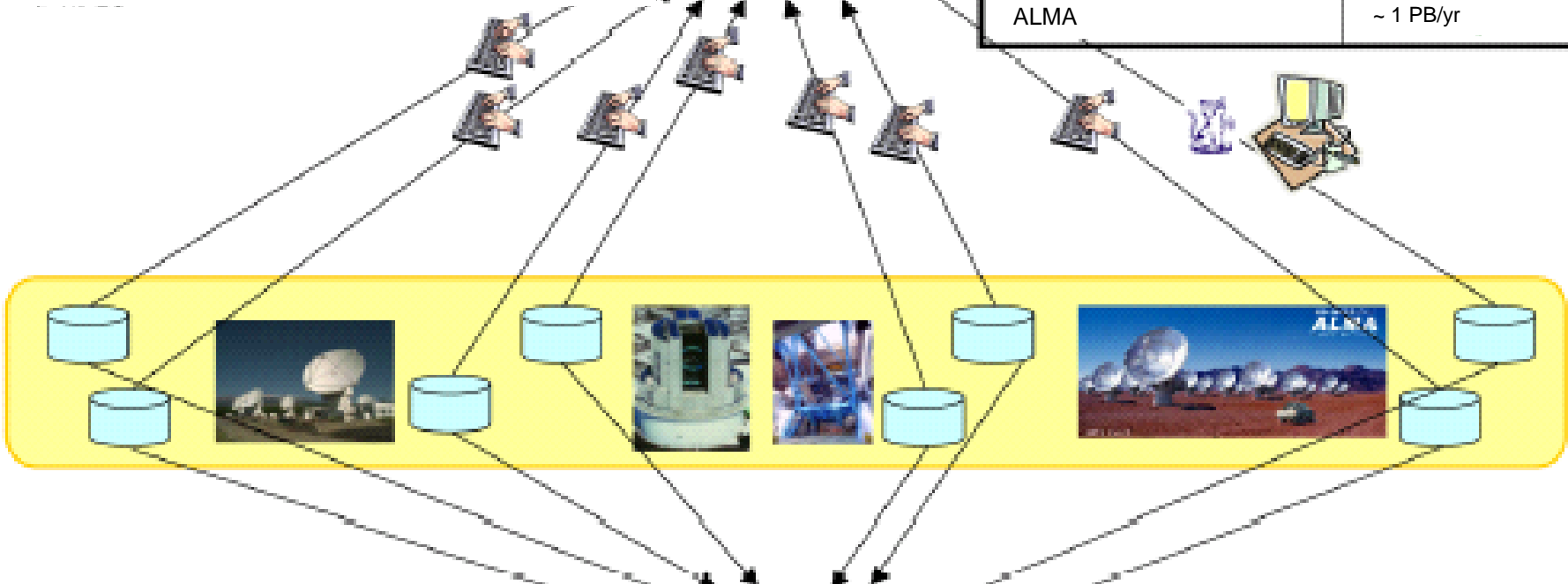
Data Resources in the World

- ESO VLT @ Paranal
- ESO telescopes @ La Silla
- Telescopes in Mauna Kea
Subaru, Keck, JCMT, CSO, SMA,,,
- Telescopes on board satellites
HST, GALEX,,,



**Too hard to collect and analyze whole data.
Need Cat's help**

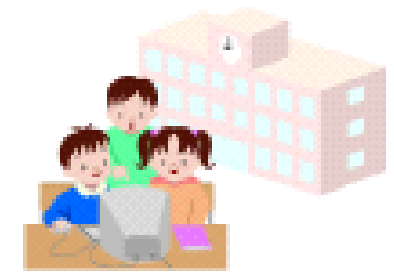
	Data Rate
Nobeyam Radio Obs.	~ 1 TB/yr
SUBARU telescope	~ 20 TB/yr
ALMA	~ 1 PB/yr



Accelerate astronomical research, and sufficient time for research itself !!

Virtual Observatory

Even for educational use



Accessible from anywhere at any time

VO- New Research Infrastructure in the 21st Century



A collection of integrated astronomical data archives and software tools that utilize computer networks to create an environment in which research can be conducted.

<http://www.encyclopedia.com/html/v1/virtobserv.asp>

International Endorsements



- IAU XXVth GA Res. (2003 Jul.)
- OECD Rec. ('04 Aug)
 - place archives that may be accessible via internet
 - provide adequate funding as long-term issues

VO Projects in the world



- 15 countries and a region (EU)
- International Virtual Observatory Alliance (IVOA) Standards to interoperate VOs

<http://www.ivoa.net/>





Standardization in IVOA



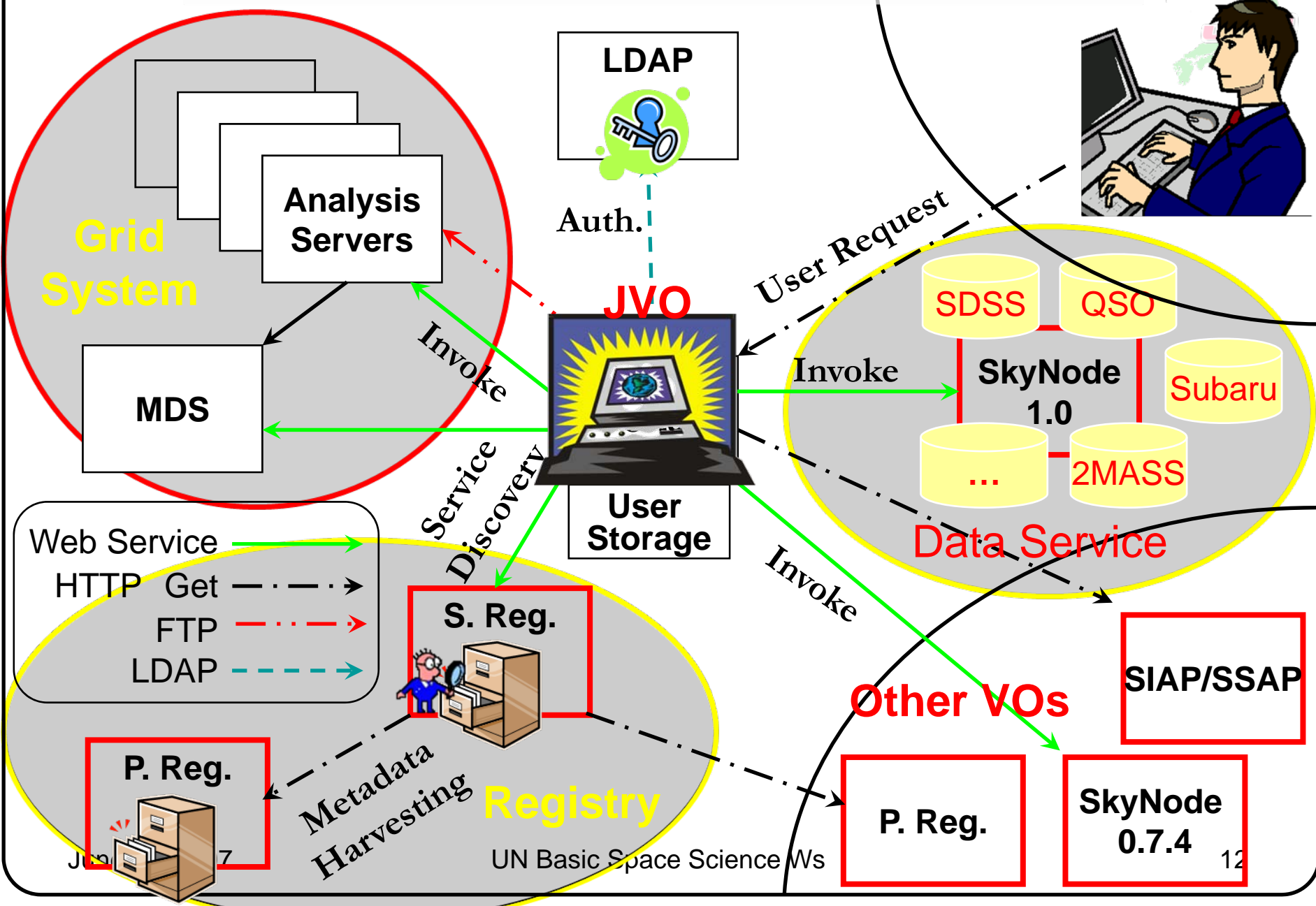
- Query Language to Federated DBs (VOQL)
- Access resource meta-data based on the OAI-PMH
- Access Images, Spectra, Catalogues, etc:
SkyNode, SIAP, SSAP, STC, etc.
- Unified Attribute Names:
UCD (Unified Contents Descriptions)
- **Output format**: VOTable (XML)
- and so on

IVOA Interoperability WS

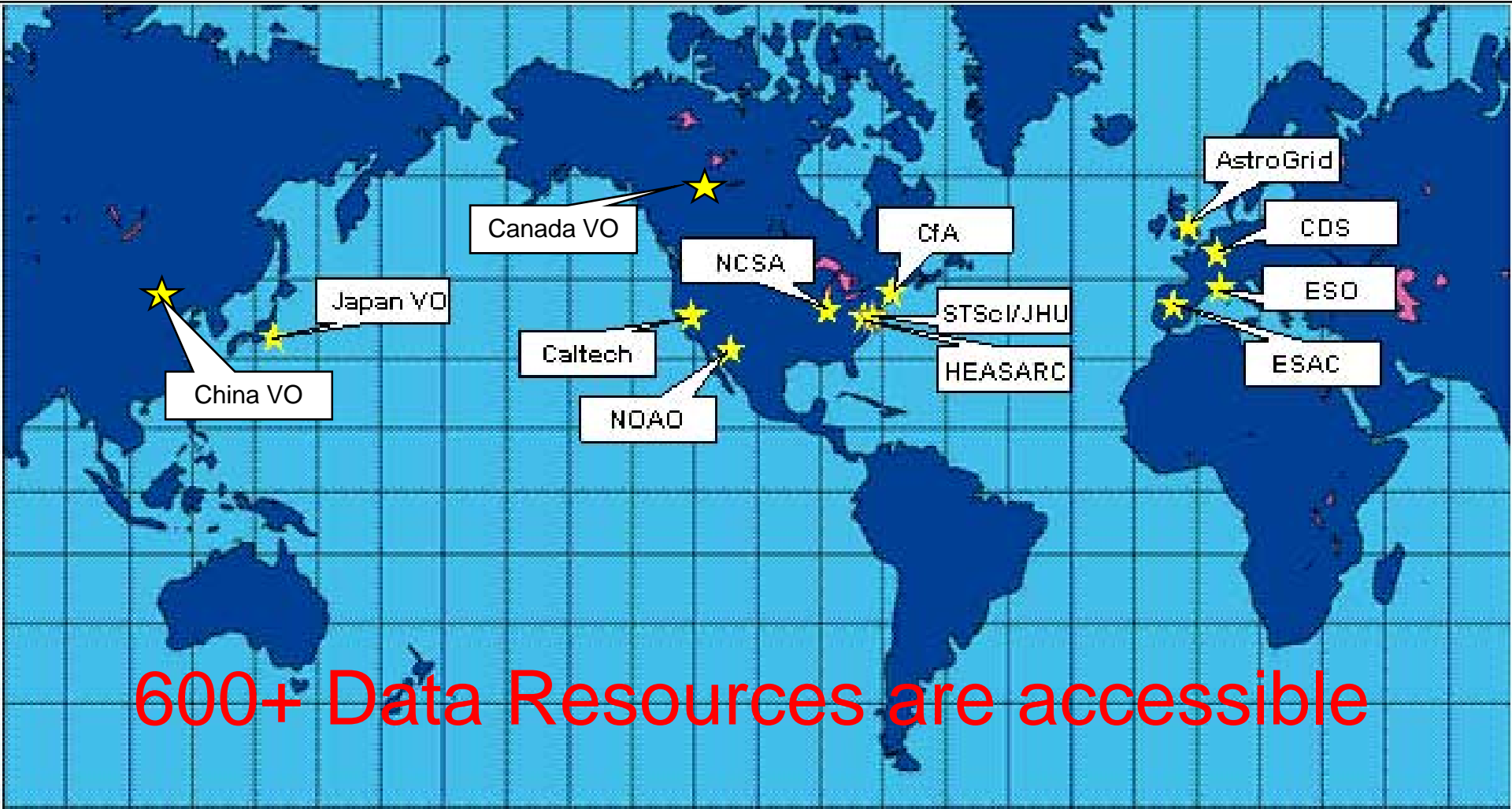


- Twice a year
- Discussions toward standardization
- **Human network as a basis for cyber network**

Overview of the JVO Portal Service



Interconnected VO Data services in the World

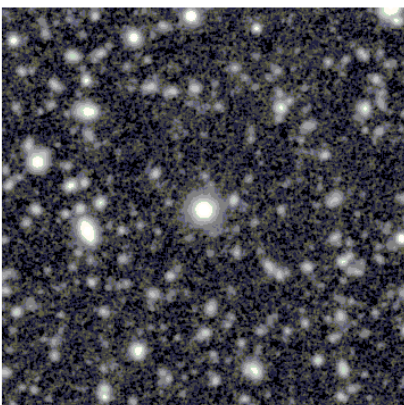


600+ Data Resources are accessible

Data Viewer

[Status](#) | [Registry](#) | [Search](#) | [Workflow](#) | [Result](#) | [QSO](#) | [DataViewer](#) | [Usage](#) | [Logout](#)

Name	Origin	Scale	Contrast
tmp0	http://jvo.nao.ac.jp/	hist	min = 0.0 max = 0.0 auto = true

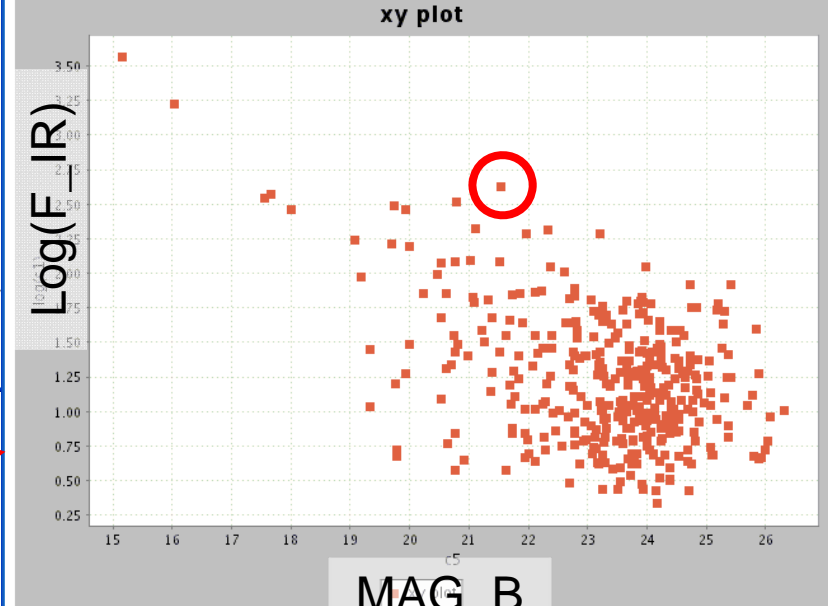


Scale :
 Contrast :

 VOTable :

xy plot

X expression:
 Y expression:
 bin number:
 Invert X:
 Invert Y:



VOTable View

[Status](#) | [Registry](#) | [Search](#) | [Workflow](#)

Metadata:

MESSAGE:

FROM: 0 MAX: 20 SCROLL: 1

SELECT: c0,c1,c2,c3,c4,c5,c6,c7,c8,c9,c10,c11,c12,c13

FILTER:

ORDER:

800 records, 1 2 3 4 5 6 7 8 9 10

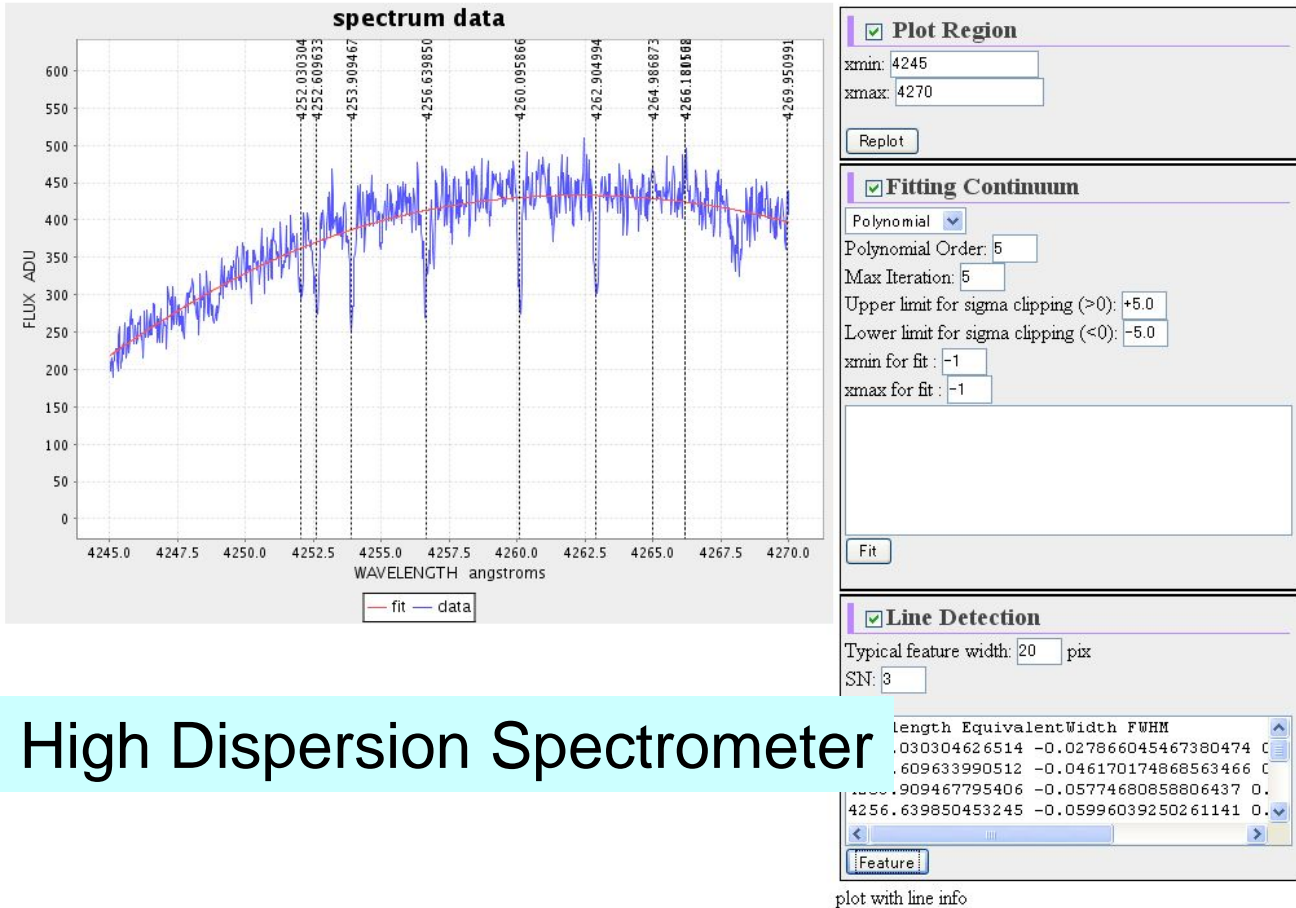
	Alias Name	C0	C1	C2	C3	C4	C5		
#	check	download	<input type="button" value="IR.OBJECT"/>	<input type="button" value="IR.FLUX_ISO_45"/>	<input type="button" value="IR.RA"/>	<input type="button" value="IR.DEC"/>	<input type="button" value="OPT.NUMBER"/>	<input type="button" value="OPT.MAG_AUTO_B"/>	<input type="button" value="OPT.MA"/>
0	<input type="checkbox"/>	Download	SWIRE2_J021648.87-045812.0	3663.32006835938	34.2036514282227	-4.97001981735229	SXDS-RC-088303	15.1500997543335	14.79259:
1	<input type="checkbox"/>	Download	SWIRE2_J021700.24-050112.7	1676.02001953125	34.2510414123535	-5.02021980285645	SXDS-RC-067315	16.025899887085	15.65180:
2	<input checked="" type="checkbox"/>	Download	SWIRE2_J021705.98-045953.3	422.559997558594	34.2749404907227	-4.99815988540649	SXDS-RC-092411	21.533899307251	20.07570:
3	<input type="checkbox"/>	Download	SWIRE2_J021704.82-045409.2	370.059997558594	34.2701187133789	-4.90256977081299	SXDS-RC-125356	17.6541996002197	17.30109:

Spectral Data from Subaru



Status | Registry | Search | Workflow | Result | QSO | DataViewer | Tools | SubaruAnalysis | VOSpace | MDS | Usage | Logout

Name	Origin	xmin	xmax
tmp0	http://jvo.nao.ac.jp/	-1.0	-1.0



- queries
- display
- Baseline estimate
- Line detection
- VOSpec

High Dispersion Spectrometer

User ID	User Name	Group	Last Login
ohishi	Masatoshi Ohishi	jvo	2007-01-22 17:48:56

Total memory = 425197kB Used memory = 84917kB (19%)

Improvement of Work Flow system

Items in FY2006

- Improvement of WFDL
 - Shorten the volume of DL
 - Array definition
 - Awk-like description (loop description in a single line)
 - and so on
- Built-in functions
 - Available to register and use built-in functions
- Status and Log system

```
<?xml version="1.0" encoding="EUC-JP"?>
<Workflow xmlns="http://jvo.sao.ac.jp/workflow/v0.5" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:instanceName="Galaxy ClusteringStudy05">
  <name>Galaxy ClusteringStudy05</name>
  <author>Taji Shirasaka</author>
  <identifier>ivo://jvo.sao.ac.jp/workflow/sample/identifier</identifier>
  <create_date>2006/12/19 09:00:00</create_date>
  <update_date>2006/12/19 09:00:00</update_date>
  <description>Search for Galaxy Clustering around QSO</description>
  <status>OK</status>
  <variables>
    <variable name="sq1" type="String"/>
    <variable name="sq11" type="String"/>
    <variable name="sq12" type="String"/>
    <variable name="sq13" type="String"/>
    <variable name="sq14" type="String"/>
    <variable name="sq15" type="String"/>
    <variable name="sq16" type="String"/>
  </variables>
  <variable name="tableNameForQSO" type="String">
    <value>ivo://jvo/vizier/V11/235qso_veron_2003</value>
  </variable>
  <variable name="tableNameForImage" type="String">
    <value>ivo://jvo/subaru/spms/spms_view</value>
  </variable>
  <variable name="magLimit" type="double">
    <value>11.0</value>
  </variable>
</Workflow>
```

WF Editor

#	Command Name	Status	# of Execution	# of Failure	Elapsed Time
0	work_20070322152302223	executing	0	0	3.708 sec
0.0	SEQUENCE	executing	1	0	3.212 sec
0.0.0	executeQuery	success	1	0	1.883 sec
0.0.1	storeVOTable	success	1	0	0.029 sec
0.0.2	executeQuery	executing	1	0	1.268 sec
0.0.3	storeVOTable	not executed	0	0	-- sec
0.0.4	executeQuery	not executed	0	0	-- sec
0.0.5	storeVOTable	not executed	0	0	-- sec
0.0.6	executeQuery	not executed	0	0	-- sec
0.0.7	storeVOTable	not executed	0	0	-- sec
0.0.8	executeQuery	not executed	0	0	-- sec
0.0.9	storeVOTable	not executed	0	0	-- sec

User ID | User Name | Group | Last Login

tanaka	Tanaka Masahiro	admin	2007-03-19 17:55:06
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Total memory = 295305kB Used memory = 53549kB (18%)

Execution monitor

– Reduction **10s**
 (Bias+Flat+Distortion+
 Astrometry)

– Transfer **30s**

votable-viewer - Mozilla Firefox

ファイル(E) 編集(E) 表示(V) 移動(G) ブックマーク(B) ツール(T) ヘルプ(H)

VOTable Viewer

Status | Registry | Search | Workflow | Result | QSO | DataViewer | Usage | Logout

Metadata:

MESSAGE: OK

FROM: 0 MAX: 20 SCROLL: 1

SELECT: c31,c32,c1,c2,c3,c4,c5,c6,c7,c8,c9,c10,c11,c1

FILTER:

ORDER:

<< < < < > > > >

1000records,
 1 2 3 4 5 6 7 8 9 10

Aladin v3.7 multiview

Load... Save... Tools... Print... Help... Quit

Position J2000 02:19:05.43 -04:55:01.9 Pixel 8 bits 027 / 255

SUPA00130730.fits SUPA00130730+SUPR0607291038430727.fits

select
 dist
 draw
 tag
 text
 filter
 rgb
 asso
 isamp
 cont
 zoom
 mglas
 pixel
 prop
 del

SUPA00130730
 SUPA00130730

6.85' x 13.47' 6.84' x 13.66'

multiview Dview B1] - SUPA00130730+SUPR0607291038430727.fits - Local file [C:\DOCUME~1\yssh Zoom 1/8x

(c)1999-2006 ULP/CNRS - Centre de Données astronomiques de Strasbourg 2 planes, 2 views, 28Mb

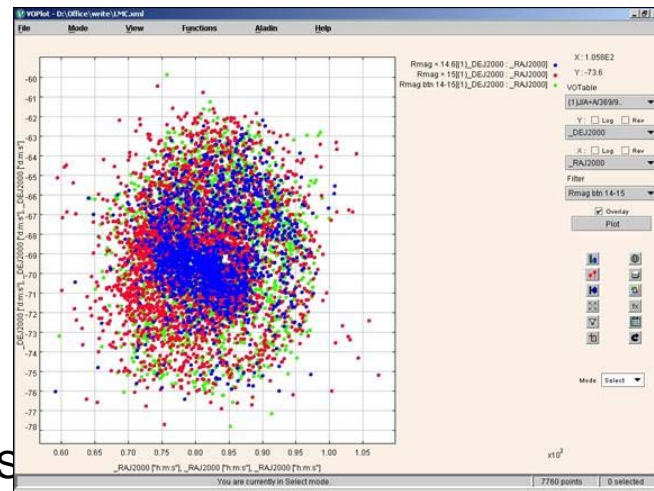
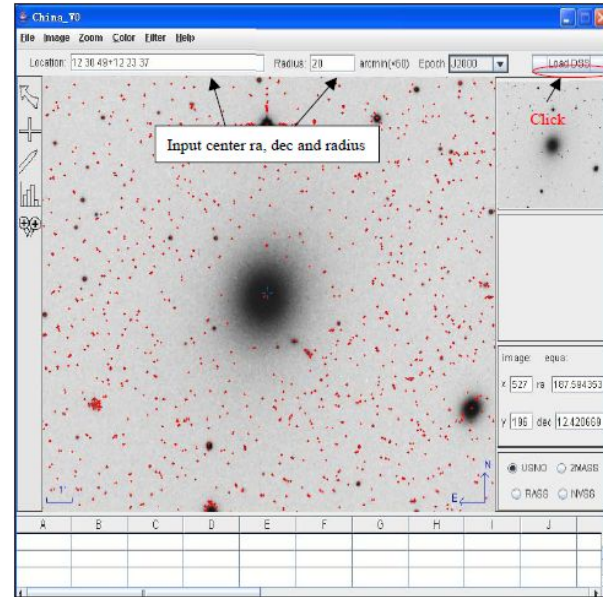
Data Reduction:
 ~24 hours → ~1 hour

	Alias Name	C31	C32	C1	C2	C3	C4	C5	
#	check	download	<input type="button" value="TO.ACCESS_REF_RA"/>	<input type="button" value="TO.ACCESS_REF_RA"/>	<input type="button" value="TO.PAW_ID"/>	<input type="button" value="TO.LO_START"/>	<input type="button" value="TO.OFFTIME"/>	<input type="button" value="TO.FILTER_ID"/>	<input type="button" value="TO.DETECTOR_ID"/>
0	<input type="checkbox"/>	Download	Link	SUPA00134470	2002-09-30 11:11:47.326	900.0	W-J-B	w67c1	
1	<input type="checkbox"/>	Download	Link	SUPA00134480	2002-09-30 11:27:47.082	900.0	W-J-B	w67c1	
2	<input type="checkbox"/>	Download	Link	SUPA00134490	2002-09-30 11:42:44.419	900.0	W-J-B	w67c1	

Software Tool providers



- VO-China
 - VOFilter : VOTable → OpenOffice data
 - VOIMPAT : Image processing and analysis tool
 - ...
- VO-India
 - VO-Plot: to plot contents in VOTable
 - ...



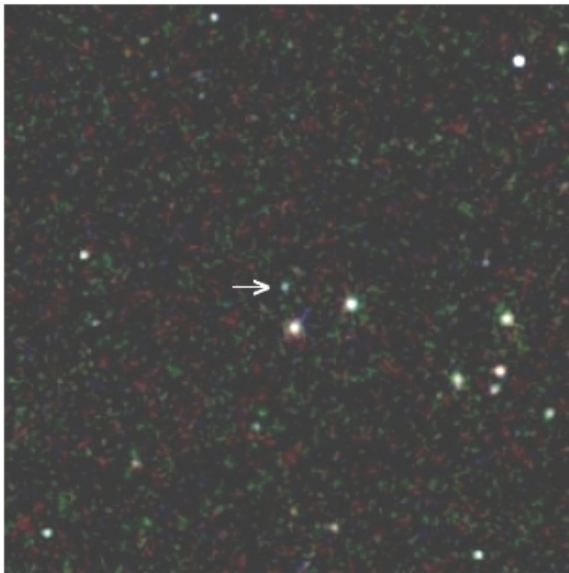
Discovery of a Brown Dwarf: SDSS/2MASS (US VO)



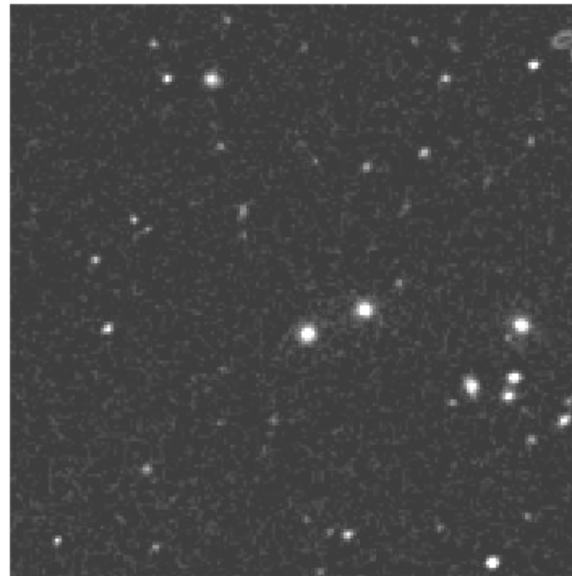
2MASSW J1217-03

A methane (T-type) dwarf in the constellation Virgo

The near-infrared view



The optical view



2MASS Composite JHK_s Atlas Image

Palomar Digitized Sky Survey



A.J.Burgasser (Caltech), J.D.Kirkpatrick (IPAC/Caltech), M.E.Brown (Caltech),
I.N.Reid (U.Penn), J.E.Gizis (U.Mass), C.C.Dahn & D.G.Monet (USNO, Flagstaff),
C.A.Beichman (JPL), J.Liebert (Arizona), R.M.Cutri (IPAC/Caltech), M.F.Skrutskie (U.Mass)

The 2MASS Project is a collaboration between the University of Massachusetts and IPAC

discoveries like
this much easier if
databases jointly
queryable



Detection of MANY Type II Quasars (EURO-VO)

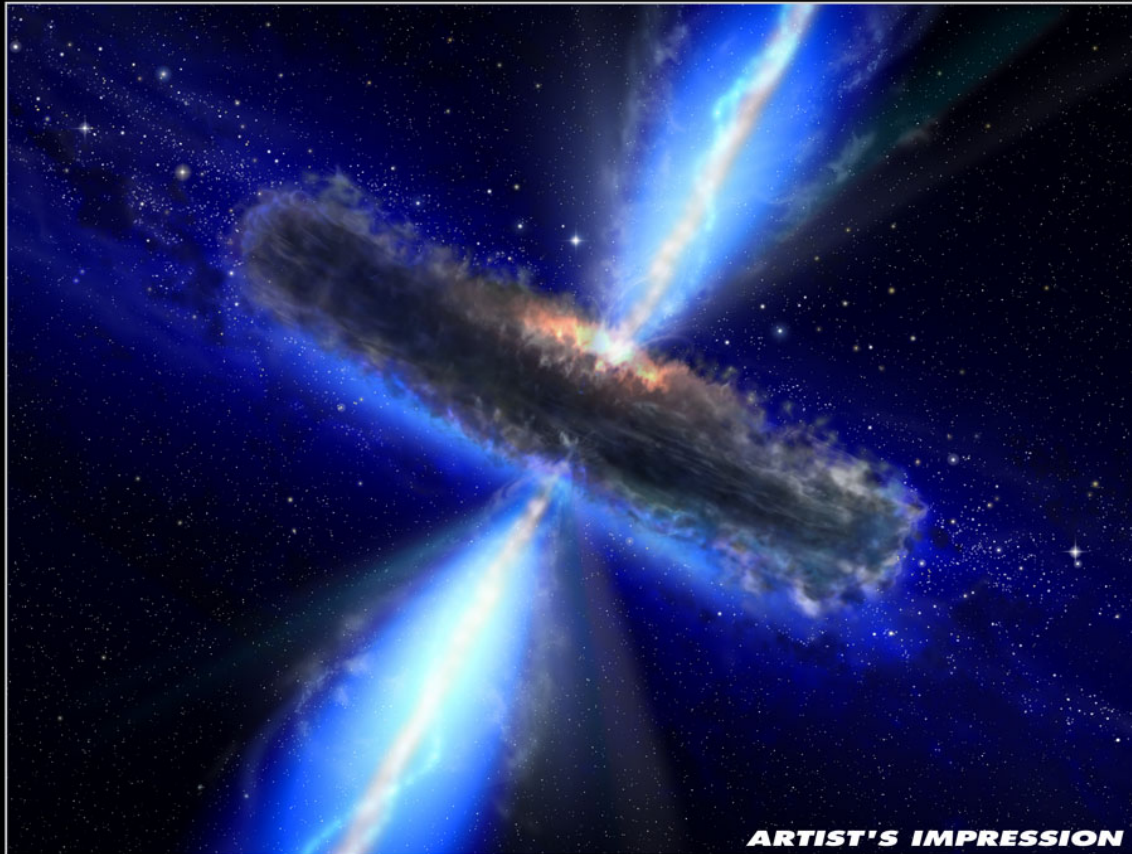


NEWS RELEASE

Virtual observatory discovers missing black holes



HEIC 0409



ARTIST'S IMPRESSION

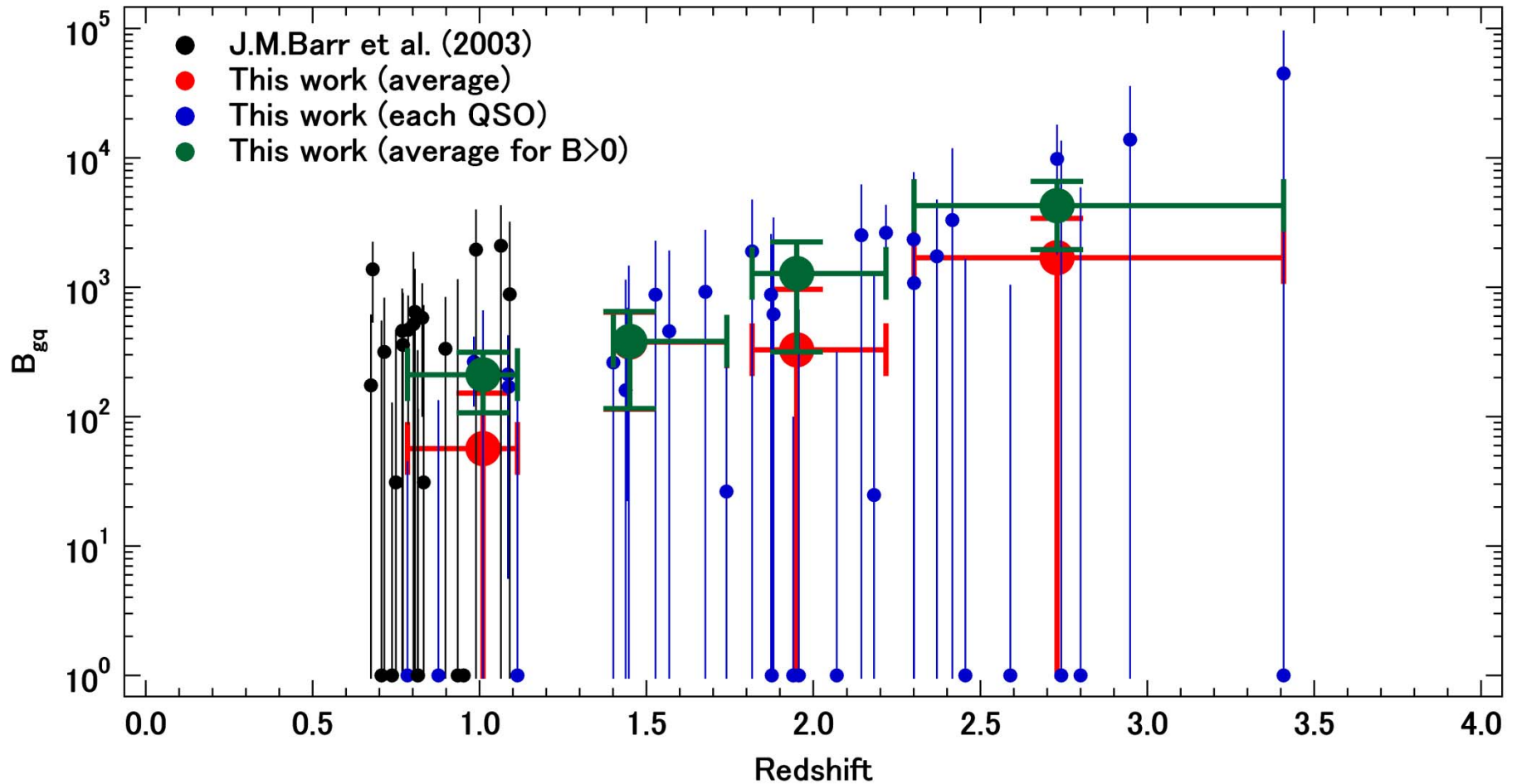


HUBBLE SPACE TELESCOPE



ESA/NASA, the AVO project and Paolo Padovani

Study on Environment around QSOs (Japan VO)





New Moves

- Some VO projects move from R&D phase to operations phase
 - UK, Japan, US, EU,,,
- New VO projects
 - Brazil, Chinese Taipei, Blugaria, Tagikistan, Ireland, Czech, Argentine,,,



Items to be done

- Distributed Storage to store query/analysis results
- Secure access to VOs : single-sign-on
- Other Standardizations
 - Standard application interface
- Advertisement to Data Centers
 - data centers need implement VO interfaces
- VO schools for astronomers

<http://www.ivoa.net/>



Contact Persons:

Francoise Genova (CDS) – chair

Dave de Jong (NOAO) – vice chair

M. Ohishi (NAOJ)

-- ex-chair

