



SDSS Web Services

Coding against the Universe

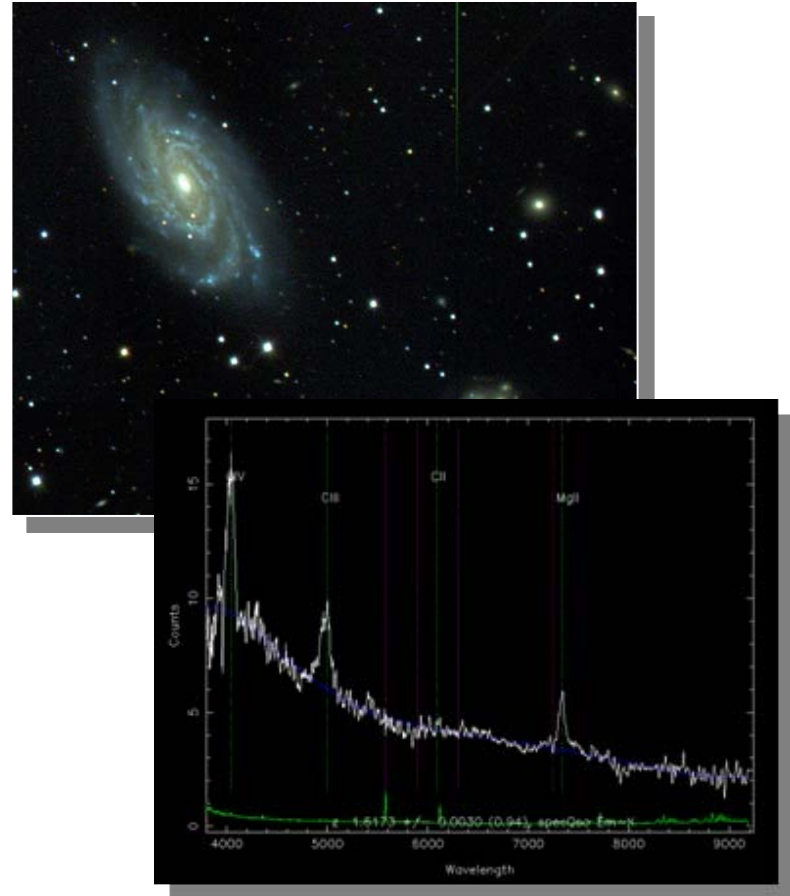


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Outline

- ✚ SDSS Primer
- ✚ Technology
- ✚ Web Services
 - ☒ Data Access
 - Images
 - Spectra
 - Catalog
 - ☒ Higher Level





SDSS Imaging Survey

- ❖ 2.5m telescope
 - ❖ Apache Point, NM
 - ❖ 5 photometric bands
 - ❖ Drift scan operation
- ❖ Photo pipeline
 - ❖ 100,000,000 galaxies
 - ❖ Automated reduction
 - ❖ Catalog archive server











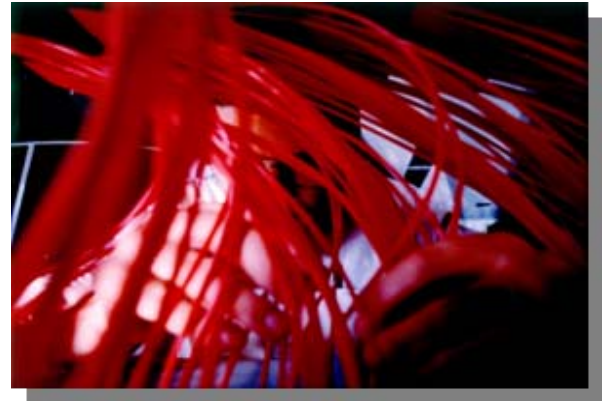
SDSS Spectroscopy

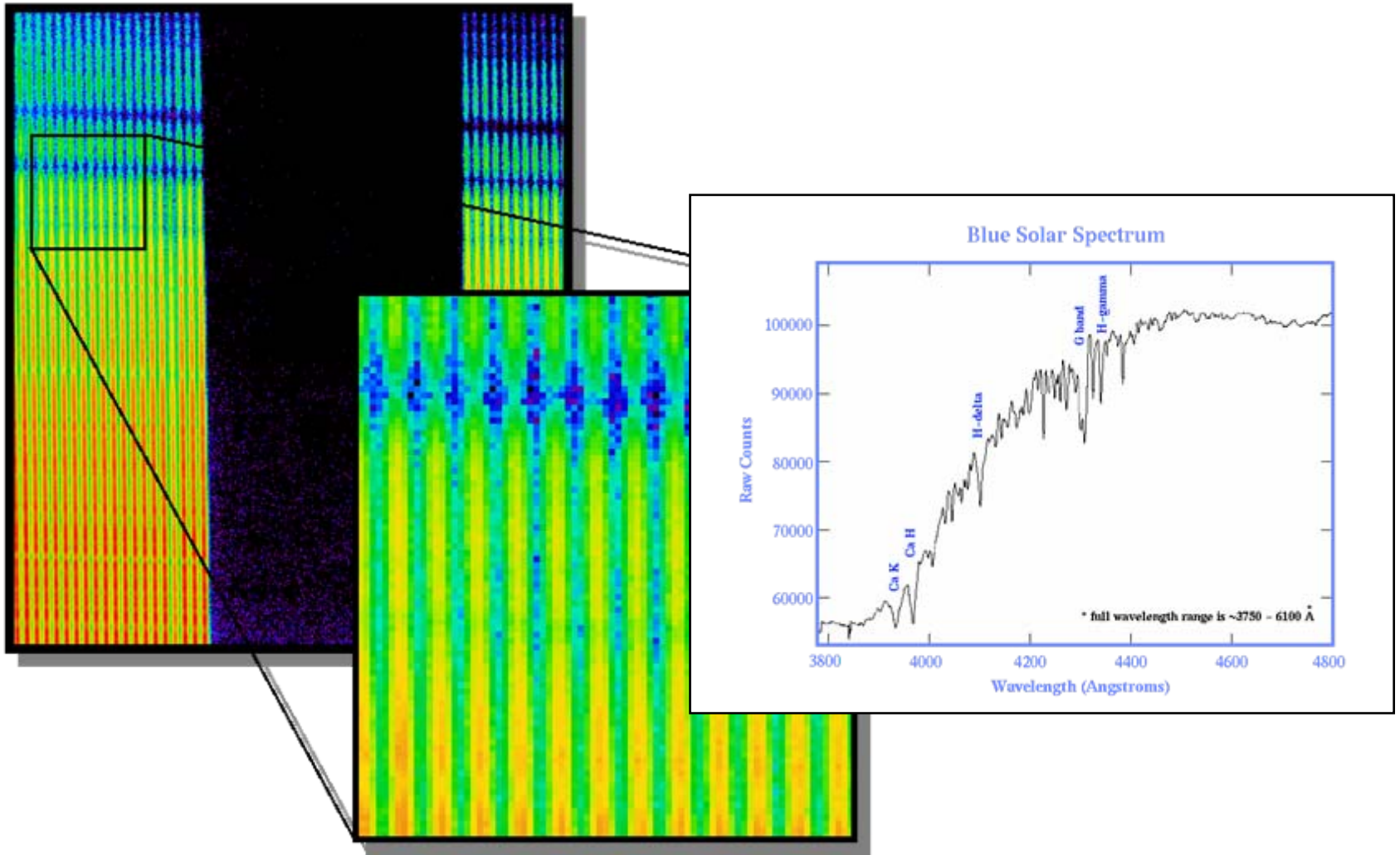
❖ Two spectrographs

- ❖ Red and blue part
- ❖ Optical fibers
- ❖ 640 in each bundle
- ❖ Plugged manually

❖ Automatic reduction

- ❖ 2D and 1D pipelines
- ❖ Catalog archive server







Developing Web Services

✦ We chose the .NET Framework

- ✦ The C# programming language
- ✦ Extensive class library (for free)
- ✦ Simple and efficient database access
- ✦ Fast imaging and graphics routines
- ✦ Rapid development in Visual Studio
- ✦ Very easy Web Services programming



✦ Use CVS for versioning



Custom Tools and Packages

✚ Wrapper for **CFITSIO** by Vivek Haridas (JHU)

- ✚ Access to FITS tables and images from C#
- ✚ XML Web Services return FITS in attachment

✚ Scientific Plotting

- ✚ Using TeeChart Lite
- ✚ Fast plotting of online data





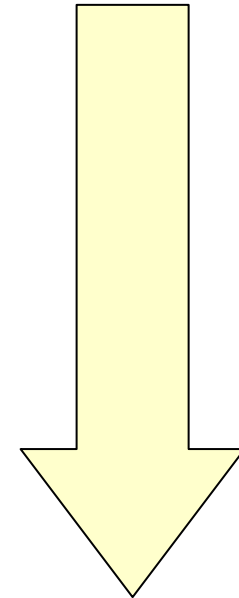
Available Web Services

✦ SDSS Web Services

- ✦ Field Finder and SIAP
- ✦ SDSS Image Cutout
- ✦ Spectrum and Filter Services
- ✦ Scientific Catalog Archive
- ✦ DensityMap Services

✦ Other Relevant Services

- ✦ NED Services Wrapper
- ✦ Cosmic Distances





SDSS Fields and SIA

Field Images

- Search for fields (HTM)
- Get all info, e.g. WCS
- Returns links to FITS

Simple Image Access

- Wrapper on top of Fields
- Returns links in VOTable

SdssFields Web Service - Microsoft Internet Explorer

Address <http://skyservice.pha.jhu.edu/dev/sdssFields/sdssFields.asmx>

SdssFields

This is an **XML Web Services** interface to find fields in the **Sloan Digital Sky Survey**. Send comments to **Tamas Budavari** -- budavari[at]pha.jhu.edu

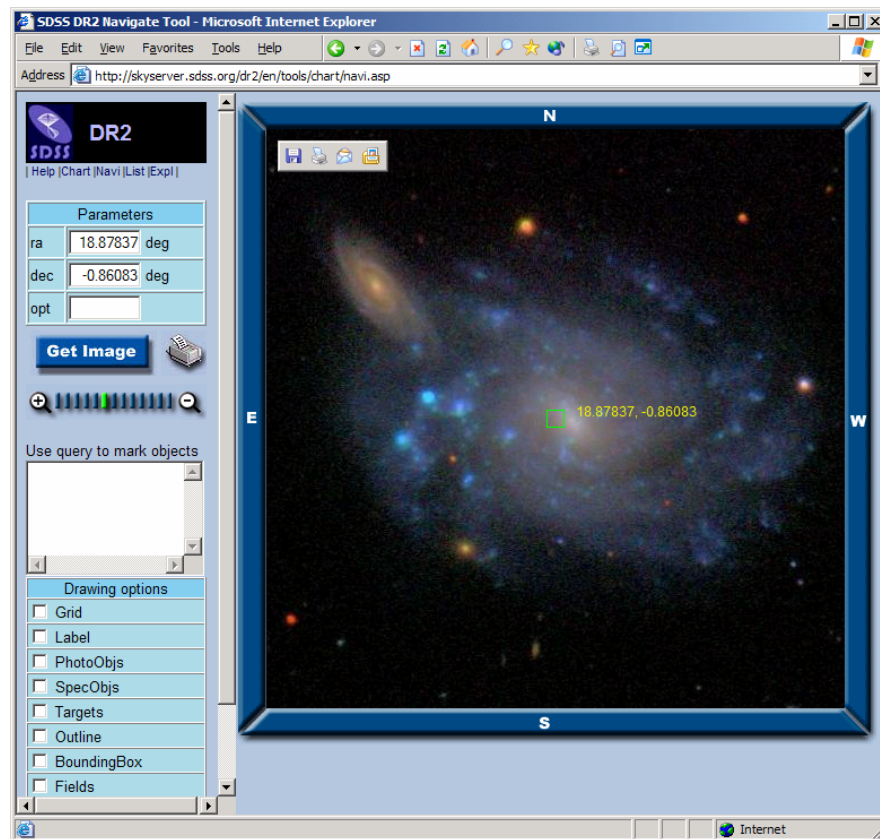
The following operations are supported. For a formal definition, please review the [Service Description](#).

- FieldArray**
Return all fields around the given pointing within the search radius.
Input 1: ra in degrees (double)
Input 2: dec in degrees (double)
Input 3: radius in arcmins (double)
Output: array of fields (Field[])
- ListOfFields**
Return a simple list of strings that have **run**, **rerun**, **camcol**, **field**.
Input 1: ra in degrees (double)
Input 2: dec in degrees (double)
Input 3: radius in arcmins (double)
Output: list of fields (string[])
- UrlOfFields**
Return only the URLs of the (gzip'd) **FITS** images in the given photometric band.
Input 1: ra in degrees (double)
Input 2: dec in degrees (double)
Input 3: radius in arcmins (double)
Input 4: band name, any combination of 'u', 'g', 'r', 'i', 'z' (string)
Output: list of urls to fits files (string[])
- Revisions**
Return current revision number.



SDSS Image Cutout

- ✚ Build JPEG mosaics
 - ✚ For given (RA, Dec)
 - ✚ Arbitrary zoom levels
 - ✚ Overplot catalog data
 - ✚ Overplot geometry
 - ✚ MapQuest like navigation
 - ✚ List of objects
- ✚ Proper WS
 - ✚ JPEG returned in DIME or byte array





Spectrum Services

Public repository

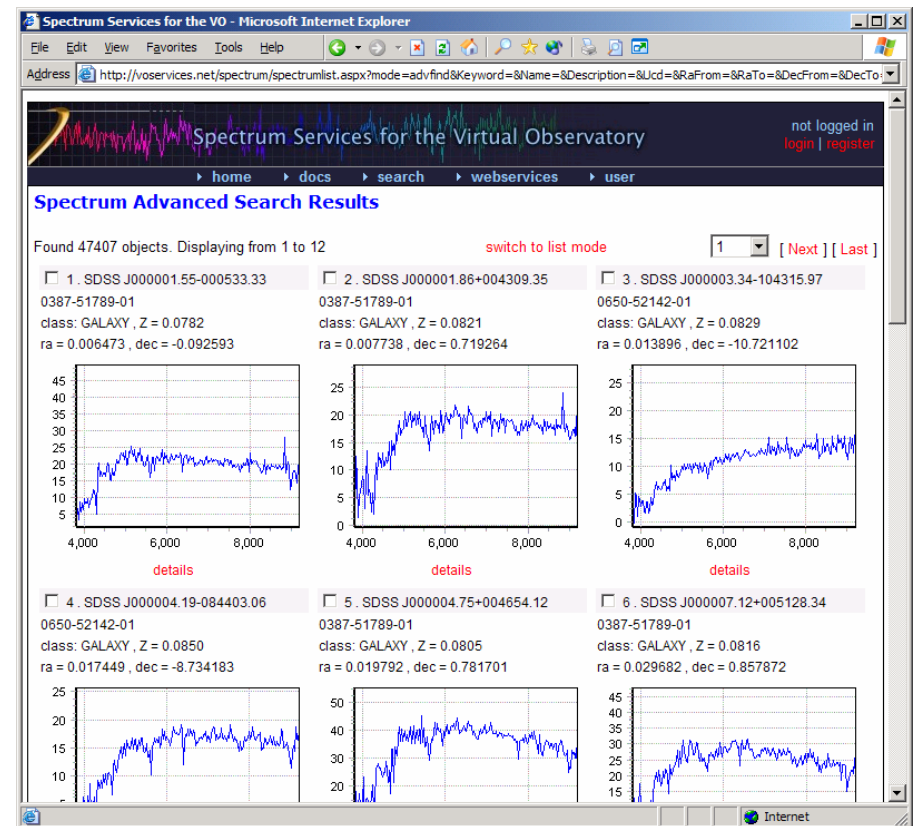
- 500,000 spectra (2B row)
- Spatial search and more
- Register & submit yours

Web site

- On-the-fly plotting
- Building composites

Web services

- More options and tools





SDSS Catalog Services

CasJobs

- Access to a 1TB of data
- 80M unique galaxies
- Queue system for SQL
- MyDB
 - 500MB remote DB
 - Upload and extract

Web services

- Web site interface
- Command-line client

http://casjobs.sdss.org/CasJobs/MyDB.aspx - Microsoft Internet Explorer

Address http://casjobs.sdss.org/CasJobs/MyDB.aspx

SDSS Query / CasJobs

Home Query Guide FAQ ChangeLog History MyDB Import Groups Output My P

Tables **Tamas Budavari 's MyDB**

200 KB of 100000 KB used

From this page you can get various information about the contents of both your MyDB and shared tables within your groups. Click the left table links to get information about a specific table, such as rows, columns or size. From the table pages you can also perform various table-specific tasks, such as:

- Extract and download data in various formats
- Publish a table, or remove it from publication
- Rename a table
- Drop a table

The colors of the table links on the left are indicative of their type.

- Published Tables are Orange
- Group Tables are Green
- Tables that are currently Loading data are Blue
- Tables that contain results from a Failed query are Red

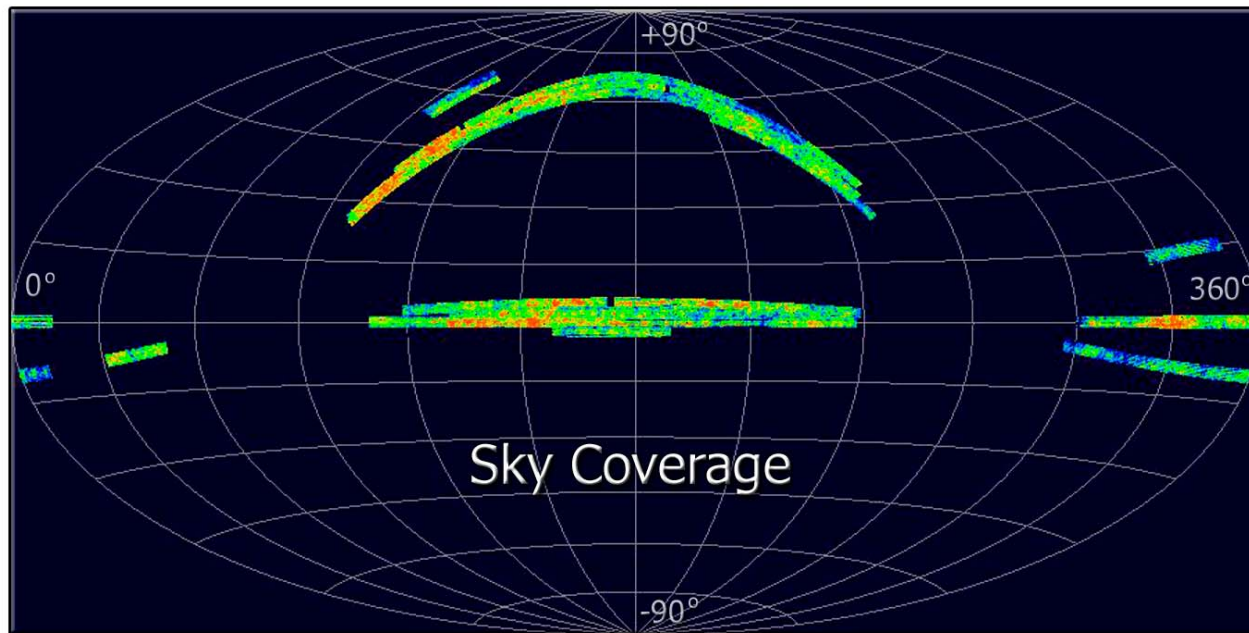
Sizes are approximations only.
Row counts are approximations only. For exact value run a count.
There's always some overhead, even empty MyDB's take up space.
Group tables do not count towards your MyDB size limit.

Nolan Li
Last Modified: Tuesday, June 29, 2004 at 3:58:05 PM , \$Name: v1_8_1 \$, \$Revision: 1.7 \$



SDSS DensityMap Services

- ⊕ A SQL query to image converter
 - ⊞ Select x, y, f and build color coded $f(x, y)$ image





Other Services

✚ Wrapper for NED

- ✚ Name resolver function
- ✚ Search by coordinate

```
NED ned = new NED();  
ObjInfo o = ned.ObjByName("m101");  
/* Use o.ra, o.dec, etc... */
```

✚ Cosmic Distances

- ✚ Various distance measures
- ✚ Using Λ CDM cosmology

```
Distance d = new Distance();  
float z=0.1, h=0.7, m=0.3, l=0.7;  
float r = d.Luminosity(z, h, m, l);
```

✚ Available from

<http://www.voservices.org>



Consuming Web Services

```
bash
elf: budavari$ cat wsclient-howto.txt
=====
HOW TO BUILD A WS CLIENT
=====

STEP 1: Generate classes
cmd> wsdl.exe http://voservices.net/NED/ws_v1_0/NED.asmx

STEP 2: Write client
-->
class NedClient
{
    static void Main(string[] args)
    {
        NED n = new NED(); // proxy
        ObjInfo o = n.ObjByName(args[0]); // ws call
        System.Console.WriteLine("Coords: "+o.ra+" "+o.dec);
        foreach(CrossID c in o.ArrayOfCrossID)
            System.Console.WriteLine(c.objname);
    }
}
<--

STEP 3: Compile
cmd> csc.exe client.cs NED.cs

STEP 4: Run it, e.g.
cmd> client.exe m31

elf: budavari$
```



Conclusions

✚ SDSS Web Services...

- ✚ ...provide access to scientific data and tools
- ✚ ...are (very) easy to consume
- ✚ ...are being used :-)

✚ Development coordinated w/ IVOA

- ✚ Open SkyQuery for federating archives
- ✚ SDSS Open SkyNode