ASTRONOMICAL DATA BASES

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Goals

1. Introduce students to the vast amount of astronomical data that are archived for public access on the web.
2. Download digital "fits" files that can be used for quantitative analysis (as opposed to pretty pictures in "jpeg" format).
3. Examine with public-domain visualization software.
4. This only scratches the surface. Turn loose in the "virtual observatory."
5. (Introduce analysis and simulation software from public domain)

Note: in this Word document the web links are "live". Simply CTRL-click on them.

VISUALIZATION SOFTWARE

Google "karma visualization software."
www.atnf.csiro.au/computing/software/karma/
Ready-to-go installation package.
Note extensive online documentation.

Many alternatives: e.g.,
DS9 http://hea-www.harvard.edu/RD/ds9/
and IDL (latter not free)

Not all can display spectral "data cubes", like
karma is designed to do.

FINDING OBJECTS

Galactic: SIMBAD http://simbad.u-strasbg.fr/

Example: VES735 or KR 140
2h20m07.19s 61d07m04.9s Equ J2000

Extragalactic: NED
http://nedwww.ipac.caltech.edu/

Both have many useful features and links (e.g., coordinate conversion calculator).

EXAMPLE S OF PUBLIC ARCHIVES

CADC http://www1.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/cadc/
(accounts are free)

Data from many telescopes are archived. Explore one, the "Canadian Galactic Plane Survey."

CGPS

CGPS itself has many multi-frequency images probing various phases of the ISM.
Related surveys in the International Galactic Plane Survey are the VGPS (done with the VLA) and the SGPS (done with Australia's ATCA).

Find CGPS data for region of W3 and KR 140 used in the "Case Study" in lecture 3.

1420 Mhz radio continuum (free-free and synchrotron)
Using kvis (from karma): Display with calibration and coordinates, in colour, zoom, slice, Gaussian fitting, etc.
Demonstrate contours %0.1:1+0.1
Point out radio galaxies; compact HII regions; etc.

100 micron (thermal emission from dust); lower resolution than HIRES.

CO cube (decimated version to avoid long download)
Demonstrate how built up from spectra.
Demonstrate movie on frames 55 to 150, 150ms, anti-flicker

MAST http://stdatu.stsci.edu/

See links to software, virtual observatory

Again various Missions (see tab) have links:

Digital sky survey DSS http://stdatu.stsci.edu/dss
H alpha from the red plate.

Also XMM, etc.

HEASARC

High energy astrophysics archive (Chandra, etc.)

http://heasarc.gsfc.nasa.gov/

NASA/IPAC Infrared Science Archive
http://irsa.ipac.caltech.edu/Missions/missions.html

Check out Oasis and other useful tools.

Interactive **IRAS**
http://irsa.ipac.caltech.edu/applications/IRAS/ISSA/
4 bands available. Search on VES735

Interactive **2MASS**
http://irsa.ipac.caltech.edu/applications/2MASS/IM/interactive.html
3 bands available. Note: Double star (K band)

Interactive **MSX**
http://irsa.ipac.caltech.edu/applications/MSX/MSX/
Band A is the most sensitive and measures PAH.

IRIS
Improved Reprocessing of the IRAS Survey
www.cita.utoronto.ca/~mamd/IRIS
Use this product rather than ISSA above.

BU GRS (^{13}CO)

www.bu.edu/galacticring/new_data.html

Boston University survey of the Galactic plane in the first quadrant, including the molecular ring. Used the FCRAO observatory (now closed).

International Virtual Observatory

www.ivoa.net/

PUBLICALLY AVAILABLE SOFTWARE FOR ANALYSIS AND SIMULATION

IRAF, STSDASS, DAOPHOT, SEXTRACTOR

CLOUDY www.nublado.org
Gary Ferland's photoionization code (quasars, H II regions, novae, PDRs, and much more)

DUSTY www.pa.uky.edu/~moshe/dusty
Radiative transfer in dust clouds; Moshe Elitzur; not evolving.

ATLAS, PHOENIX (Hauschildt) for stellar atmospheres radiative transfer

Electromagnetic scattering
Mie theory, spheroids, cylinders.
DDA (Draine)

ZEUS www.astro.princeton.edu/~jstone/zeus.html
MHD code; Jim Stone

FLASH
http://flash.uchicago.edu/website/home/
radiative hydrodynamics

SPH
e.g., summary at
http://star-www.st-and.ac.uk/~pja3/sph.html
Smooth particle hydrodynamics.

N-body

Literature searches

ADS is very comprehensive.
http://adswww.harvard.edu/
Downloading the manuscript can involve having a subscription, but that can often be avoided by downloading the "astroph" archived link.
(Again note the many links on this home page – the "web" is indeed an interconnected web.)

There are many useful link to other resources, including astro images, at major library web sites, such as the one in Toronto:

http://www.astro.utoronto.ca/AALibrary/