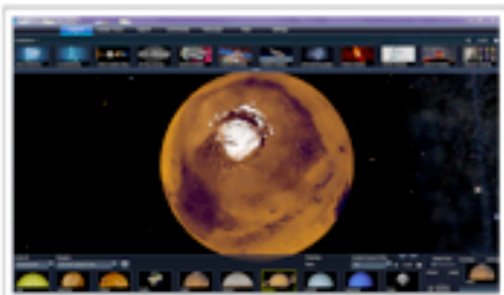


WorldWide Telescope Ambassadors Program

<http://www.cfa.harvard.edu/WWTAmbassadors/>

Harvard University, WGBH & Microsoft Research

Alyssa Goodman, Patricia Udomprasert, Annie Valva & Curtis Wong



What is WorldWide Telescope and its Ambassadors Program?
WorldWide Telescope (WWT) is a fantastic "Universe Information System" created primarily by Curtis Wong and Jonathan Ray at Microsoft Research. It functions as a Virtual Astronomical Observatory linking its users to much of the world's store of online data and information about our Universe. WWT is evolving to become a key research tool within the online astronomy ecosystem known in the US presently as the "VAO" (see A. Goodman's "Seamless Astronomy" talk at this meeting), but it also offers unprecedented new opportunities for STEM outreach.

The **WorldWide Telescope Ambassadors Program** promotes WWT as a future-learning way to teach and learn STEM concepts by recruiting astronomically-literate volunteers who are trained to be experts in using WWT as a teaching tool.

Who are we?

Our current collaboration brings together professional astronomers and science educators at Harvard, computational virtuosos at MS Research, and STEM education and outreach specialists at WGBH. The next phase of the project (see table below) will include participants from selected areas within the US, including Washington, Florida, Arizona, Alaska, and Appalachia.

Who are the WWT Ambassadors, and what do they do?

WWT Ambassadors are carefully recruited for training from amongst: 1) retired STEM professionals and amateur astronomers with a demonstrable deep knowledge of astronomy and physics; 2) undergraduate and graduate students and postdoctoral fellows in Astronomy and Physics; and 3) science teachers. In their training, Ambassadors learn how to use WWT's tools in general, and also how to create and publish guided "tours" of astrophysical concepts. These Tours allow users to display beautiful astronomical images in their proper context in the night sky, while demonstrating the physical principles at work in those images. Ambassadors can create and use materials within WWT; give volunteer presentations at variety of public venues; help out in classroom settings; or choose to do more than one of the above!



What have we done so far?

Our program began in the fall of 2009. Initial Ambassadors are currently working with 80 middle school students and their teacher, Michelle Bartley, at the Clarke Middle School in Lexington, MA, helping the students to prepare tours within WWT based on a six-week-long research experience. WWT and its Ambassadors have generated tremendous enthusiasm from the students, and have inspired quality learning through exploration and discovery. Results from the Pilot at Clarke are being collected online through a dedicated commenting site open to all students, and an analysis of the Pilot experience will serve to inform the NSF proposal being submitted to expand the program in the Spring of 2010.

What's the whole plan, and what are the program's goals?

We are presently preparing a proposal to the National Science Foundation, based in large part on our "Pilot" experience, to implement "Phase I" of the Ambassadors Project (see table), where we will begin a limited expansion within the US, carefully selecting cities and partners where we will be able to maximize success with the available resources, while increasing the socioeconomic diversity of our sites. We plan to expand nationally in Phase II, and internationally in Phase III. With minimal advertising, we have already received inquiries from dozens of interested and qualified potential volunteers in multiple states and countries.

A critical goal of this project is to create a **full astronomy curriculum using WWT Tours created by our Ambassadors**. These Tours will be vetted by the astronomy and science education professionals within our collaboration, and they will be freely available, centrally managed, and searchable, through web services at WGBH. The entire WWT Ambassadors "Tour Curriculum" will be integrated with **WGBH Teachers' Domain**, which currently has nearly 400,000 registered users.

WorldWide Telescope can help change how students learn science by demonstrating the joys of inquiry and discovery, and the WWT Ambassadors Program is designed to help to increase science literacy in the general public while forming intergenerational connections within their communities.

Phase	Scope	Timeline
Pilot	Boston Area	Fall 2009-Spring 2010
Phase I	Limited US Expansion	Fall 2010-Summer 2011
Phase II	US-wide	Fall 2011-Summer 2012
Phase III	International	2012+



External Research

Microsoft Research

E/PO ADVERTISEMENT

The WorldWide Telescope Ambassadors Program

www.cfa.harvard.edu/WWTAmbassadors/

- About
- Galileo Tour
- Project Team
- How to get involved
- Tour-making Tutorials
- Documents
- Events
- Protected
- WorldWide Telescope

Galileo Tour

See a video of our interactive Tour in WWT recreating Galileo's historic observations of Jupiter's moons.

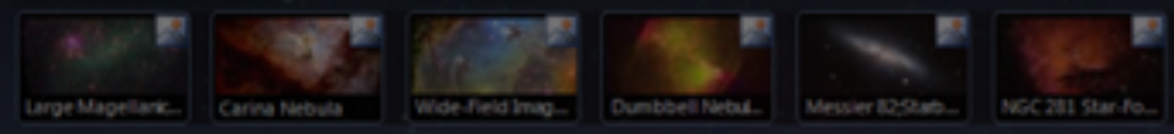
WorldWide Telescope (WWT) is a rich visualization environment that functions as a virtual telescope, allowing anyone to make use of professional astronomical data to explore and understand the universe. As of early 2010, the new WWT Ambassadors Program is recruiting astronomically-literate volunteers, including retired scientists engineers—all of whom will be trained to be experts in using WWT as a teaching tool. Ambassadors will give volunteer presentations at public libraries, community centers, museums, and schools, demonstrating WWT's power to help laypeople visualize and understand our universe. Ambassadors will learn how to create and publish guided "tours" of astrophysical concepts, which allow users to display beautiful astronomical images in their proper context in the night sky, while demonstrating the physical principles at work in those images.

Tour creators will be able to draw upon and link tours to highly vetted multimedia content from NOVA, the renowned PBS multi-platform series produced by WGBH. Virtual tours will be freely available and centrally managed in order to form a comprehensive astronomy curriculum for both formal and informal educational use. The tours will be searchable and distributed online from popular websites such as NOVA Online and WGBH Teachers' Domain, touting almost 400,000 registered users. www.teachersdomain.org

WWT Ambassadors will help to increase science literacy in the general public while forming intergenerational connections within their communities.

6th grade students at Clarke Middle School, Lexington, MA learn about the universe using the WorldWide Telescope

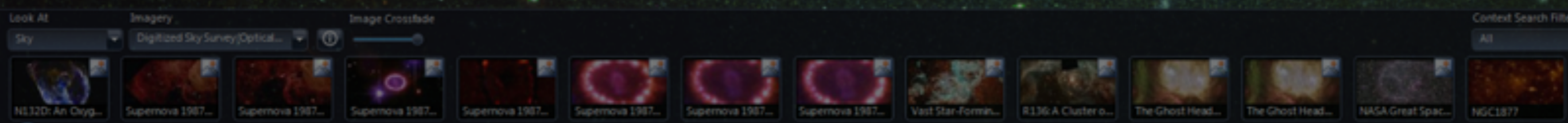
WWT allows users to explore our universe in rich detail, from our solar system out to the largest observed structures in the cosmos.



Seamless Astronomy

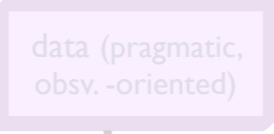
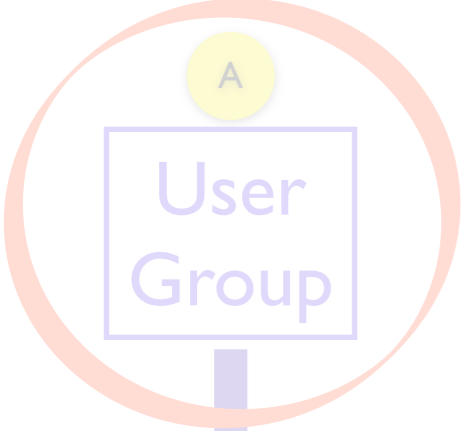
Alyssa A. Goodman
Harvard-Smithsonian Center for Astrophysics

with Alberto **Accomazzi**, Rahul **Davé**,
Gus **Muench** & Michael **Kurtz** (Harvard-Smithsonian CfA);
Tim **Clark** (Massachusetts General Hospital/Harvard Medical School);
Jonathan **Fay** & Curtis **Wong** (Microsoft Research)
+extended & upcoming collaboration with Chris Borgman & Alberto Pepe* (UCLA);
Doug Burke; Sarah Block, Pepi Fabbiano, et al. (CfA); E. Bressert (U. Exeter);
J. Hendler & D. McGuinness (RPI); A. Conti & C. Christian (STScI); A. Connolly et al. (U. Washington)



Discourse Ontology

Workflow Ontology
(e.g. myexperiment)



No time for detail in 10 minutes...

please ask Pepi or Jonathan....



Existing "VO" Tools

Early Science Demonstrations



Realm of "Seamless Astronomy"

Data



2010
Evermore
Seamless
Astronomy

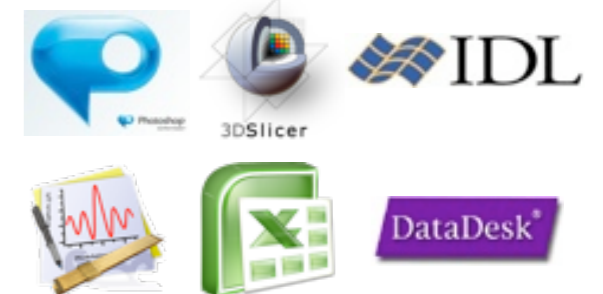
**Advanced
Search &
InfoViz tools**



Literature



Standalone Analysis Software



What should we do now?

Focus on interconnections/modularity interconnections/modularity

Involve more “free agents” free agents

Provide institutional data/code repositories repositories

Make users aware w/o “software-speak” awareness/usability

This simple argument, first made at the 2009 WWT session at AAS, seems to be working:

“Astronomy research tools should work as seamlessly as travel research tools.”

Top Stories

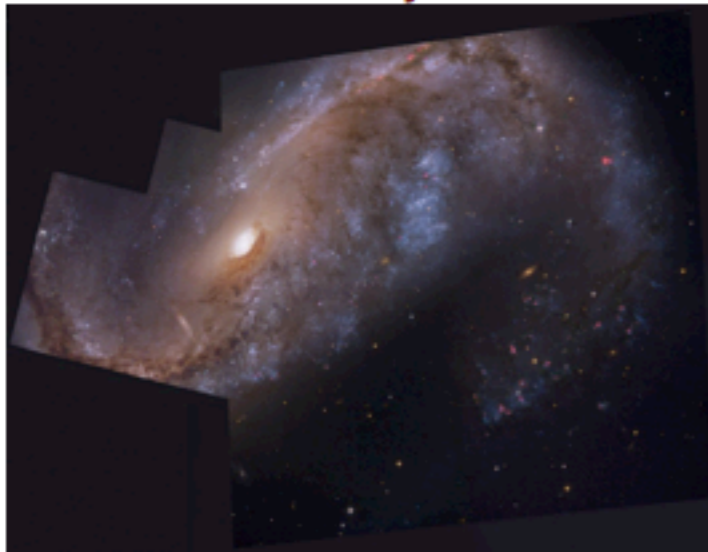
- [Obama Promotes New Health Care Law](#)
Voice of America - [all 26785 related »](#)
- [Waste issue hurting US nuclear revival-panel](#)
Reuters - [all 92 related »](#)
- [Dems, GOP Trade Accusations of Politically Exploiting Threats](#)
FOXNews - [all 900 related »](#)
- [Pope accountable for hiding priest abuses: U.S. victim](#)
Reuters - [all 1832 related »](#)
- [NYPD: Powder sent to Congressman non-hazardous](#)
The Associated Press - [all 158 related »](#)

Gmail

Movies: 02421

Astronomy Picture Of the Day (APOD)

NGC 2442: Galaxy in Volans



[Distorted galaxy](#) NGC 2442 can be found in the southern constellation of the [flying fish](#), (Piscis) Volans. [Read More](#)

Facebook

Welcome, Alyssa Goodman [logout](#)



What's on your mind?

[Share](#)



Elissa Stein Cushman



"My Mom's On Facebook" Song Goes Viral

26

Toodledo - Your to-do list

Toodledo

[Add Task](#)

[Hotlist](#)

[Starred](#)

[Folders](#)

[Due-Dates](#)

[Priorities](#)

[Recently Completed](#)

[All Tasks](#)

[Settings](#)

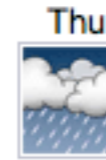
Weather

Cambridge, MA

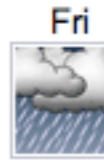


58°F

Current: Mostly Cloudy
Wind: S at 11 mph
Humidity: 41%



65° | 39°



39° | 22°



41° | 31°



50° | 44°

College Park, MD

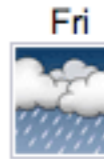


72°F

Current: Sunny
Wind: S at 11 mph
Humidity: 29%



74° | 49°



49° | 32°



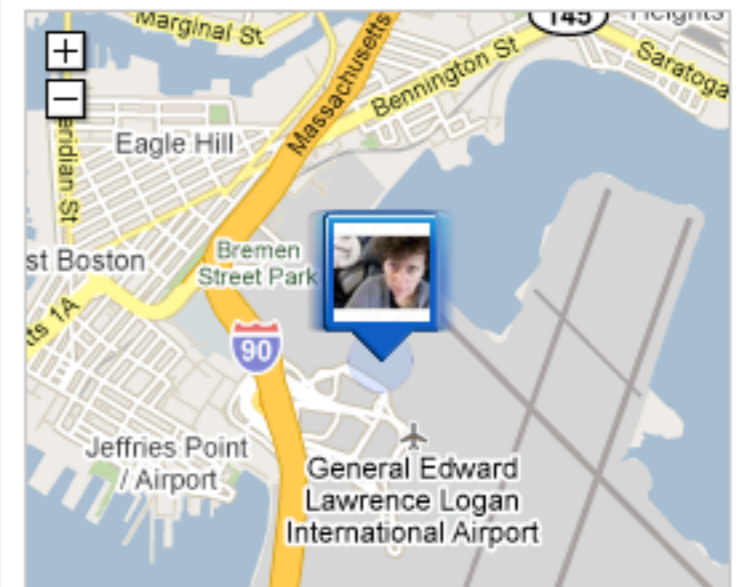
52° | 40°



59° | 50°

Google Translate

Google Latitude



Seamless Astronomy

Semantic Search

Info-Viz for Analytics Results

Data Viewer (e.g. WWT)

Ar3Dive Browser

Mockup based on work of Eli Bressert, excerpted from NASA AISRP proposal by Goodman, Muench, Christian, Conti, Kurtz, Burke, Accomazzi, McGuinness, Hendler & Wong, 2008

AstroNavigator

Project 1 Project 2 Project 3 Edit

QSO MgII absorption lines observed

Authors **A**
Drinkwater, Webster R.L., et al.

Description
The results of a large R-band

STARS WITH Nebula at

IC 348 Example Requires

← **~Fiction**
very soon fact,
e.g. CfA & U.W. work!

Fact →
right now,
e.g.
www.cfa.harvard.edu/~COMPLETE/

COMPLETE Data Coverage Tool

http://www.worldwidetelescope.org/COMPLETE/WWTCoverageTool.html#

COMPLETE Data Available

Control Panel Control Overview Control Settings

Full-Cloud Data (Phase I, All Data Available)

Dataset	Show	Perseus	Ophiuchus	Serpens	Link
GBT: HI Data Cube	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
IRAS: Av/Temp Maps	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
FCRAO: 12CO	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
FCRAO: 13CO	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
JCMT: 850 microns	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
Spitzer c2d: IRAC 1.3 (3.6,5.8 μm)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
Spitzer c2d: IRAC 2.4 (4.5,8 μm)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
CSO/Bolocam: 1.2-mm	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
Spitzer MIPS: Derived Dust Map	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data

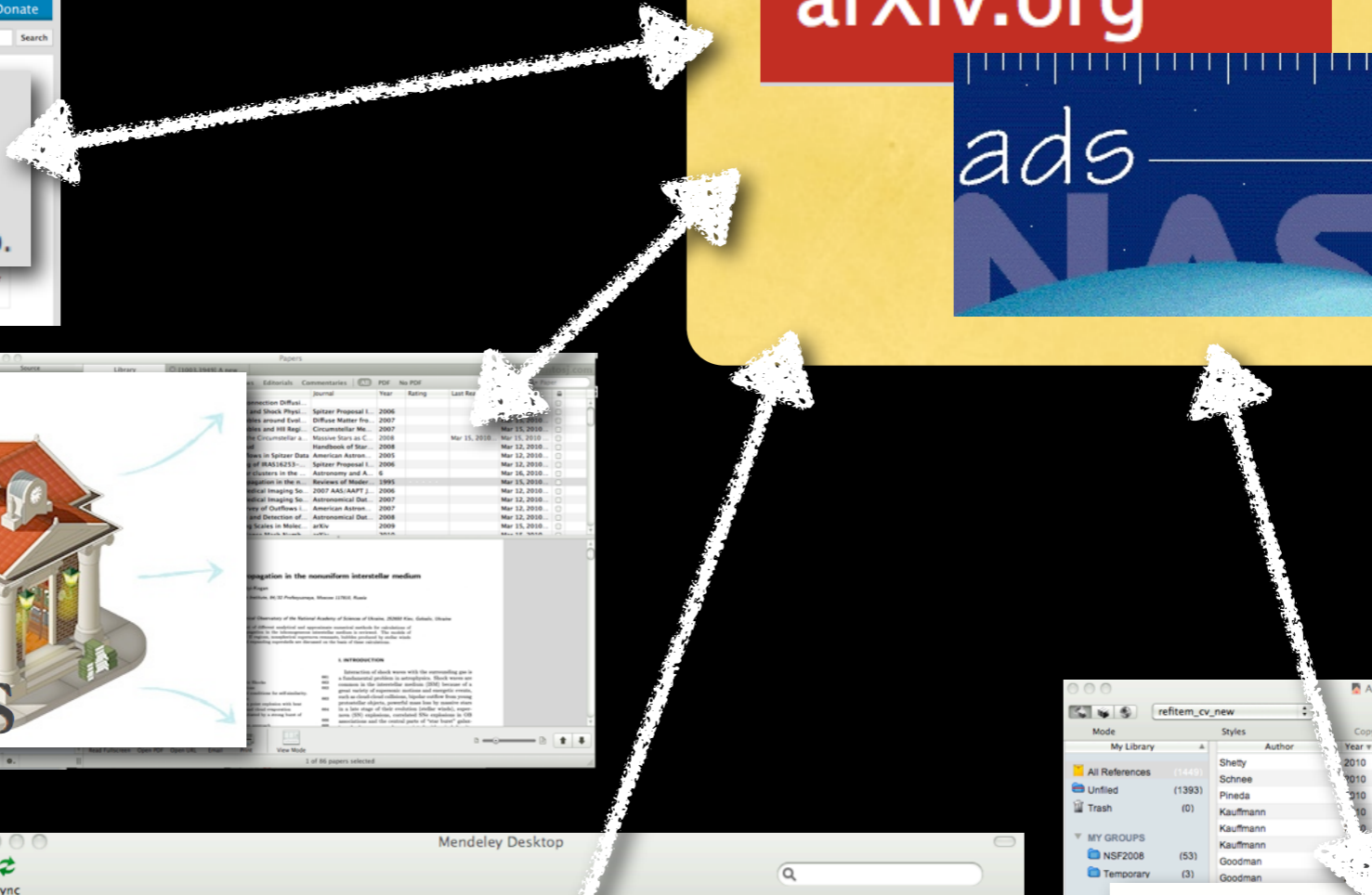
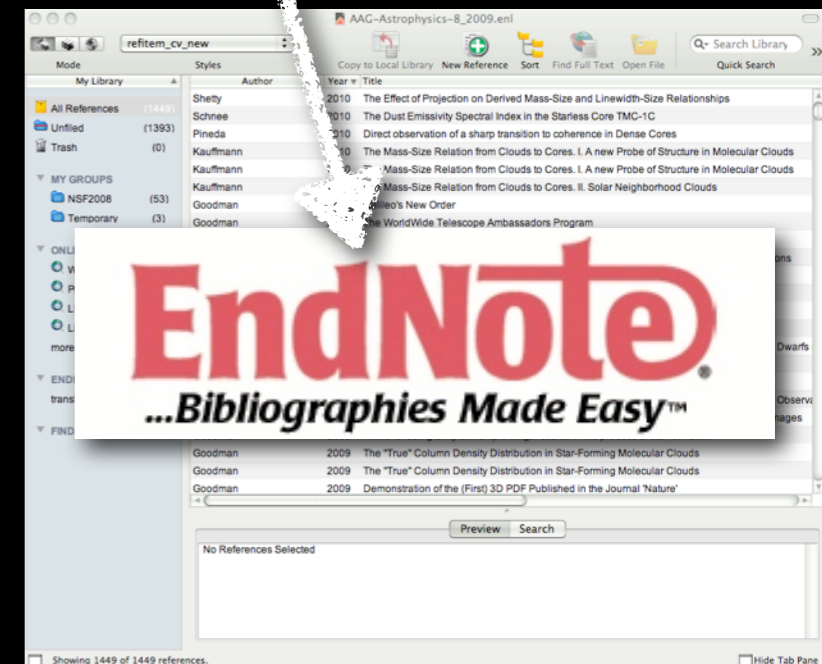
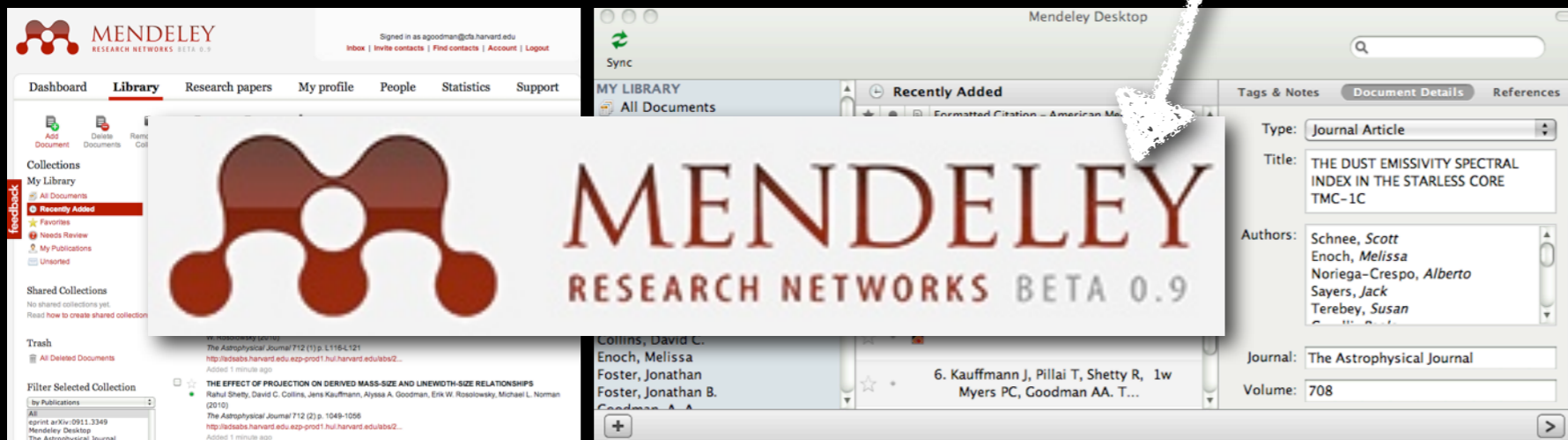
Targeted Regions (Phase II, Some Data Not Yet Available)

CTIO/Calar Alto: NIR (J,H,K _s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
IRAM 30-m: NH ₂ and C18O	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
IRAM 30-m: 1.1-mm continuum	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
Megacam/MMT: r,i,z Images	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data

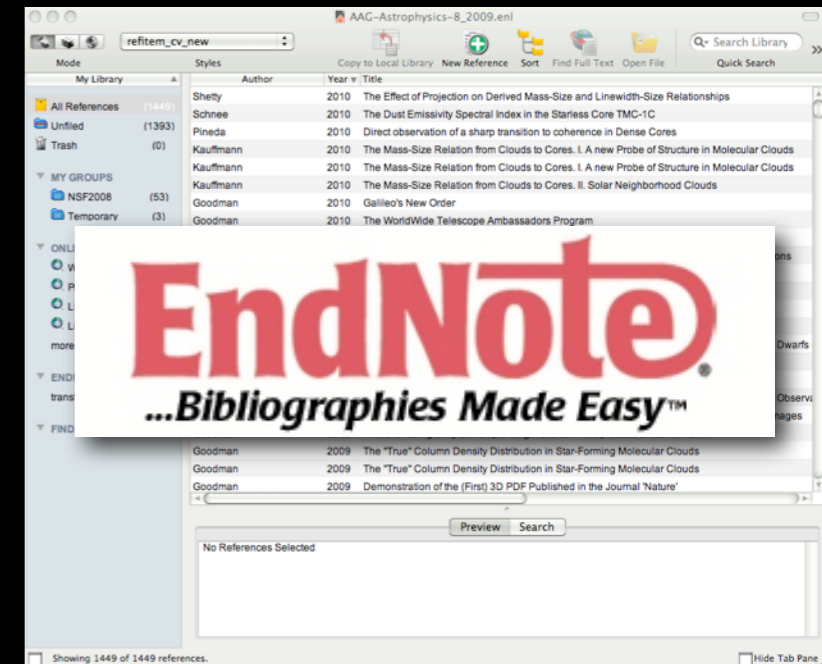
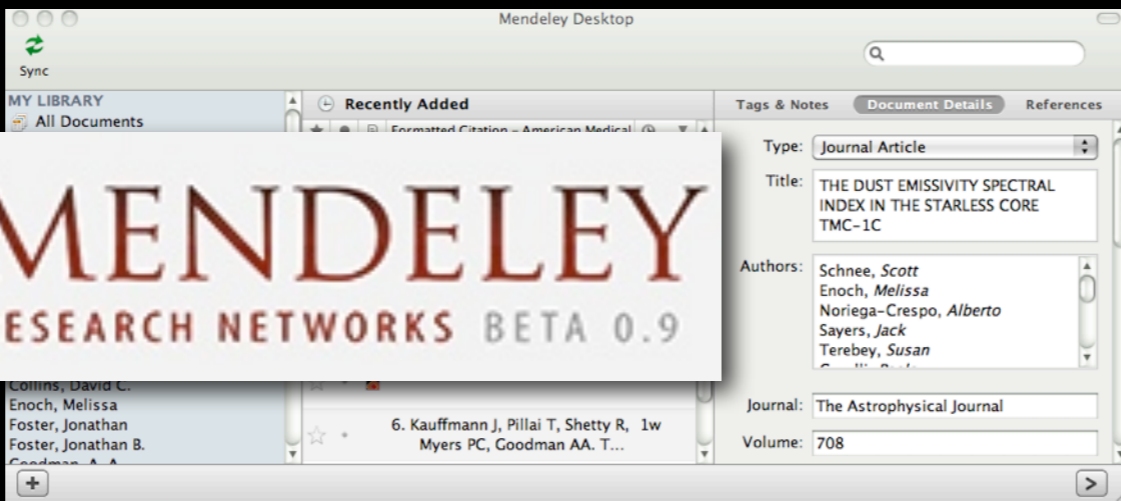
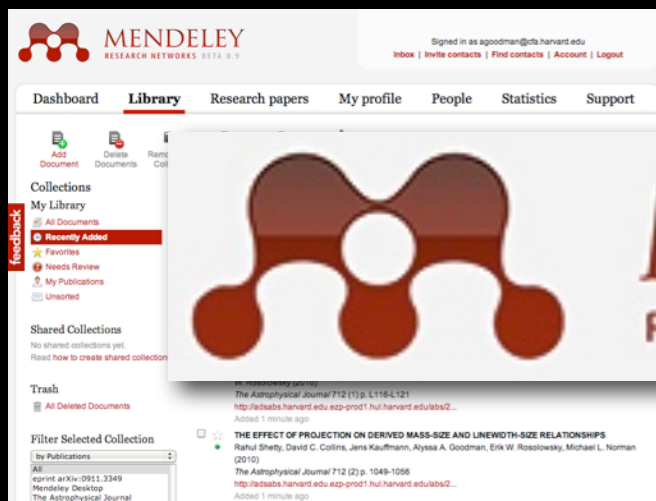
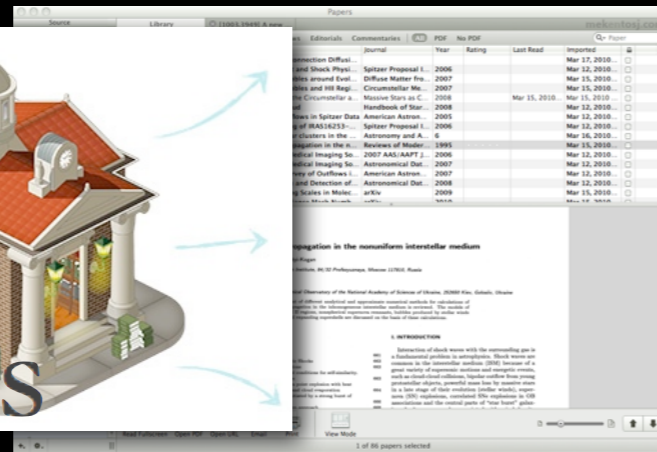
Catalogs & Pointed Surveys

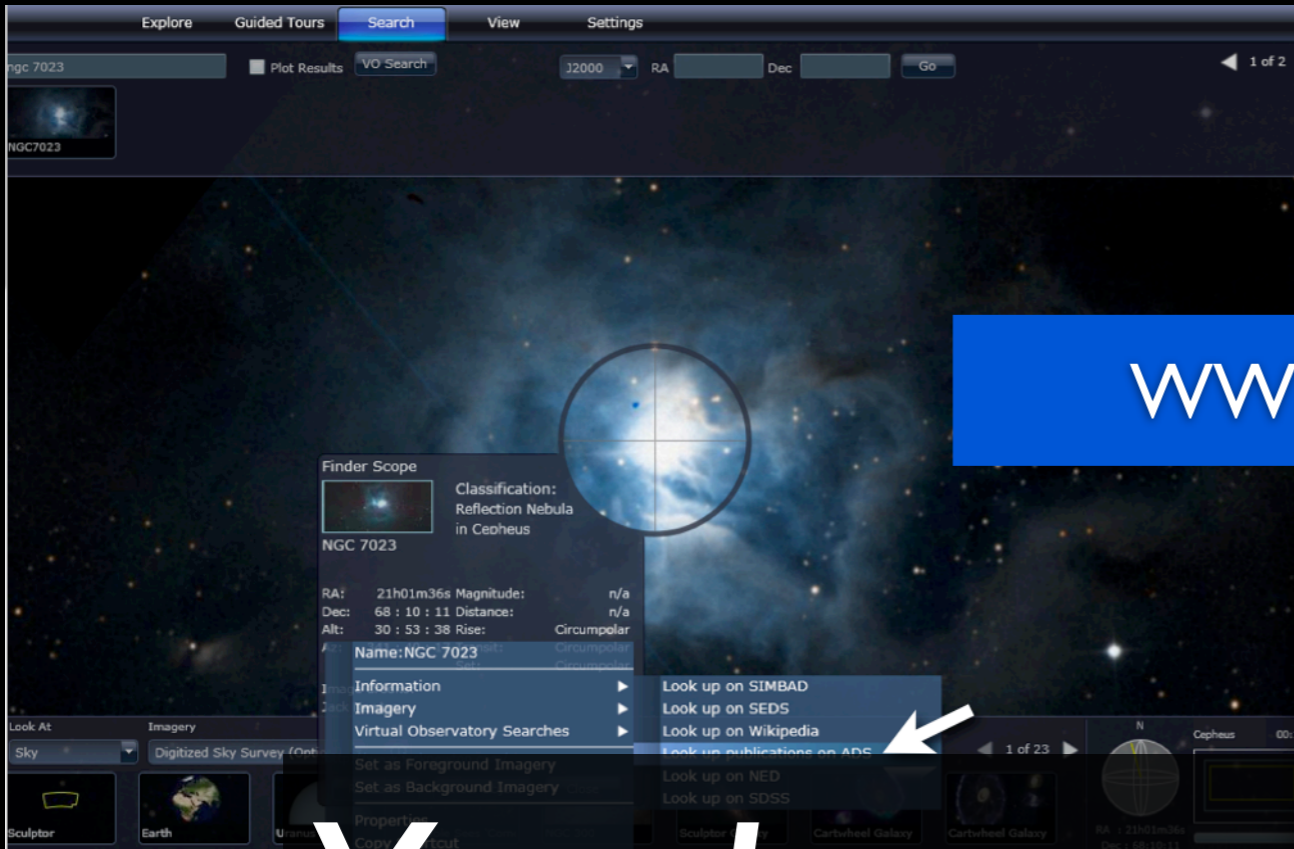
NH3 Pointed Survey	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
YSO Candidate list (c2d)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data

Literature Handling: *Diverse Apps, Common Data*

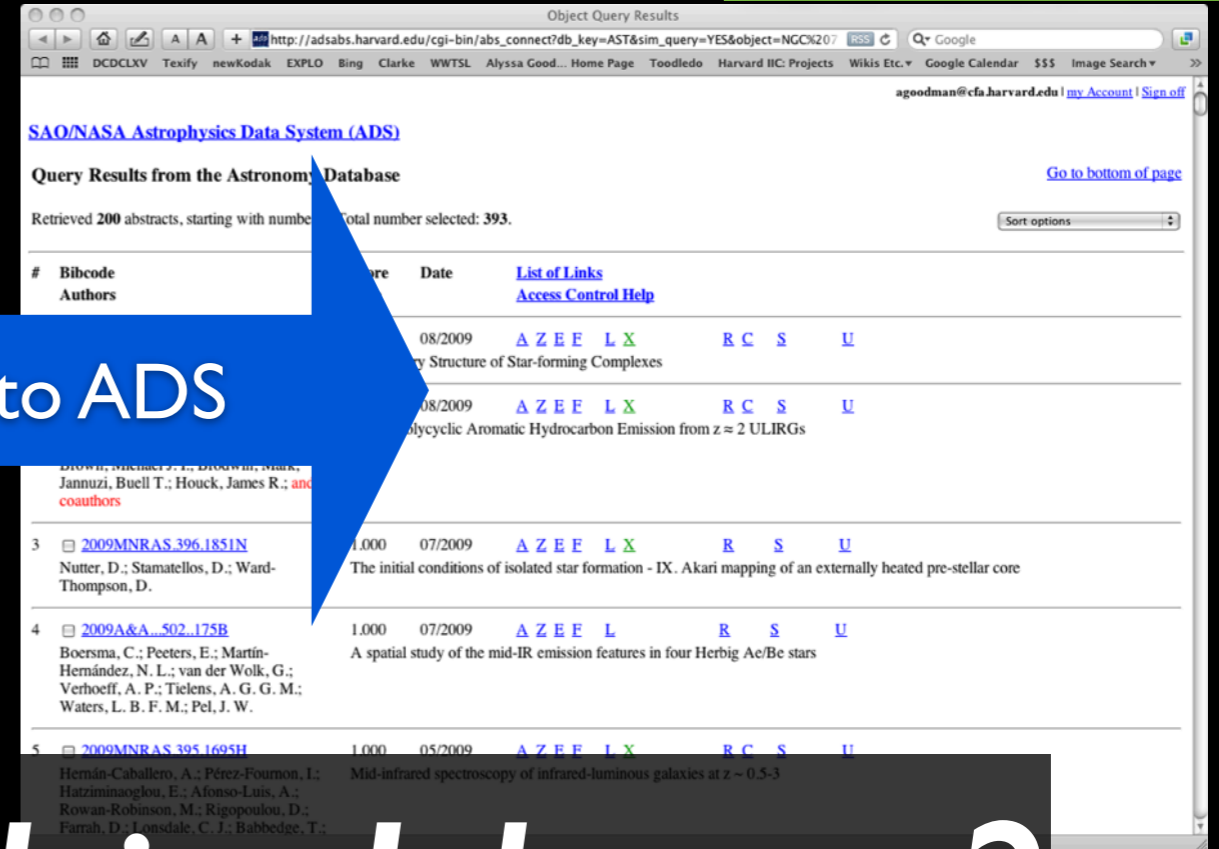


What fraction of astronomy researchers **know** about these tools?





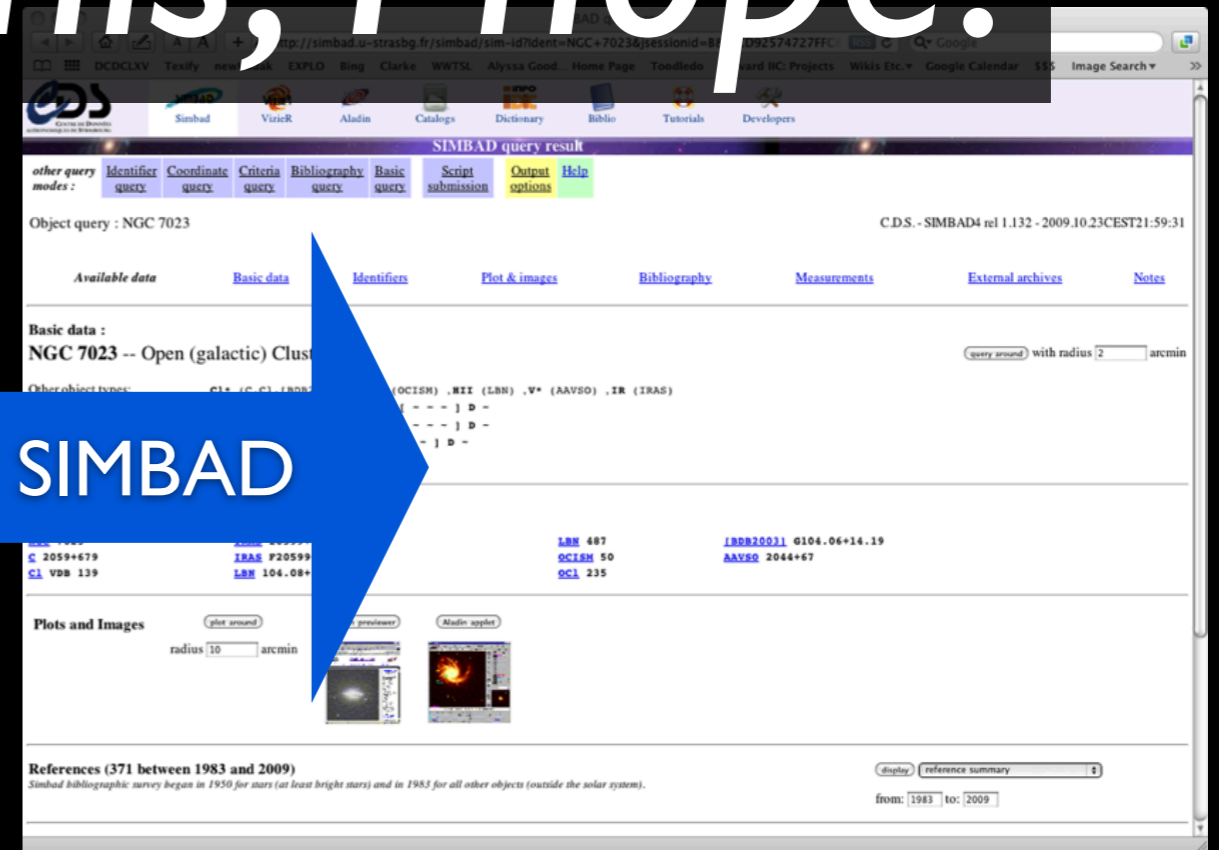
WWT to ADS



You know this, I hope?



WWT to SIMBAD



ADS Faceted Topic Search (Alpha)

http://adsres.cfa.harvard.edu/cgi-bin/topicFacetSearch

ads

ADS Faceted Topic Search (alpha)

PAH Search

e.g.: "dark energy", "extrasolar planets", "weak lensing" "spin hall"

Keyword Search:

- Most relevant
- Most recent
- Most important

Subject Area Search:

- Most popular
- Most useful
- Most instructive

[ADS Home](#) | [Abstract Search](#) | [Help](#)

*“alpha” Faceted Topic Search in ADS
(courtesy of Michael Kurtz & Alberto Accomazzi)*

ADS Query Results

http://adsres.cfa.harvard.edu/cgi-bin/topicFacetSearch?q=PAH;qtype=RELEVANT

SAO/NASA Astrophysics Data System (ADS)

Query Results from the ADS Database [Go to bottom of page](#)

Selected and retrieved 200 abstracts. Sort options

#	Bibcode Authors	Score	Date	List of Links Access Control Help
1	<input type="checkbox"/> 2007ApJ...657..810D Draine, B. T.; Li, Aigen	100.000	Mar 2007	A E F X R C c S N O U
2	<input type="checkbox"/> 2007ApJ...663..866D Draine, B. T.; Dale, D. A.; Bendo, G.; Gordon, K. D.; Smith, J. D. T.; Armus, L.; Engelbracht, C. W.; Helou, G.; Kennicutt, R. C., Jr.; Li, A.; and 10 coauthors	96.842	Jul 2007	A E F X R C c S N U
3	<input type="checkbox"/> 2007ApJ...654L..49S Spoon, H. W. W.; Marshall, J. A.; Houck, J. R.; Elitzur, M.; Hao, L.; Armus, L.; Brandl, B. R.; Charmandaris, V.	95.232	Jan 2007	A E F X R C c S N U
4	<input type="checkbox"/> 2005ApJ...628L..29E Engelbracht, C. W.; Gordon, K. D.; Rieke, G. H.; Werner, M. W.; Dale, D. A.; Latter, W. B.	95.090	Jul 2005	A E F X R C c S N U

Related Objects

- [M 82 \(14\)](#)
- [NGC 7027 \(12\)](#)
- [NGC 7023 \(10\)](#)
- [NAME ORI BAR \(10\)](#)
- [NAME RED RECTANGLE \(9\)](#)
- [QSO B1254+571 \(8\)](#)
- [NGC 2023 \(8\)](#)
- [NGC 253 \(8\)](#)
- [M 17 \(8\)](#)
- [PN G093.9-00.1 \(7\)](#)
- [NGC 7714 \(7\)](#)
- [IC 4553 \(7\)](#)
- [NGC 6240 \(6\)](#)
- [NGC 292 \(5\)](#)
- [NAME RHO OPH REGION \(5\)](#)
- [NAME LMC \(5\)](#)
- [MCG+10-14-025 \(5\)](#)
- [4C 47.36A \(5\)](#)
- [VV 65 \(4\)](#)
- [SBSG 0335-052 \(4\)](#)
- [QSO B2300+086 \(4\)](#)
- [NGC 7331 \(4\)](#)
- [NGC 4151 \(4\)](#)
- [NGC 1808 \(4\)](#)
- [NGC 1097 \(4\)](#)
- [NAME CAMPBELL'S HYDROGEN STAR \(4\)](#)
- [Mrk 273 \(4\)](#)
- [M 81 \(4\)](#)
- [M 42 \(4\)](#)
- [GSC 02342-00359 \(4\)](#)
- [\[KIB2003\] G29.957-0.018 \(3\)](#)
- [\[KIB2003\] G23.955+0.150 \(3\)](#)

Open "http://www.worldwidetelescope.org/wwtweb/goto.aspx?object=NGC%20%207023&ra=21.026913&dec=58.163300" in a new window

list of objects with links to WWT browser
(thanks to ADS team & Jonathan Fay)

Now we got to NGC 7023 by using the **literature as a filter**.

The screenshot displays the Microsoft WorldWide Telescope Web Client interface. The browser address bar shows the URL: <http://www.worldwidetelescope.org/webclient/default.aspx?wtml=http%3a%2f%2f>. The navigation menu includes 'Explore', 'Guided Tours', 'Search', 'View', and 'Settings'. The breadcrumb trail reads 'Collections > Open Collections > Link Collection >'. A thumbnail for 'NGC 7023' is visible in the top left. The main view is a large, detailed image of the NGC 7023 nebula, a bright blue and white star-forming region. The bottom control panel features a 'Look At' dropdown set to 'Sky', an 'Imagery' dropdown set to 'Digitized Sky Survey (Optical)', and an 'Info' icon. Below these are three thumbnails: 'Cepheus', 'NGC 7023', and 'NGC7023'. On the right, a celestial globe shows the location of NGC 7023 in the constellation Cepheus, with coordinates RA: 21h01m37s and Dec: 68:09:48. A 'Done' button is located at the bottom left.



Spitzer Space Telescope

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- By Subject
- Outside Institutions

What's Happening Archive

Visuals

- Image Use Policy

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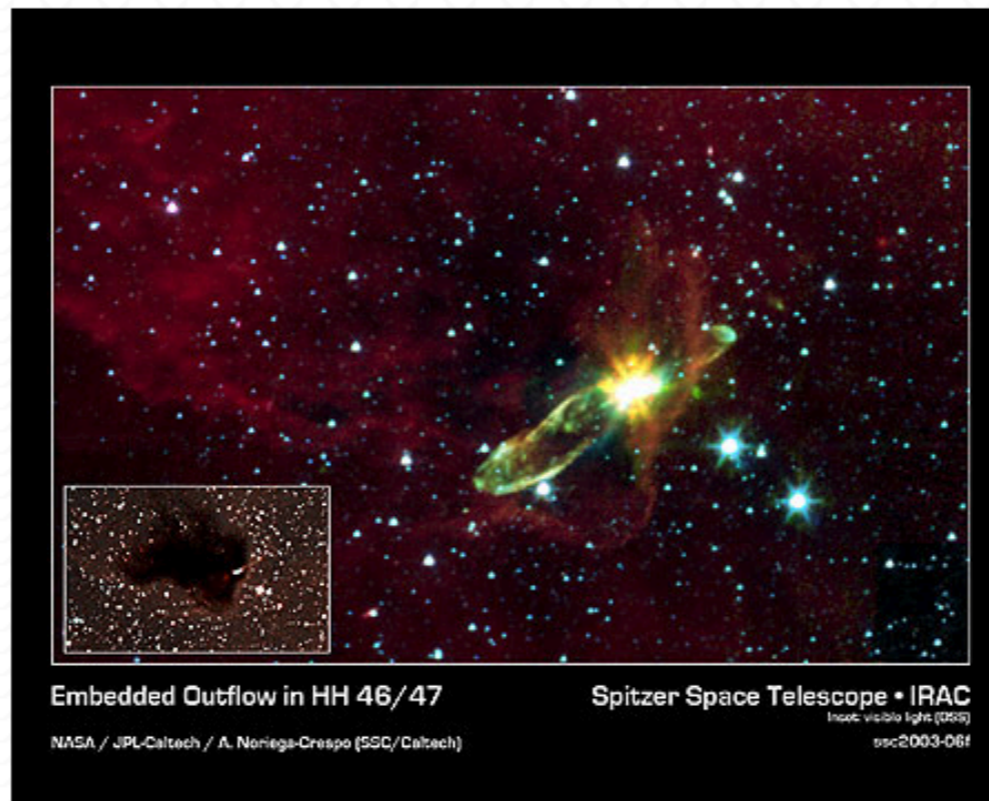
- Mailing List
- RSS Feed (XML)

References

- Fast Facts
- Press Kit (.pdf)
- Fact Sheet (.pdf)
- Field Guides
- Glossary

Media Contacts

INTRODUCTION | PRESS RELEASE | VISUALS | QUICK FACTS



Embedded Outflow in HH 46/47

Spitzer Space Telescope • IRAC

NASA / JPL-Caltech / A. Noriega-Crespo (SSC/Caltech)

Image: visible light (DSS) ssc2003-06f

Credit: NASA/JPL-Caltech/A. Noriega-Crespo (SSC/Caltech), Digital Sky Survey

HH46/47

This image from NASA's Spitzer Space Telescope transforms a dark cloud into a silky translucent veil, revealing the molecular outflow from an otherwise hidden newborn star. Using near-infrared light, Spitzer pierces through the dark cloud to detect the embedded outflow in an object called HH 46/47. Herbig-Haro (HH) objects are bright, nebulous regions of gas and dust that are usually buried within dark clouds. They are formed when supersonic gas ejected from a forming protostar, or embryonic star, interacts with the surrounding interstellar medium. These young stars are often detected only in the infrared.

The Spitzer image was obtained with the infrared array camera. Emission at 3.6 microns is shown as blue, emission from 4.5 and 5.8 microns has been combined as green, and 8.0 micron emission is depicted as red.

HH 46/47 is a striking example of a low-mass protostar ejecting a jet and creating a bipolar or two-sided outflow. The central

Seamlessness through...

flickr

+

astrometry.net

+

WWT !?

HH4647

Share This

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[SEND TO GROUP](#)
[ADD TO SET](#)
[BLOG THIS](#)
[ALL SIZES](#)
[ORDER PRINTS](#)
[ROTATE](#)
[EDIT PHOTO](#)
[DELETE](#)



Embedded Outflow in HH 46/47 **Spitzer Space Telescope • IRAC**
Inset: visible light (DSS)
 NASA / JPL-Caltech / A. Noriega-Crespo (SSC/Caltech) ssc2003-06f

Uploaded on January 6, 2009 by [Alyssa_Goodman](#)

Alyssa_Goodman's photostream

16 uploads

browse

This photo also belongs to:

[+ astrometry \(Pool\) x](#)

Tags

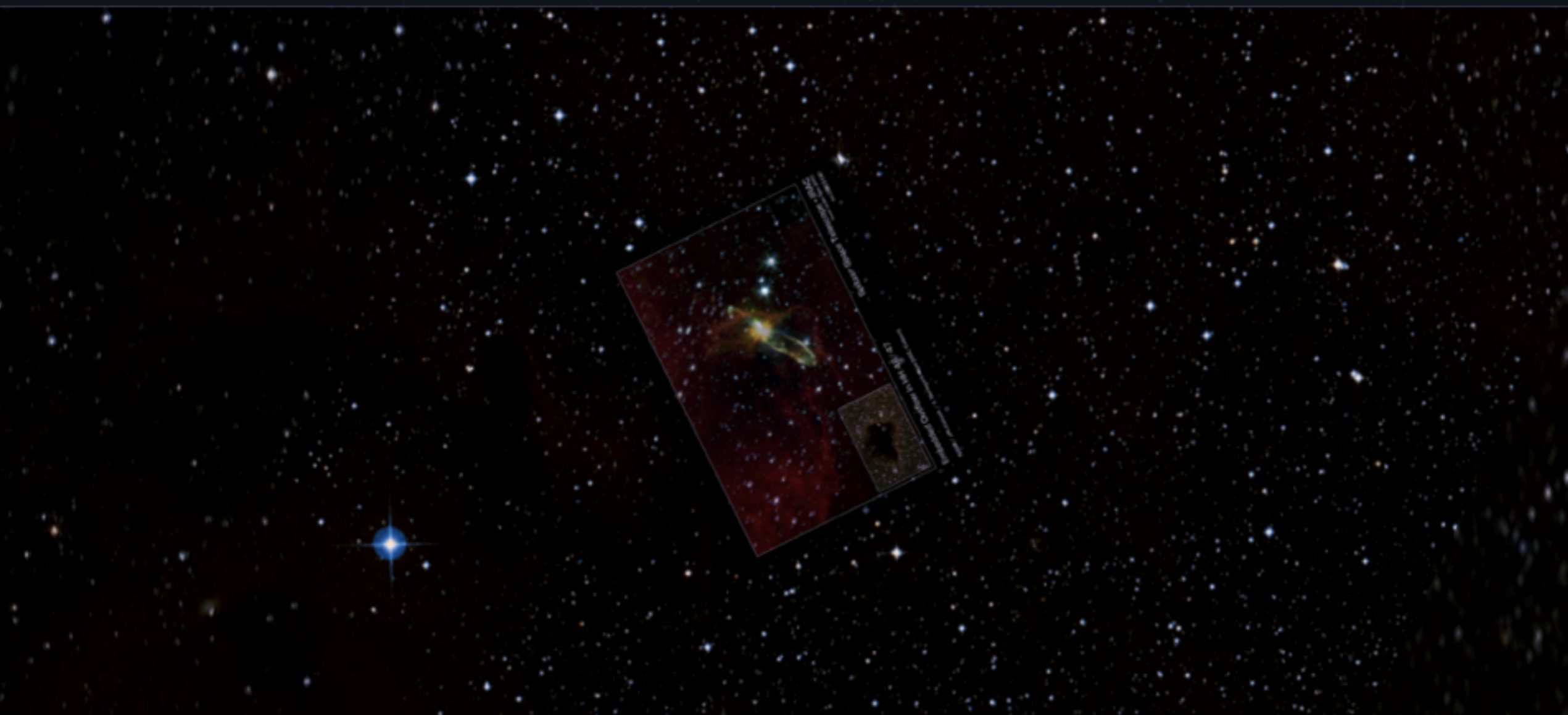
- [Astrometrydotnet:version=10145 x](#)
- [Astrometrydotnet:id=alpha-200901-20629873 x](#)
- [Astrometrydotnet:status=solved x](#)

[Add a tag](#)

Additional Information

- [All rights reserved \(edit\)](#)
- [Anyone can see this photo \(edit\)](#)
- [Add to your map](#)
- Taken on [December 12, 2003 \(edit\)](#)
- [Photo stats](#)
- Viewed 7 times (Not including you)
- [Edit title, description, and tags](#)

[Flag your photo](#)



Look At: Sky | Imagery: Digitized Sky Survey (Optical) | Info: ⓘ | Image Crossfade: [Slider] | 1 of 1

Vela | Bubbly Little Star

N Vela 00:35:33

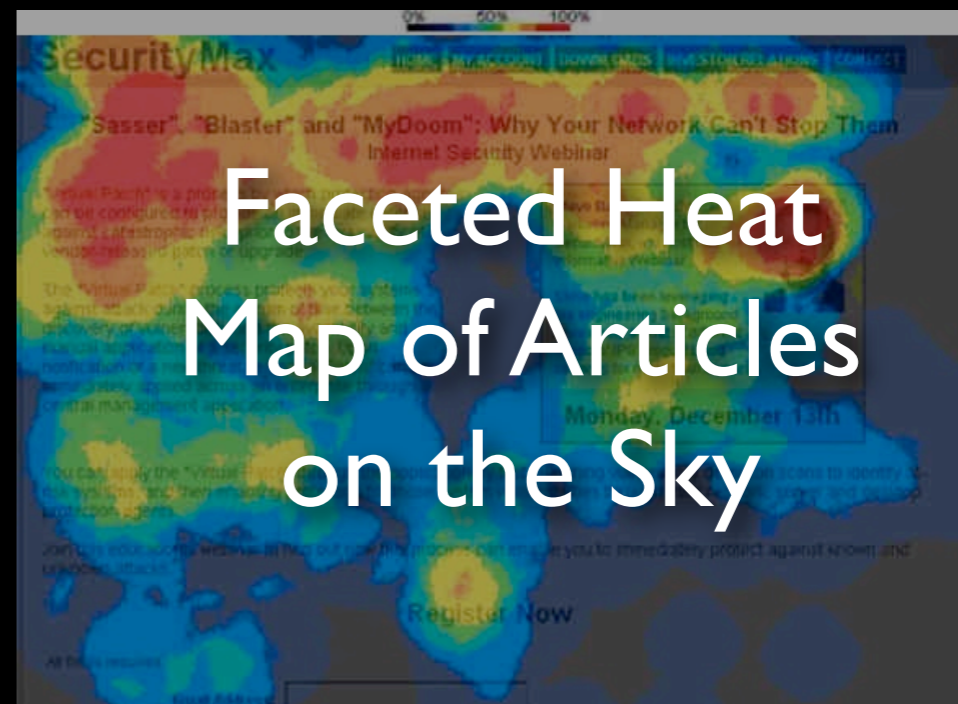
RA : 08h25m39s
Dec : -31:01:10

interconnections/modularity

Coming (Very) Soon...

Historical Image Layer
Extracted from ALL
ADS holdings (using
astrometry.net)

[ADS+WWT+who wants to help?]



[ADS+CDS+WWT are doing it!]

Prototype of Articles on the Sky (April 2010)

Aladin v6.0 *** BETA VERSION (based on v6.052) ***

File Edit Image Catalog Overlay Tool View Interop Help

Gal

simbad-biblio51

Zoom 1/64x

Frame: Gal

360.00000 +00.00000
360° x 180°

360° x 180°

grid north multiview match

(c)1999-2010 Uds/CNRS - Centre de Donnees astronomiques de Strasbourg

0 sel / 0 src 43M

or...

with thanks to CDS/Pierre Fernique

The future is here... data *IN* articles

interconnections/modularity

free agents

repositories

awareness/usability

Note: This work came from the "AstroMed" project am.iic.harvard.edu

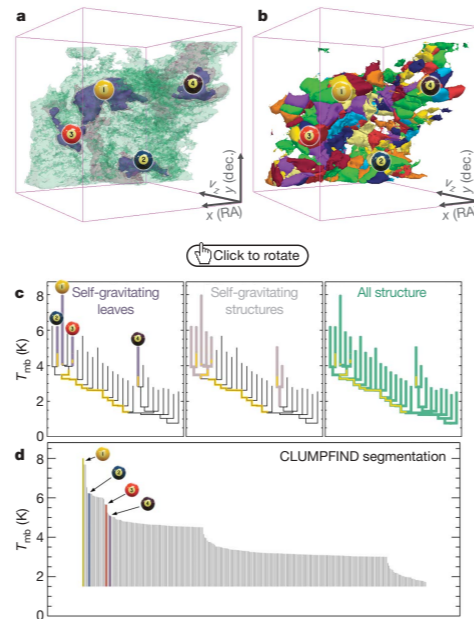


Figure 2 | Comparison of the 'dendrogram' and 'CLUMPFIND' feature-identification algorithms as applied to ^{13}CO emission from the L1448 region of Perseus. **a**, 3D visualization of the surfaces indicated by colours in the dendrogram shown in **c**. Purple illustrates the smallest scale self-gravitating structures in the region corresponding to the leaves of the dendrogram; pink shows the smallest surfaces that contain distinct self-gravitating leaves within them; and green corresponds to the surface in the data cube containing all the significant emission. Dendrogram branches corresponding to self-gravitating objects have been highlighted in yellow over the range of T_{mb} (main-beam temperature) test-level values for which the virial parameter is less than 2. The x - y locations of the four 'self-gravitating' leaves labelled with billiard balls are the same as those shown in Fig. 1. The 3D visualizations show position-position-velocity (p - p - v) space. RA, right ascension; dec., declination. For comparison with the ability of dendrograms (**c**) to track hierarchical structure, **d** shows a pseudo-dendrogram of the CLUMPFIND segmentation (**b**), with the same four labels used in Fig. 1 and in **a**. As 'clumps' are not allowed to belong to larger structures, each pseudo-branch in **d** is simply a series of lines connecting the maximum emission value in each clump to the threshold value. A very large number of clumps appears in **b** because of the sensitivity of CLUMPFIND to noise and small-scale structure in the data. In the online PDF version, the 3D cubes (**a** and **b**) can be rotated to any orientation, and surfaces can be turned on and off (interaction requires Adobe Acrobat version 7.0.8 or higher). In the printed version, the front face of each 3D cube (the 'home' view in the interactive online version) corresponds exactly to the patch of sky shown in Fig. 1, and velocity with respect to the Local Standard of Rest increases from front (-0.5 km s^{-1}) to back (8 km s^{-1}).

data, CLUMPFIND typically finds features on a limited range of scales, above but close to the physical resolution of the data, and its results can be overly dependent on input parameters. By tuning CLUMPFIND's two free parameters, the same molecular-line data set⁸ can be used to show either that the frequency distribution of clump mass is the same as the initial mass function of stars or that it follows the much shallower mass function associated with large-scale molecular clouds (Supplementary Fig. 1).

Four years before the advent of CLUMPFIND, 'structure trees'⁹ were proposed as a way to characterize clouds' hierarchical structure

using 2D maps of column density. With this early 2D work as inspiration, we have developed a structure-identification algorithm that abstracts the hierarchical structure of a 3D (p - p - v) data cube into an easily visualized representation called a 'dendrogram'¹⁰. Although well developed in other data-intensive fields^{11,12}, it is curious that the application of tree methodologies so far in astrophysics has been rare, and almost exclusively within the area of galaxy evolution, where 'merger trees' are being used with increasing frequency¹³.

Figure 3 and its legend explain the construction of dendrograms schematically. The dendrogram quantifies how and where local maxima of emission merge with each other, and its implementation is explained in Supplementary Methods. Critically, the dendrogram is determined almost entirely by the data itself, and it has negligible sensitivity to algorithm parameters. To make graphical presentation possible on paper and 2D screens, we 'flatten' the dendrograms of 3D data (see Fig. 3 and its legend), by sorting their 'branches' to not cross, which eliminates dimensional information on the x axis while preserving all information about connectivity and hierarchy. Numbered 'billiard ball' labels in the figures let the reader match features between a 2D map (Fig. 1), an interactive 3D map (Fig. 2a online) and a sorted dendrogram (Fig. 2c).

A dendrogram of a spectral-line data cube allows for the estimation of key physical properties associated with volumes bounded by isosurfaces, such as radius (R), velocity dispersion (σ_v) and luminosity (L). The volumes can have any shape, and in other work¹⁴ we focus on the significance of the especially elongated features seen in L1448 (Fig. 2a). The luminosity is an approximate proxy for mass, such that $M_{\text{lum}} = X_{13\text{CO}} L_{13\text{CO}}$, where $X_{13\text{CO}} = 8.0 \times 10^{20} \text{ cm}^{-2} \text{ K}^{-1} \text{ km}^{-1} \text{ s}$ (ref. 15; see Supplementary Methods and Supplementary Fig. 2). The derived values for size, mass and velocity dispersion can then be used to estimate the role of self-gravity at each point in the hierarchy, via calculation of an 'observed' virial parameter, $\alpha_{\text{obs}} = 5\sigma_v^2 R / GM_{\text{lum}}$. In principle, extended portions of the tree (Fig. 2, yellow highlighting) where $\alpha_{\text{obs}} < 2$ (where gravitational energy is comparable to or larger than kinetic energy) correspond to regions of p - p - v space where self-gravity is significant. As α_{obs} only represents the ratio of kinetic energy to gravitational energy at one point in time, and does not explicitly capture external over-pressure and/or magnetic fields¹⁶, its measured value should only be used as a guide to the longevity (boundedness) of any particular feature.

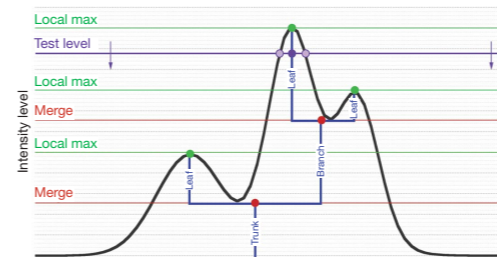


Figure 3 | Schematic illustration of the dendrogram process. Shown is the construction of a dendrogram from a hypothetical one-dimensional emission profile (black). The dendrogram (blue) can be constructed by 'dropping' a test constant emission level (purple) from above in tiny steps (exaggerated in size here, light lines) until all the local maxima and mergers are found, and connected as shown. The intersection of a test level with the emission is a set of points (for example the light purple dots) in one dimension, a planar curve in two dimensions, and an isosurface in three dimensions. The dendrogram of 3D data shown in Fig. 2c is the direct analogue of the tree shown here, only constructed from 'isosurface' rather than 'point' intersections. It has been sorted and flattened for representation on a flat page, as fully representing dendrograms for 3D data cubes would require four dimensions.



How do we increase the fraction of astronomy researchers who know about these tools?



User Groups
(CfA now has one)



+Suggestions?!



User Groups (CfA now has one)



NVO
NATIONAL VIRTUAL OBSERVATORY
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Welcome to the New NVO Home Page! We welcome your **feedback** on the new site.

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The Aladin Sky Atlas

[Download Aladin on your machine](#) | [Start Aladin applet \(fr - US - Ja - In - UK - Co\)](#)

New: Aladin release 6 - April 2009
Measurement browser by interactive histogram, Outreach mode, SAMP compatible, RICE compression support, etc.

New: The Aladin manual - April 2009 - The full user manual in English

Description Aladin is an interactive software sky atlas allowing the user to interactively access related data and information from the service and other archives for all known sources in the field. Created in 1999, Aladin has become a widely-used VO portal such as locating data of interest, accessing and exploring data, multi-wavelength data. Compliance with existing or emerging standards with other visualisation or analysis tools, ability to easily copy topics allowing Aladin to be a powerful data exploration and science enabler.

The Aladin sky atlas is available in three modes: a Java Standalone application, a Java applet interface and a simple previewer.

HARVARD UNIVERSITY
TSC
Time Series Center

register | login | **CfA** | **iic**

Home Search Projects Surveys Publications People

Home > Search

Search Setting

Searching method:
 VPT PDI GPU

Survey:
 ASAS OGLE2

Open in new window.

Use a File
Use a time series data from your local machine to search.

OR

Draw It
Draw the curve you would like to search for.

How do we increase the number of people who create and interlink new tools?

Kiva model  proposed at MSR in semi-jest in 2009...

Should implemented through VAO “Associates,”
WWT Partners, and more.

How do we organize such diverse tools, so as to make them interoperably useful?....

“SAMP” is a great technical start, but offers a very significant user interface challenge.

interconnections/modularity

SAMP

The screenshot displays the SAMP software interface, which is a multi-windowed application for astronomical data analysis. The main window, titled "Microsoft WorldWide Telescope", shows a star field with several white circles highlighting specific objects. Overlaid on this are several other windows:

- Aladin v6.0**: A window showing a grayscale astronomical image of a star cluster with red triangles marking specific stars. The title bar indicates it is a BETA VERSION based on v6.021.
- TOPCAT**: A window displaying a "Scatter Plot" of data points. The plot shows a clear upward trend, with red circular markers on a grid. The y-axis ranges from 68.15 to 68.30.
- Desktop - FITS Manager**: A window showing a grid of spectral plots for multiple objects, each labeled "spSpec-51911-045". A context menu is open over one of the plots, listing actions such as "View", "Sort By", "SAMP", "View FITS", "Edit", "Rate", "Add To Category", "Refresh", and "Property".

The SAMP interface includes a menu bar with options like "Explore", "Guided Tours", "Search", "Community", "Telescope", "View", and "Settings". The Windows taskbar at the bottom shows the system clock at 00:14:04 and several application icons.

ADS Query Results

SAO/NASA Astrophysics Data System (ADS)

Query Results from the ADS Database

Selected and retrieved 200 abstracts.

#	Bibcode	Score	Date	List of Links	Access Control Help
1	2006glsw.book..269S	81.000	n/a 2006	A E X R C c U	
3	2003ARA&A..41..645R	61.000	n/a 2003	A E E X R C c U H	
4	2008ARNPS..58..99H	51.000	Nov 2008	A X R C c U	
5	2003astro.ph..6465S	44.000	Jun 2003	A X R C c U H	
6	2006MNRAS..368.1323H	41.000	May 2006	A E G X R C c U	

“Faceted Browsing”

Why?

an easy to use, web based application using the IVOA which allows a user to perform:

observations

data browsing

observations to participate in an infrastructure which allows one to:

Fork me on GitHub

- create intelligent applications which can reason and inference with
- publish resources as Linked Data, externally indexed.
- easily aggregate metrics of interest to publishers, funding agencies
- let others build applications on this substrate using SPARQL queries

We will be carrying out these efforts as part of ADS Labs.

Bootstrapping in ADS Labs

ADS Labs is an effort to put out more forward thinking, somewhat unstable applications will be incubated in ADS Labs before being pushed out to ADS

1. The results of queries on a bibliographic database will be made available in a user interface.
2. We will switch to a semantic backend with a SPARQL interface
3. Development on Ontologies (which this site details) continues and
4. Finally we'll combine the databases so as to have one large semantic application.

Examples of Applications

Here are examples of what such applications might look like:

Da Browser http://dabrowser.semantic.ads.org

lmc

Advanced

Data **Literature** **Objects**

Object One, Object Two, Object Three

Microensing in the LMC

Ogle Variables in the LMC

Wavelength: Optical, Xray

Modular Functionality

Download!

Collaborative Astronomy at University of Washington

- **Research in a Browser**

- **“iGoogle” for Astronomy**

- Collections of simple atomic applications (gadgets)
 - Users choose the view they want
 - All gadgets can communicate with each other

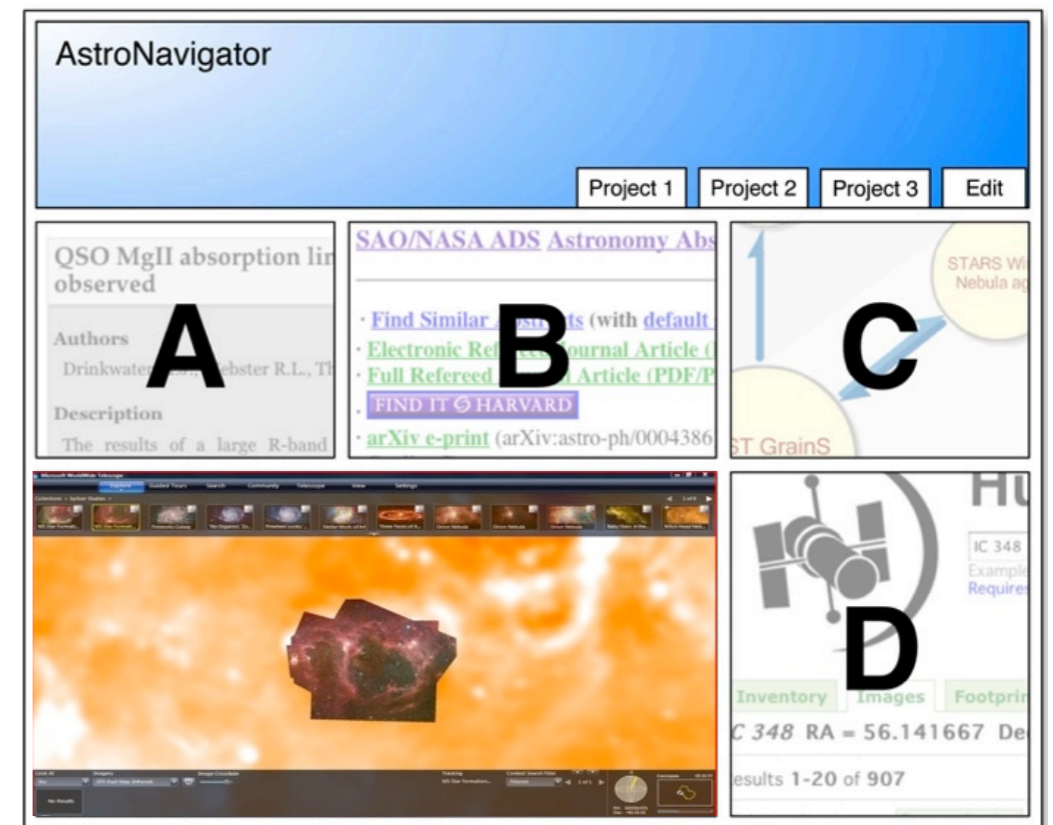
- **Customizable and sharable**

- Users can build and share “mashups”
 - Widgets are simple to create
 - Widgets call virtual observatory resources

- **Efficient**

- Communication is within the browser (fast)
 - Built from javascript (standard)

Show Andy Connolly's Movie....



Select Gadgets

Rearrange based on your preference

The screenshot shows a web-based astronomy interface. At the top left, there is a logo for 'SDSS Gadget Server'. The top right corner shows the user is signed in as 'ajc' with links for 'Sign-out' and 'Help'. Below the header, there is a navigation bar with buttons for 'Add Gadgets', 'Add New Tab', 'Clone Active Tab', and 'Remove Active Tab'. The main content area contains several gadgets: 'Input Coords' with fields for RA and dec and a GO button; 'Get Sky Objects' with a 'Select Service' dropdown, a 'Max: 50' input, and a 'Get Objects' button; 'Name Resolve' with an 'Input Object Name' field and a 'Go' button; 'DataGadget v0.1' which displays 'DataGadget v0.1'; and 'Sky Viewport' which shows a star chart with constellation names like Ursa Major, Lynx, Leo Minor, Cancer, Gemini, Leo, Canis Minor, Sextans, and Monoceros. The star chart also includes a compass, zoom controls, and coordinates: RA 8h40m58.67s, Dec 25°00'00.00".



Query the SDSS based on viewport
Name resolver and zoom to field
and return the source overlaid on images

The screenshot shows a web browser window titled "Gadget Server" with a navigation bar containing "Add Gadgets", "Add New Tab", "Clone Active Tab", and "Remove Active Tab". The main content area has tabs for "Home", "HR Diagram", and "HR Diagram 2".

Four annotated gadgets are visible:

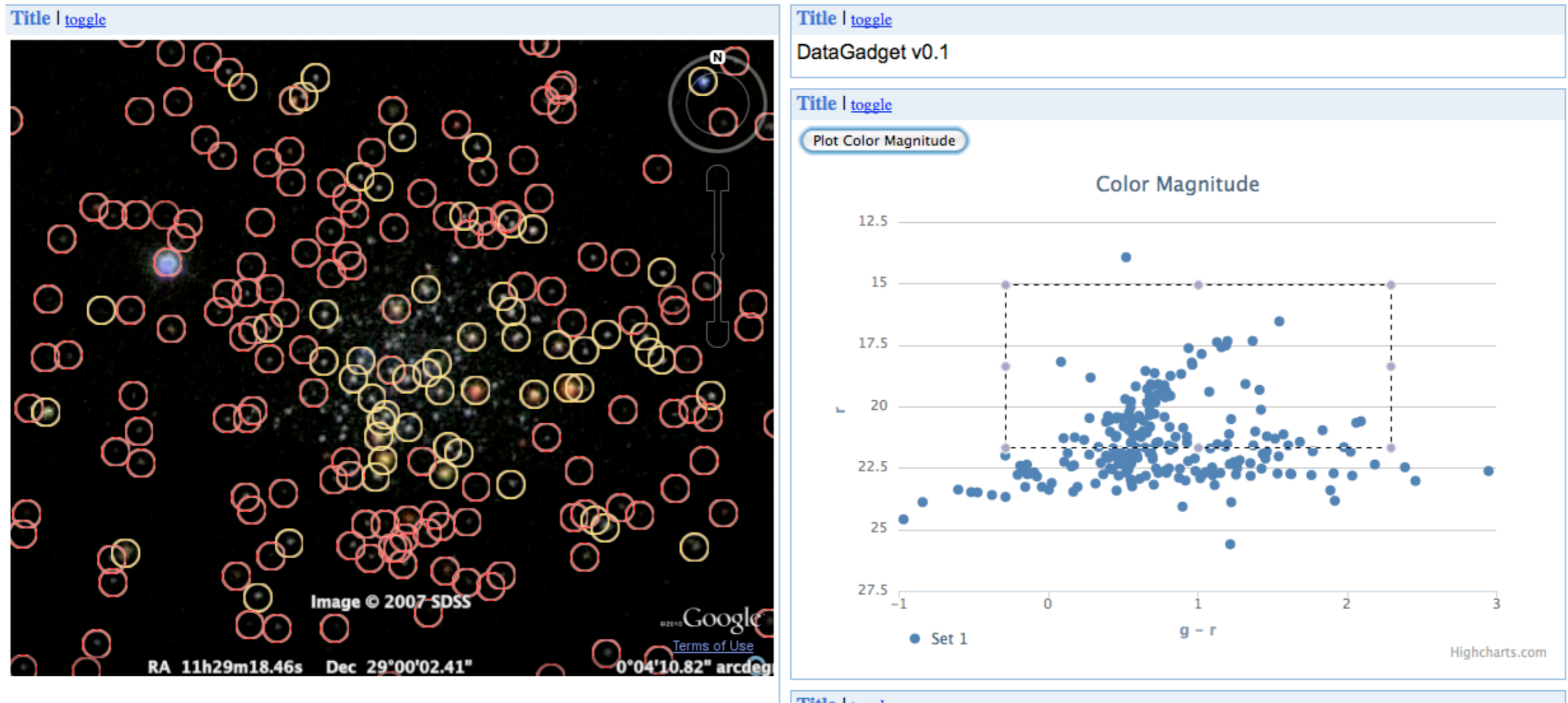
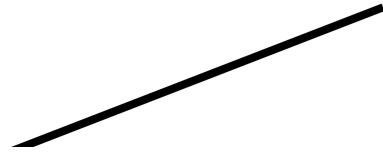
- Sky Viewport:** A central window displaying a star field with red circles around objects. Labels include "Messier 87", "IC 3443", "NGC 4478", and "NGC". Coordinates at the bottom are "RA 12h30m10.20s Dec 12°24'55.39" 0°28'24.0".
- DataGadget v0.1:** A central control panel with a "Get Sky Objects" section containing a dropdown menu set to "SDSS", a "Max: 50" input, and a "Get Objects" button.
- Input Coords:** A form with "RA:" and "dec:" input fields and a "GO" button.
- Name Resolve:** A form with an input field containing "m87" and a "Go" button.

Annotations include:

- Arrows pointing from the text "Query the SDSS based on viewport" to the Sky Viewport and DataGadget.
- Arrows pointing from "Name resolver and zoom to field" to the Name Resolve and Sky Viewport.
- Arrows pointing from "and return the source overlaid on images" to the Sky Viewport.
- A large arrow pointing from the text "All gadgets communicate through the data gadget" to the DataGadget.



Create, store and share multiple views of gadgets



Interaction allows selections to be shown on the viewport



WorldWide Telescope Ambassadors Program

Alyssa Goodman

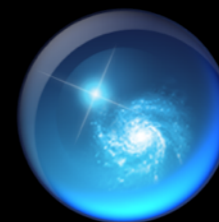
*Harvard University Professor of Astronomy,
WGBH Scholar-in-Residence, Microsoft Academic Partner*

Annie Valva

WGBH Interactive, Director of Research & Development

Pat Udomprasert

WWT Program Coordinator



How?

Using new WWT platform to give experts and learners access to the Universe



WWT Ambassadors Program

Recruiting, Vetting, Coordination



hosted/
promoted by

The logo for WGBH, consisting of the letters 'WGBH' in a bold, white, sans-serif font inside a blue, stylized shape.



“I never knew programs like this could even exist. It’s just amazing.”

–Clarke Middle School 6th grade student

More quotes from Clarke 6th Graders

“Learning about our Universe by actually seeing and exploring it makes it easier to contemplate and more fun.”

“You can explore the Universe yourself and you don't always have to only learn from the teacher.”

“It gave me a better mental map of the universe.”

(And of the 72 surveys we’ve collected, 71 are positive toward WWV Ambassadors.)