

Seamless Astronomy

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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);

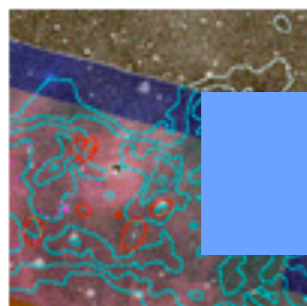
J. Hendler & D. McGuinness (RPI); A. Conti & C. Christian (STScI); A. Connolly et al. (U. Washington)



What can today's Astronomer's "Research" look like?

Research

In my *Astronomy* research, I am primarily interested in how the gas in galaxies constantly re-arranges itself over huge time spans to constantly form new stars. I have also had a long-standing interest in data *visualization*, and in improving the use of *computers* in all aspects of scientific research. I teach a course at Harvard called "The Art of Numbers," and I am very involved in the WorldWide Telescope Project, which brings astronomical data to everyone through an interface that demonstrates data delivery for the 21st Century of "e-Science."



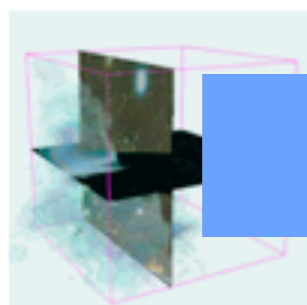
COMPLETE
The COordinated Molecular Probe

Data



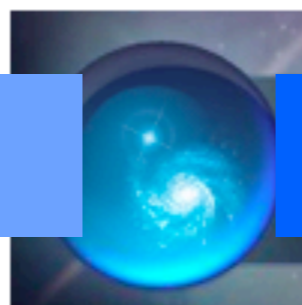
Star Formation Taste Tests
A community of theorists, numericists, and

Simulation



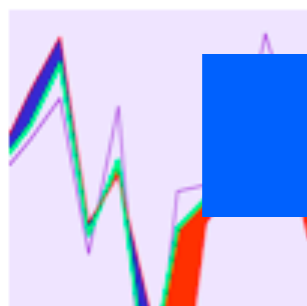
Astronomical Medicine
Exploiting the intersection of

Publishing



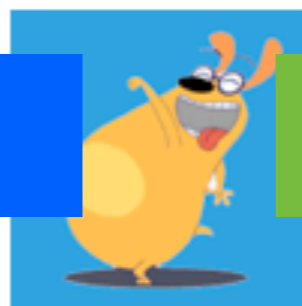
WorldWide Telescope
A beautiful portal to all of Astronomy for

e-Science Tools



Visualization

Viz



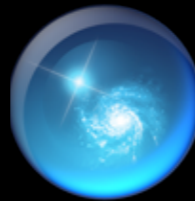
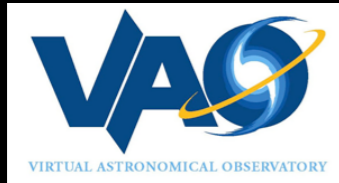
Science for Everyone

Outreach

Publishing

Data

Simulation



WorldWide Telescope

e-Science Tools

Viz

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 "VO" (see A. Goodman's "Spacewide 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 WWT. 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+

Microsoft Research, VAO, WGBH logos.

External Research, Microsoft Research logos.

“Why is one polar ice cap on Mars bigger than the other?”
– Clarke Middle School 6th Grader

The screenshot displays the Microsoft WorldWide Telescope interface. The main window shows a 3D view of Mars, highlighting its polar ice cap. The interface includes a top navigation bar with options like 'Explore', 'Guided Tours', 'Search', 'Community', 'Telescope', 'View', and 'Settings'. Below this is a 'Collections' bar with various categories such as 'My Collections', 'Constellations', 'Solar System (Sky)', 'All-Sky Surveys', 'Spitzer Studies', 'Chandra Studies', 'Hubble Studies', 'Astrophotography', 'Radio Studies', 'NOAO Studies', 'Gemini Studies', and 'Messier Catalog'. At the bottom, there is a 'Look At' panel with a dropdown menu set to 'SolarSystem' and a '3D Solar System View' dropdown. A row of planet icons is visible, with 'Saturn' highlighted. To the right, there is a 'Tracking' section set to 'Mars', a 'Context Search Filter' set to 'All', and a 'Planet Size' slider set to 'Ursa Major' (8187 km). The bottom right corner shows coordinates: 'Lng: 20:32:48' and 'Lat: +51:11:21'.

Huh?

Seems familiar...

Everyone knows...



BOXEE

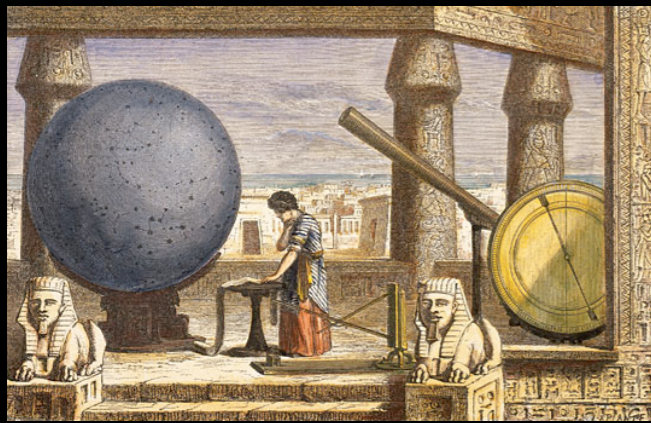


3500 years of Observing

Stonehenge, 1500 BC



Ptolemy in Alexandria, 100 AD



Observatory Tower, Lincolnshire, UK, c. 1300



Galileo, 1600



The "Scientific Revolution"

Reber's Radio Telescope, 1937



NASA/Explorer 7
(Space-based
Observing)
1959

"The Internet"



Long-distance
remote-control/
"robotic"
telescopes
1990s



"Virtual
Observatories"
21st century

“Virtual” observing

COMPLETE Data Coverage Tool

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

newKodak EXPLO Bing WWTSL Alyssa Good... Home Page Toolfeds Harvard BC Projects Wikis Etc. Google Calendar \$\$\$ Image Search Fbk share Directories ADS Best RSS (3387) BeyondADS

Finder Scope

Classification: Reflection Nebula in Perseus

NGC 1333

RA: 03h29m20s Magnitude: n/a
 Dec: 31° 24' 57" Distance: n/a
 Alt: -09° 53' 42" Rise: 17:16
 Az: 29° 51' 34" Transit: 01:32
 Set: 09:48

Image Credits:
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<http://www.gss.stsci.edu/Acknowledgments/P>

Research Show Object Close

COMPLETE Data Available

Center on Perseus Center on Ophiuchus Center on Serpens

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

Dataset	Show	Perseus	Ophiuchus	Serpens	Link
GBT: HI Data Cube	<input type="checkbox"/>	✓	✓	⊗	Data
IRAS: AvTemp Maps	<input type="checkbox"/>	✓	✓	✓	Data
FCRAO: 12CO	<input type="checkbox"/>	✓	✓	✓	Data
FCRAO: 13CO	<input type="checkbox"/>	✓	✓	✓	Data
JCMT: 850 microns	<input type="checkbox"/>	✓	✓	⊗	Data
Spitzer c2d: IRAC 1,3 (3.6,5.8 μm)	<input type="checkbox"/>	✓	✓	✓	Data
Spitzer c2d: IRAC 2,4 (4.5,8 μm)	<input type="checkbox"/>	✓	✓	✓	Data
CSO/Bolocam: 1.2-mm	<input type="checkbox"/>	✓	⊗	⊗	Data
Spitzer MIPS: Derived Dust Map	<input type="checkbox"/>	✓	⊗	⊗	Data

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

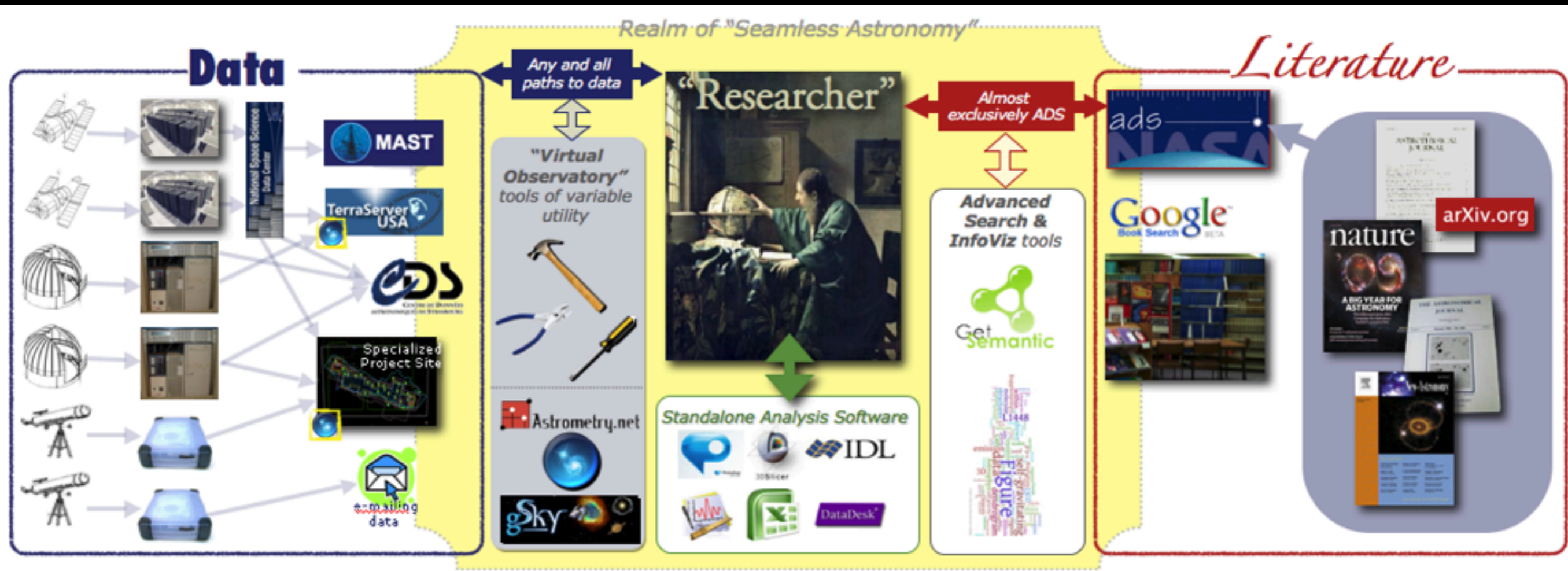
CTIO/Calar Alto: NIR (J,H,Ks)	<input type="checkbox"/>	✓	✓	⊗	Data
IRAM 30-m: N2H+ and C18O	<input type="checkbox"/>	✓	⊗	⊗	Data
IRAM 30-m: 1.1-mm continuum	<input type="checkbox"/>	✓	⊗	⊗	Data
Megacam/MMT: r,i,z images	<input type="checkbox"/>	✓	⊗	⊗	Data

Catalogs & Pointed Surveys

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

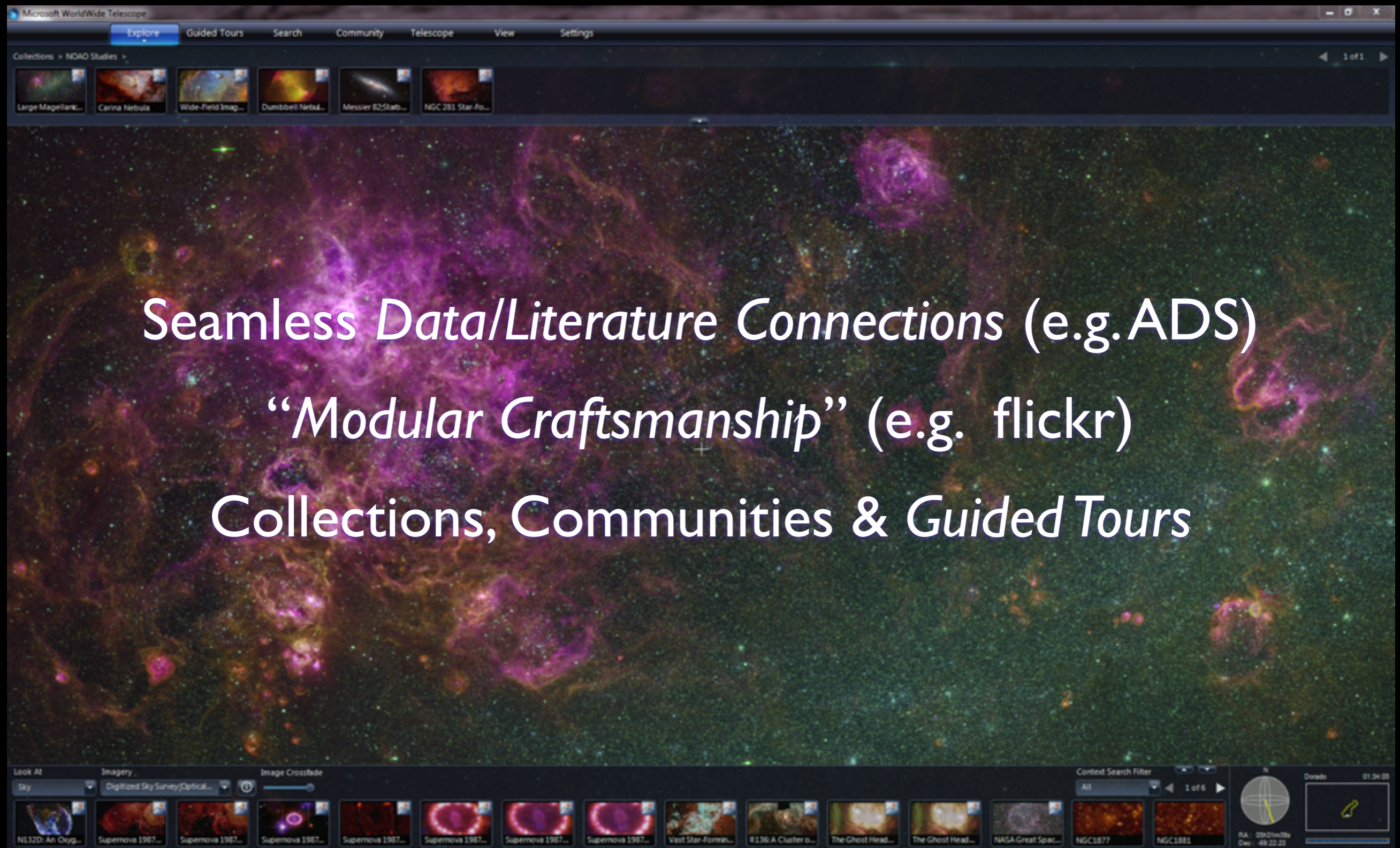
Done

Realm of Seamless Astronomy





WorldWide Telescope: a UIS from Microsoft Research [UIS=Universe Information System]



Seamless *Data/Literature Connections* (e.g. ADS)

“*Modular Craftsmanship*” (e.g. flickr)

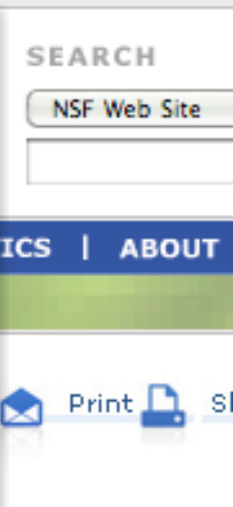
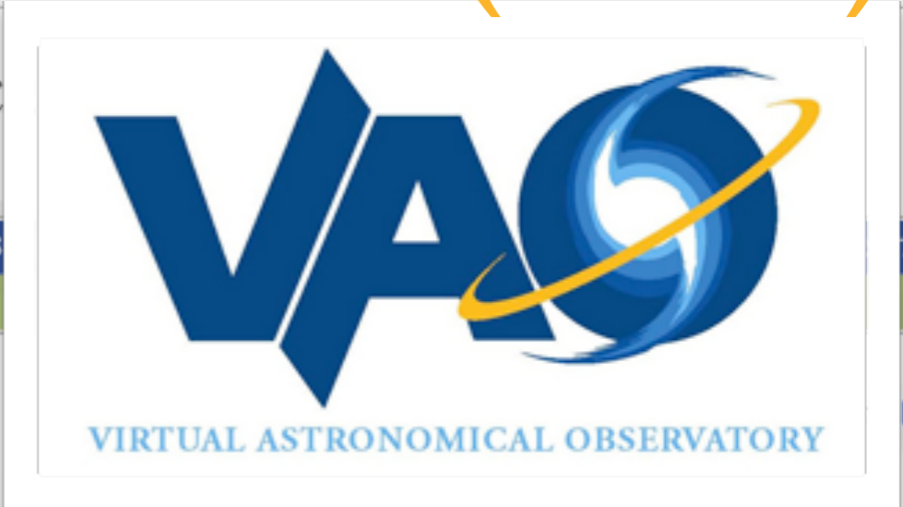
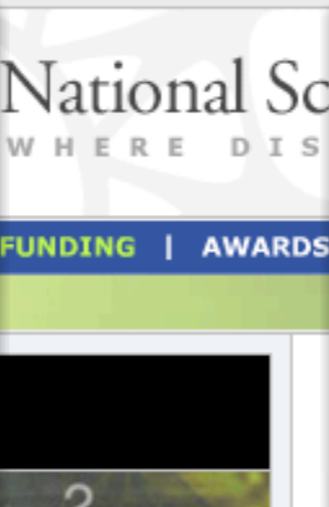
Collections, Communities & Guided Tours

Created by Curtis Wong and Jonathan Fay at MSR; AG is “Academic Partner” on the WWT Project

The (US) Backstory

2001 2008 (2010)

Science News
\$10 Million N
ScienceDaily (Oct
its users the world
research institutio
starting an ambitio
universe online.



See Also: (NVO), headed by astronomer Alex

NVO senior personnel:
Charles Alcock, University of Pennsylvania Kirk Borne, Astro
Tim Cornwell, NSF National Radio Astronomy Observatory
Optical Astronomy Observatory Giuseppina Fabbiano, Smit
Observatory Alyssa Goodman, [Harvard University](#) Jim Gray
Hanisch, Space Telescope Science Institute George Helou, N
Analysis Center Stephen Kent, Fermilab Carl Kesselman, [Un](#)
Miron Livny, University of Wisconsin, Madison Carol Lonsdo
and Analysis Center Tom McGlynn, GSFC/HEASARC/USRA A
University Reagan Moore, San Diego Supercomputer Cente
Naval Observatory, Flagstaff Station Ray Plante, [University](#)
Thomas Prince, California Institute of Technology Ethan Sch
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of Technology

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Management and Operation of the Virtual Astronomical Observatory

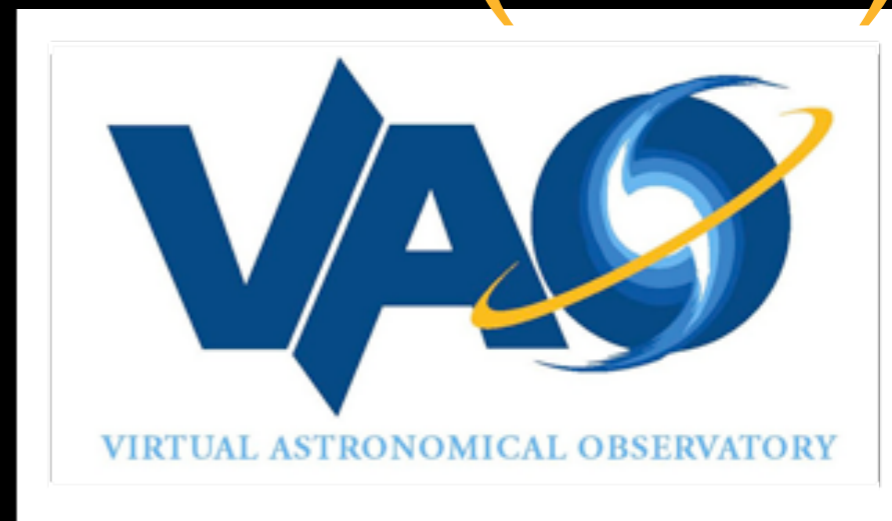
CONTACTS

Name	Email
Nigel Sharp	nsharp@nsf.gov
Eileen D. Friel	efriel@nsf.gov

PROGRAM GUIDELINES
Solicitation [08-537](#)

Please be advised that the NSF Proposal & Award Policies & Procedures (PAPPG) includes revised guidelines to implement the mentoring pro the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring that will be provided for such individuals. Proposals that do not comp this requirement will be returned without review (see the PAPP Guide Grant Proposal Guide Chapter II for further information about the implementation of this new requirement).

2001 2008 (2010)



and meanwhile...



Welcome to the New NVO Home Page! We welcome your [feedback](#) on the new site.

Discover, retrieve, and analyze astronomical data from archives and data centers around the world.

- Need help? Not sure how to start?** [Getting Started with NVO](#)
- Collect all data at a given position.** [DataScope](#)
- Count matches between catalog entries and given positions.** [Inventory](#)
- Query databases and cross-match object lists** [Open SkyQuery](#)
- Find data collections and catalogs by searching their descriptions.** [Directory](#)
- Integrate data from multiple positions and datasets.** [VIM](#)
- Query the VO from the command line.** [VO-CLI](#)
- Convert text tables to the VOTable format used by VO applications.** [Table Tools](#)
- Do more with NVO.** [Data Analysis & More](#)

AstroGrid Virtual Observatory Software for Astronomers

HOME INSTALL HELP SUPPORT

Welcome to AstroGrid

AstroGrid is the doorway to the Virtual Observatory (VO). We provide a suite of de... enable astronomers to explore and bookmark resources from around the world, find... in VOSpace, query databases, plot and manipulate tables, cross-match catalogues, an... to automate sequences of tasks. Tools from other Euro-VO projects inter-operate with...



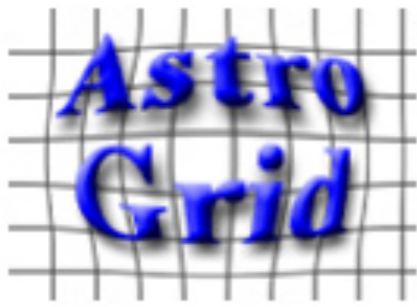
The Aladin Sky Atlas

[Download Aladin on your machine](#) [Start Aladin applet \(fr - us - de - in - uk - ca\)](#) [Jump to Aladin previewer](#) [français](#)

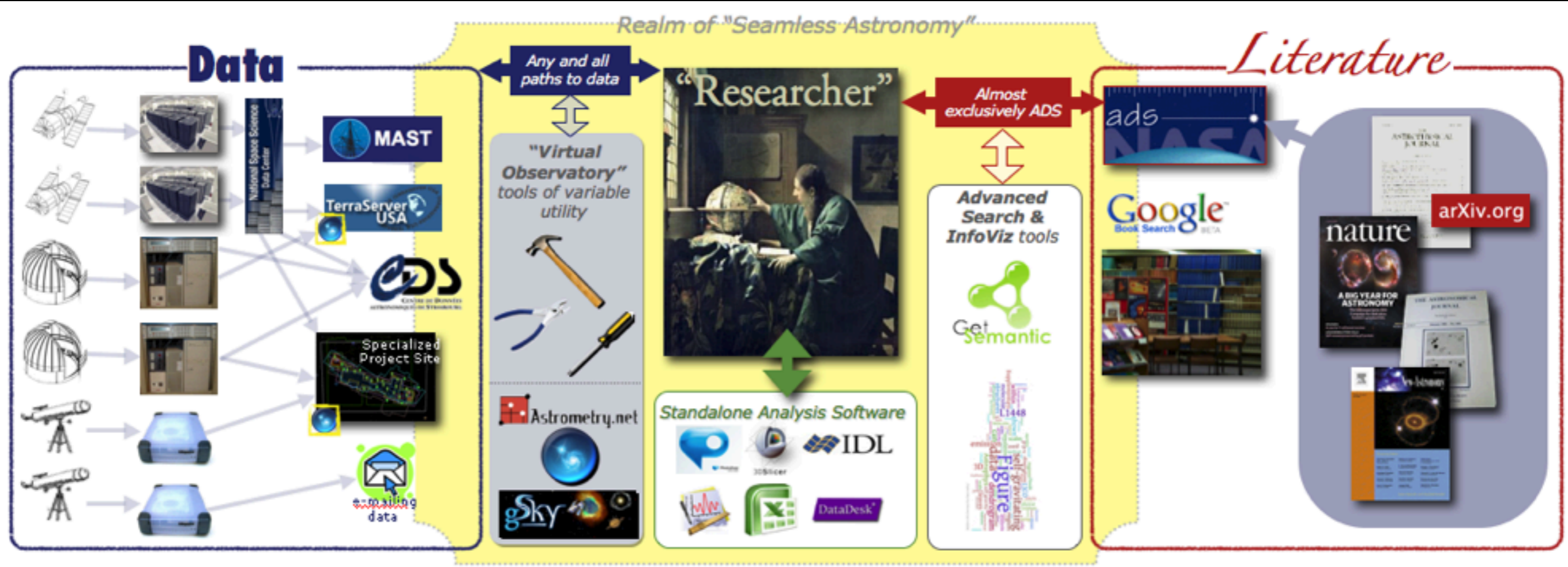
New: Aladin release 6 - April 2009
Measurement browser by [interactive histogram](#), [Outreach mode](#), [Full screen](#), [SAMP compatible](#), [RICE compression support](#), [etc...](#)

New: The Aladin manual - April 2009 - The full user manual in [English](#) and [French](#)...

Description Aladin is an interactive software sky atlas allowing the user to visualize digitized astronomical images, superimpose entries from astronomical catalogues or databases, and interactively access related data and information from the [Simbad database](#), the [VizieR service](#) and other archives for all known sources in the field ([see available data](#)). Created in 1999, Aladin has become a widely-used VO portal capable of addressing challenges such as locating data of interest, accessing and exploring distributed datasets, visualizing multi-wavelength data. Compliance with existing or emerging VO standards, interconnection with other visualisation or analysis tools, ability to easily compare heterogeneous data are key topics allowing Aladin to be a powerful data exploration and integration tool as well as a science enabler. The *Aladin sky atlas* is available in three modes: a Java Standalone application, a Java applet interface and a simple previewer.



Seamless Astronomy



But, that was 2009...

Realm of "Seamless Astronomy"

Data



2010
Evermore
Seamless
Astronomy

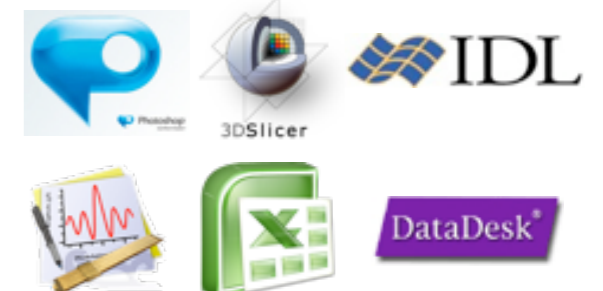
Advanced
Search &
InfoViz tools



Literature



Standalone Analysis Software



This simple argument, first made at the 2009 WWT session at American Astronomical Society Meeting, seems to be working...

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

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

When the concept of a "**Virtual Observatory**" (**VO**) was first discussed by future-looking astronomers in the mid-1990s, all thoughts were about **distributed data** and a **common system** to access it. But, information access on today's web primarily works in the **reverse**: **distributed tools** accessing **common data centers**. Capability and ease-of-use improvements to the web typically now come in the form of **nesting, aggregating or connecting tools**. Think **kayak.com**, iGoogle, or Bing Maps. In the "Seamless Astronomy" view to be discussed, today's "VO" should be thought of as the **ever-improving set of data archives, tools, interconnections**, and **standards** that strive to make astronomical research as "seamless" as travel research. The good news is that the cutting-edge of the astronomical research environment is moving rapidly in this seamless direction. The most savvy institutions are beginning to realize that the original VO model of data distributed on thousands of individual researchers' desktop hard drives is not a sustainable model, and that they need to offer **data hosting, archiving, and stewardship** services the way libraries offer such services for printed matter. **Software tools** are becoming much more **interoperable** thanks to protocols for message-passing such as "**SAMP**." And, the improved speed of **web applications** is to some extent removing platform-dependence as an obstacle to programmers and users alike. The bad news is that **most astronomers are largely unaware** of the tools that this new nirvana offers, and instead still conduct online research in the same way they did a decade ago. In this talk, I will focus in particular on how our recent work on connecting Microsoft's **WorldWide Telescope** program to other commonly-used astronomical research tools--most notably literature searching tools--has made the astronomical research environment more seamless. More generally, I will emphasize and demonstrate that an **ever-increasing diversity of tools** allow researchers to carry out a particular research task, so that the **important research** for the future lies in figuring out **how to make the tools, their interconnections, and their connections to data and literature resources useful and well-known to the astronomical community**.

From: Abstract Service <ads@cfa.harvard.edu>
 Subject: myADS Notification (Astronomy database)
 Date: March 23, 2010 12:19:23 AM EDT
 To: Alyssa Goodman



myADS Personal Notification Service
 for Alyssa Goodman
 Tue Mar 23 00:19:23 2010
 Astronomy database

- ADS Main Queries**
- [Astronomy](#) **GOODMAN, ALYSSA - Citations: 3310 (total 4002)**
 - [Physics](#) **2010NewA...15..444K: Karatas,+:** New intrinsic-colour calibration for uvby-beta photometry
 - [arXiv e-prints](#) **2010MNRAS.403.1054D: Dabringhausen,+:** Mass loss and expansion of ultra-compact dwarf galaxies through gas expulsion
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- 2010A&A...511A..90B: Breddels,+:** Distance determination for RAVE stars using stellar

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 Subject: **Your KAYAK Fare Alert: Boston (BOS) > Munich (MUC)**
 Date: March 26, 2010 3:52:30 AM EDT
 To: Alyssa Goodman
 Reply-To: Kayak Alert <alert@kayak.com>



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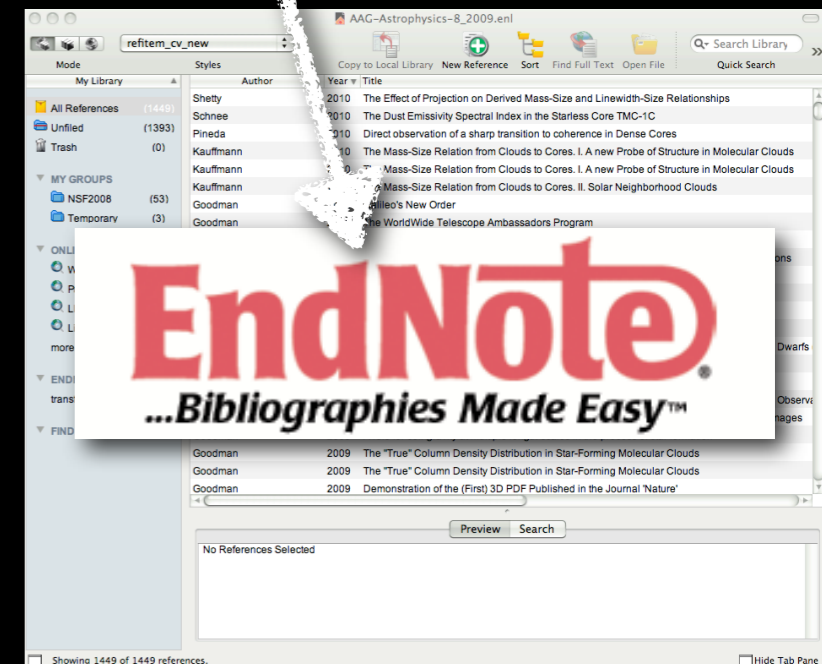
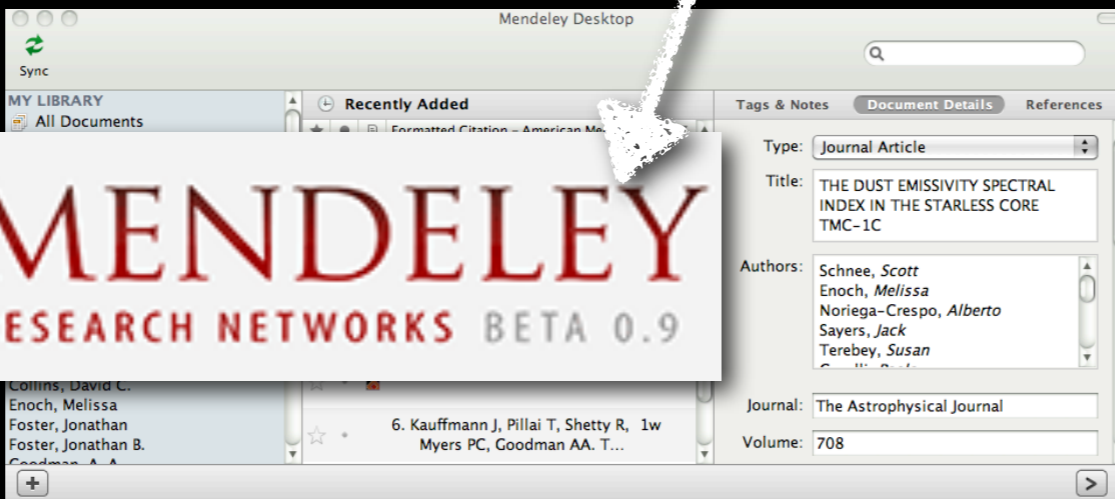
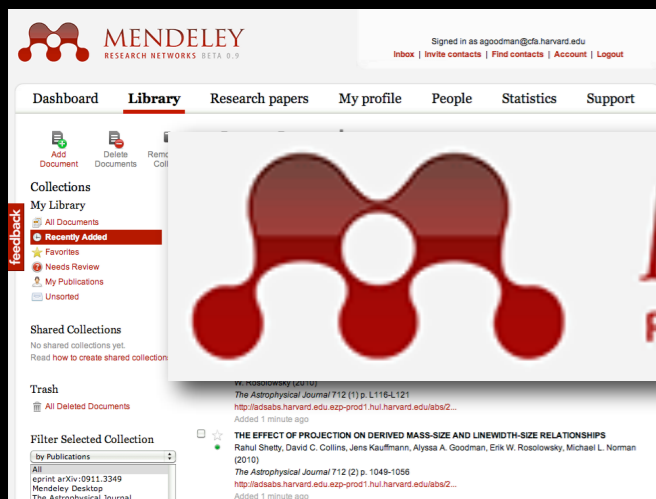
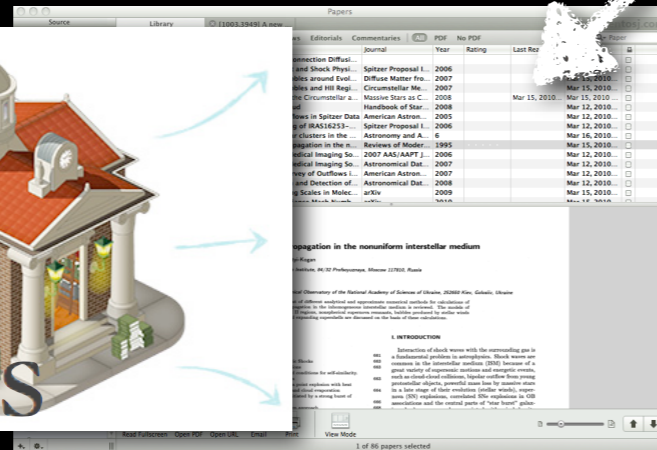
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Astronomers
 can see
 parallels...

Literature Handling: *Diverse Apps, Common Data*



What fraction of astronomy researchers know about these tools?

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add more file storage | Donate

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Search documentation | Search

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the Circumstell...	2008		Mar 15, 2010	
Massive Stars as C...	2008		Mar 15, 2010	
Handbook of Star...	2008		Mar 12, 2010	
News in Spitzer Data...	2005		Mar 12, 2010	
American Astron...	2005		Mar 12, 2010	
Spitzer Proposal I...	2006		Mar 12, 2010	
Clusters in the...	2006		Mar 16, 2010	
Astronomy and A...	6		Mar 15, 2010	
propagation in the n...	1995		Mar 15, 2010	
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ary of Outflows I...	2007		Mar 12, 2010	
American Astron...	2007		Mar 12, 2010	
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arXiv			Mar 15, 2010	

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Authors: Schnee, Scott
Enoch, Melissa
Noriega-Crespo, Alberto
Sayers, Jack
Terebey, Susan
Journal: The Astrophysical Journal
Volume: 708

Collins, David C.
Enoch, Melissa
Foster, Jonathan
Foster, Jonathan B.
Goodman, A. A.

6. Kauffmann J, Pillai T, Shetty R, 1w
Myers PC, Goodman AA. T...

AAG-Astrophysics-8_2009.enl

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Author	Year	Title
Shetty	2010	The Effect of Projection on Derived Mass-Size and Linewidth-Size Relationships
Schnee	2010	The Dust Emissivity Spectral Index in the Starless Core TMC-1C
Pineda	2010	Direct observation of a sharp transition to coherence in Dense Cores
Kauffmann	2010	The Mass-Size Relation from Clouds to Cores. I. A new Probe of Structure in Molecular Clouds
Kauffmann	2010	The Mass-Size Relation from Clouds to Cores. II. Solar Neighborhood Clouds
Kauffmann	2010	The Mass-Size Relation from Clouds to Cores. I. A new Probe of Structure in Molecular Clouds
Goodman	2010	Galileo's New Order
Goodman	2010	The WorldWide Telescope Ambassadors Program

EndNote

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39 papers

$P=1.14 \times 10^{-2}$
[34] [arXiv:1003.4900 \[pdf\]](#)

Star-forming gas in young clusters

[Philip C. Myers](#)

Comments: To appear in Astrophysical Journal, May 2010

Subjects: Galaxy Astrophysics (astro-ph.GA)

Initial conditions for star formation in clusters are estimated for protostars whose masses follow the initial mass function (IMF) from 0.05 to 10 solar masses. Star-forming infall is assumed equally likely to stop at any moment, due to gas dispersal dominated by stellar feedback. For spherical infall, the typical initial condensation must have a steep density gradient, as in low-mass cores, surrounded by a shallower gradient, as in the clumps around cores. These properties match observed column densities in cluster-forming regions when the mean infall stopping time is 0.05 Myr and the accretion efficiency is 0.5. The infall duration increases with final protostar mass, from 0.01 to 0.3 Myr, and the mass accretion rate increases from 3 to $300 \times 10^{(-6)}$ solar masses/yr. The typical spherical accretion luminosity is ~ 5 solar luminosities, reducing the luminosity problem to a factor ~ 3 . The initial condensation density gradient changes from steep to shallow at radius 0.04 pc, enclosing 0.9 solar masses, with mean column density $2 \times 10^{(22)}$ $\text{cm}^{(-2)}$, and with effective central temperature 16 K. These initial conditions are denser and warmer than those for isolated star formation.

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[NAME BUTTERFLY NEBULA \(4\)](#)
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[V* V1042 Cyg \(3\)](#)
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[PN G208.5+33.2 \(3\)](#)
[NOVA Aql 1919 \(3\)](#)
[NGC 7009 \(3\)](#)
[NGC 6537 \(3\)](#)
[NGC 3132 \(3\)](#)
[NGC 2440 \(3\)](#)
[NGC 2359 \(3\)](#)
[NGC 891 \(3\)](#)
[NAME MAGELLANIC CLOUDS \(3\)](#)
[NAME LOCAL GROUP \(3\)](#)
[NAME HOMUNCULUS NEBULA \(3\)](#)
[NAME FROSTY LEONIS NEBULA \(3\)](#)

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#	Bibcode	Score	Date	List of L	Access
	Authors	Title			
1	<input type="checkbox"/> 1995RvMP...67..661B Bisnovatyi-Kogan, G. S.; Silich, S.	19.000	Jul 1995	A E	
2	<input type="checkbox"/> 1999NewAR..43...31F Frank, A.	18.000	May 1999	A E	
3	<input type="checkbox"/> 2007ARA&A..45..177C Crowther, Paul A.	13.000	Sep 2007	A E F X	R C c S U
4	<input type="checkbox"/> 2002ARA&A..40..439B Balick, Bruce; Frank, Adam	13.000	n/a 2002	A E F	R C c S U
5	<input type="checkbox"/> 2008A&ARv..16..209P Puls, Joachim; Vink, Jorick S.; Najarro, Francisco	12.000	Dec 2008	A E X	R C c U
6	<input type="checkbox"/> 2005ApJ...631..435R Ramirez-Ruiz, Enrico; García-Segura, Guillermo; Salmonson, Jay D.; Pérez-Rendón, Brenda	12.000	Sep 2005	A E F X	R C c S U
7	<input type="checkbox"/> 1992ARA&A..30..235C Chiosi, Cesare; Bertelli, Gianpaolo; Bressan, Alessandro	12.000	n/a 1992	A G	T R C c S U



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winds and shells from stars

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ngc 7023

Plot Results

VO Search

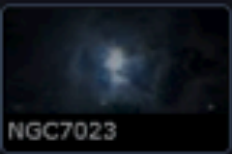
J2000

RA

Dec

Go

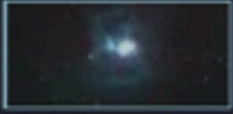
1 of 2



NGC7023



Finder Scope



Classification:
Reflection Nebula
in Cepheus

NGC 7023

RA:	21h01m36s	Magnitude:	n/a
Dec:	68 : 10 : 11	Distance:	n/a
Alt:	30 : 55 : 38	Rise:	Circumpolar
Az:	341 : 36 : 56	Transit:	Circumpolar
		Set:	Circumpolar

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Research Show Object Close

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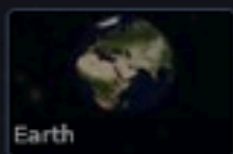
Sky

Digitized Sky Survey (Opt)

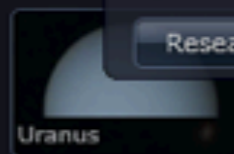
<http://www.jacknewton.com/>



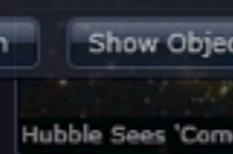
Sculptor



Earth



Uranus



Hubble Sees 'Coma'



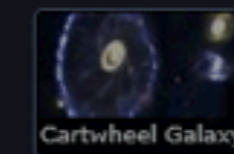
NGC 300



Sculptor Galaxy



Cartwheel Galaxy

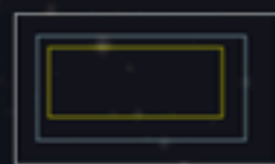


Cartwheel Galaxy



Cepheus

00:14:04



RA : 21h01m36s

Dec : 68:10:11

1 of 23

ngc 7023

Plot Results

VO Search

J2000

RA

Dec

Go

1 of 2

NGC7023

Finder Scope



Classification: Reflection Nebula in Cepheus

NGC 7023

RA: 21h01m36s Magnitude: n/a
Dec: 68 : 10 : 11 Distance: n/a
Alt: 30 : 53 : 38 Rise: Circumpolar

Az: 341.5 Alt: 30.9 Circumpolar
Set: 10.1 Set: 10.1 Circumpolar

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- Virtual Observatory Searches
- Set as Foreground Imagery
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Look At

Imagery

Sky

Digitized Sky Survey (Optical)

Sculptor

Earth

Uranus

Properties

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1 of 23

N

Cepheus

00:1



RA : 21h01m36s
Dec : 68:10:11

Done

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Retrieved 200 abstracts, starting with number 1. Total number selected: 393.

Sort options

#	Bibcode Authors	Score	Date	List of Links Access Control Help
1	<input type="checkbox"/> 2009ApJ...700.1609M Myers, Philip C.	1.000	08/2009	A Z E F L X R C S U
2	<input type="checkbox"/> 2009ApJ...700.1190D Desai, Vandana; Soifer, B. T.; Dey, Arjun; LeFloc'h, Emeric; Armus, Lee; Brand, Kate; Brown, Michael J. I.; Brodwin, Mark; Jannuzi, Buell T.; Houck, James R.; and 8 coauthors	1.000	08/2009	A Z E F L X R C S U
3	<input type="checkbox"/> 2009MNRAS.396.1851N Nutter, D.; Stamatellos, D.; Ward- Thompson, D.	1.000	07/2009	A Z E F L X R S U
4	<input type="checkbox"/> 2009A&A...502..175B Boersma, C.; Peeters, E.; Martín- Hernández, N. L.; van der Wolk, G.; Verhoeff, A. P.; Tielens, A. G. G. M.; Waters, L. B. F. M.; Pel, J. W.	1.000	07/2009	A Z E F L R S U
5	<input type="checkbox"/> 2009MNRAS.395.1695H Hernán-Caballero, A.; Pérez-Fourmon, I.; Hatziminaoglou, E.; Afonso-Luis, A.; Rowan-Robinson, M.; Rigopoulou, D.; Farrah, D.; Lonsdale, C. J.; Babbedge, T.;	1.000	05/2009	A Z E F L X R C S U

ngc 7023

Plot Results

VO Search

J2000

RA

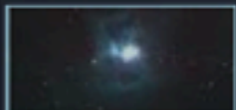
Dec

Go

1 of 2

NGC7023

Finder Scope



Classification:
Reflection Nebula
in Cepheus

NGC 7023

RA: 21h01m36s Magnitude: n/a
Dec: 68 : 10 : 11 Distance: n/a
Alt: 30 : 53 : 38 Rise: Circumpolar

Az: 341.5 Alt: 30.9 Az: 341.5 Alt: 30.9
Set: 00:00:00 Set: 00:00:00

- Name: NGC 7023
- Information
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Earth

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Hubble Sees 'Comet'

NGC 300

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Cartwheel Galaxy

N

Cepheus

00:1

1 of 23



RA : 21h01m36s
Dec : 68:10:11

Done



SIMBAD query result

[other query modes :](#)
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Object query : NGC 7023

C.D.S. - SIMBAD4 rel 1.132 - 2009.10.23CEST21:59:31

[Available data](#)[Basic data](#)[Identifiers](#)[Plot & images](#)[Bibliography](#)[Measurements](#)[External archives](#)[Notes](#)

Basic data :

NGC 7023 -- Open (galactic) Cluster

[query around](#) with radius arcmin

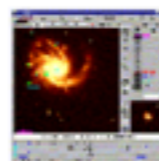
Other object types: **C1*** (C,C1,[BDB2003]) ,**OpC** (OCISM) ,**HII** (LBN) ,**V*** (AAVSO) ,**IR** (IRAS)
 ICRS coord. (ep=2000): 21 01 36.9 +68 09 48 (-) [- - -] D -
 FK5 coord. (ep=2000 eq=2000): 21 01 36.9 +68 09 48 (-) [- - -] D -
 104.0616 +14.1926 (-) [- - -] D -
 Fluxes (I): **B** 7.20 [-] D -

Identifiers (11) :

NGC 7023	IRAS 20599+6755	LBN 487	IBDB2003 G104.06+14.19
C 2059+679	IRAS F20599+6755	OCISM 50	AAVSO 2044+67
C1 VDB 139	LBN 104.08+14.21	OCL 235	

Plots and Images

[plot around](#)
 radius arcmin

[Aladin previewer](#)[Aladin applet](#)

References (371 between 1983 and 2009)

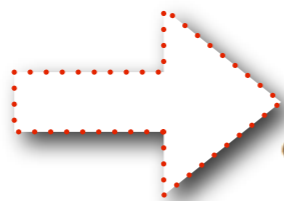
Simbad bibliographic survey began in 1950 for stars (at least bright stars) and in 1983 for all other objects (outside the solar system).

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

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Subject Area Search:

- Most popular
- Most useful
- Most instructive

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*“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

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#	Bibcode	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)

And now we got to NGC 7023 by using the literature as a filter.

The screenshot displays the Microsoft WorldWide Telescope Web Client interface. At the top, 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'. Below the menu, a breadcrumb trail reads 'Collections > Open Collections > Link Collection >'. A small thumbnail of NGC 7023 is visible in the top left corner, labeled 'NGC 7023'. The main view area shows a large, detailed image of the star-forming region NGC 7023, characterized by a bright central star and surrounding blue nebulae. At the bottom, a control panel includes 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 side of the control panel, there is a '1 of 1' indicator, a compass rose, a map of the Cepheus constellation with a yellow box highlighting the target area, and the coordinates 'RA : 21h01m37s' and 'Dec : 68:09:48'. The bottom left corner of the interface shows the text 'Done'.

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INTRODUCTION PRESS RELEASE VISUALS QUICK FACTS



Embedded Outflow in HH 46/47 Spitzer Space Telescope • IRAC
NASA / JPL-Caltech / A. Noriega-Crespo (SSC/Caltech) 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

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Embedded Outflow in HH 46/47

Spitzer Space Telescope • IRAC

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

Image visible light (0209) ssc2003-064

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

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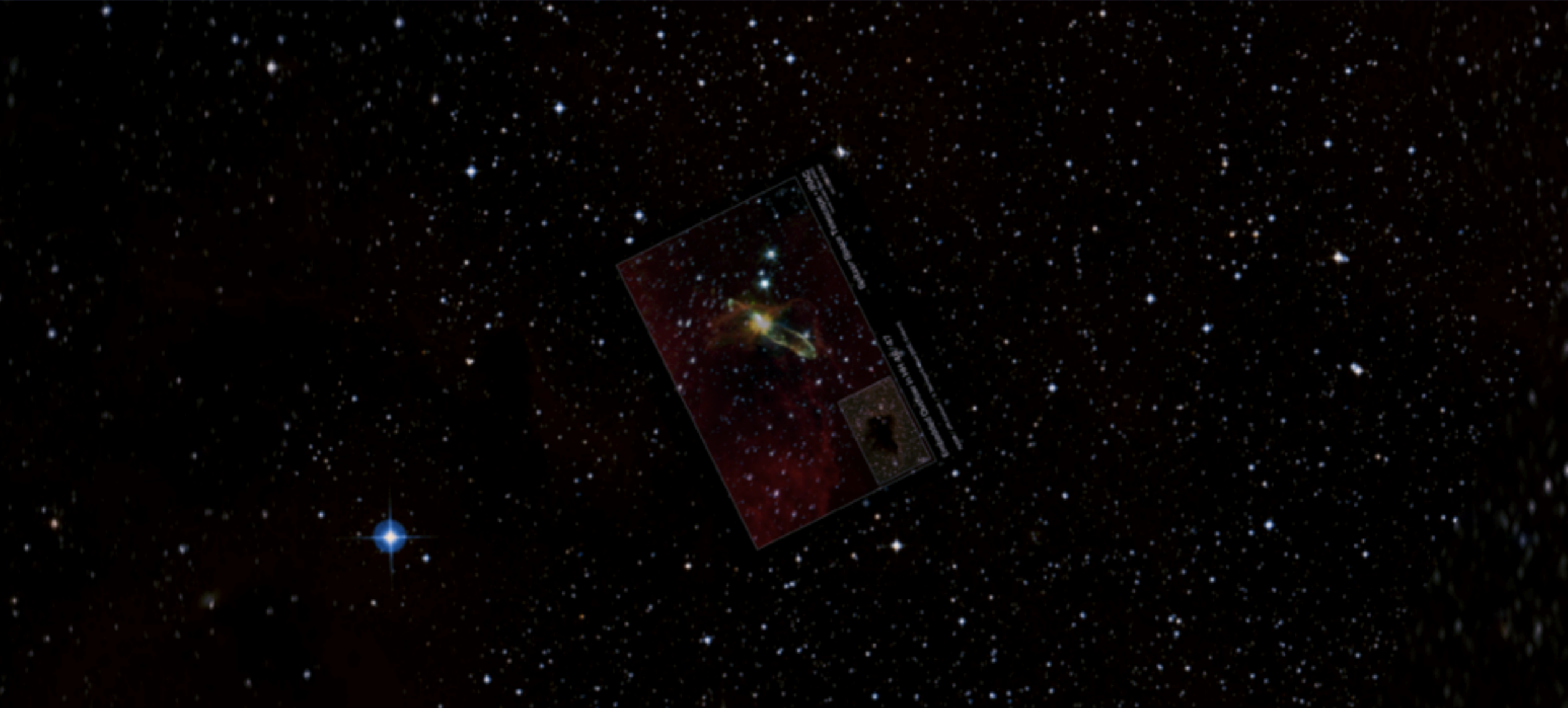
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View

Settings

Collections > Open Collections > HH4647 >

1 of 1



Look At: Sky (dropdown)

Imagery: Digitized Sky Survey (Optical) (dropdown)

Info: [Info icon]

Image Crossfade: [Slider]

Navigation: 1 of 1

Map: Vela constellation map with a yellow box indicating the current view area. RA: 08h25m39s, Dec: -51:01:10

Thumbnail: Bubbly Little Star

Coming (Very) Soon...

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



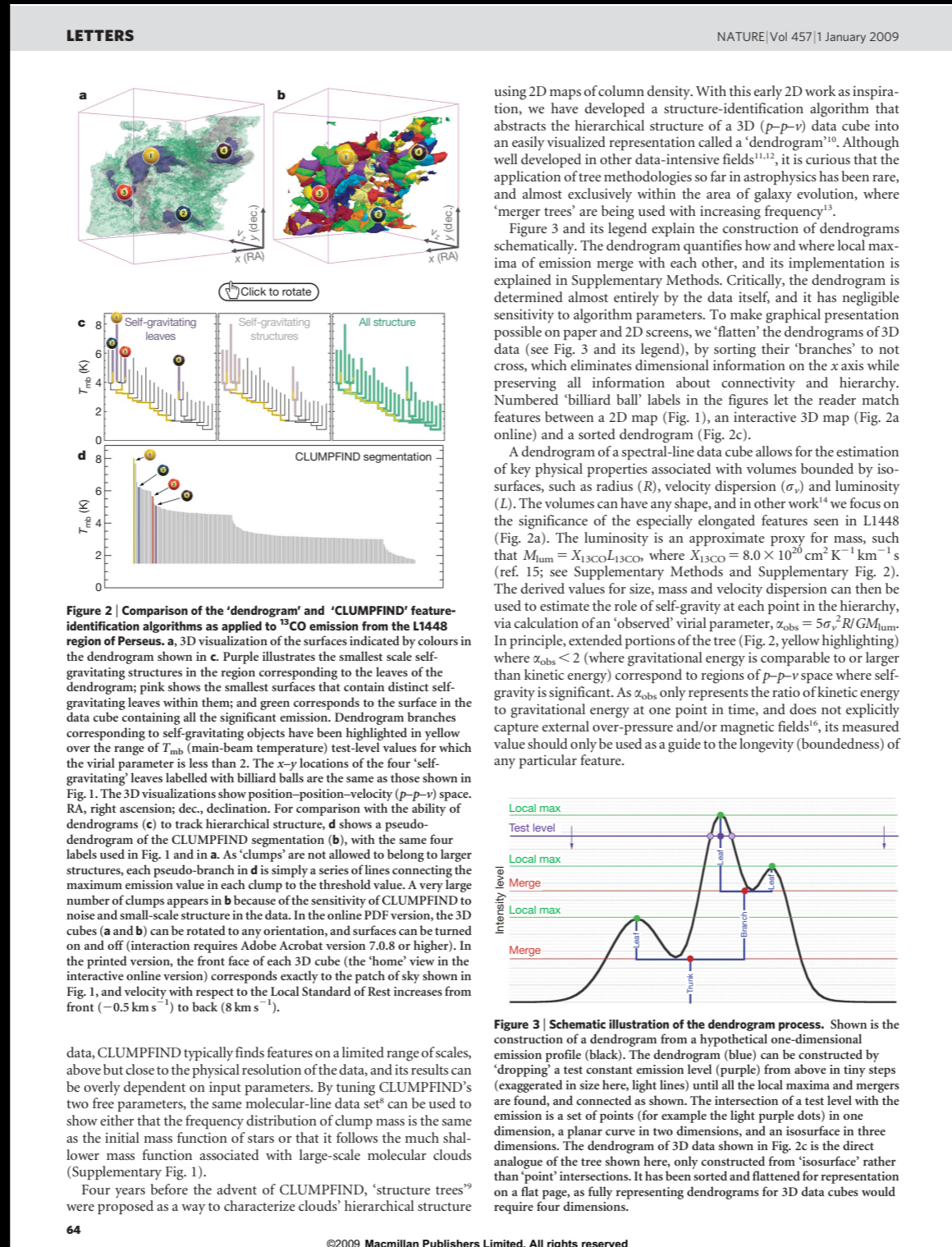
Faceted Heat
Map of Articles
on the Sky

The image shows a world map with a color-coded overlay representing the density of articles. The colors range from blue (low density) to red (high density). A legend at the top indicates percentages: 0%, 50%, and 100%. The map shows high concentrations of articles in North America and Europe. Text overlays on the map include "SecurityMax", "Sasser", "Blaster" and "MyDoom": Why Your Network Can't Stop Them Internal Security Webinar, "Virtual Patch" is a product that can be configured to fill gaps in a network's security, "The Virtual Patch" is a product that can be configured to fill gaps in a network's security, "Monday, December 13th", "Register Now", and "Book Address".

[e.g.ADS-CDS-WWT]

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

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



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).

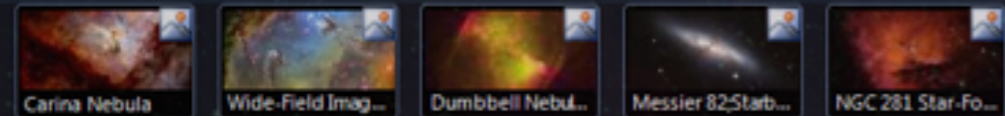
A dendrogram of a spectral-line data cube allows for the estimation of key physical properties associated with volumes bounded by isosurfaces, such as radius (R), velocity dispersion (σ_v) and luminosity (L). The volumes can have any shape, and in other work¹⁴ we focus on the significance of the especially 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.

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



Studies >



“Old Data”

astrometry.net/flickr/WWWT

“New Data”

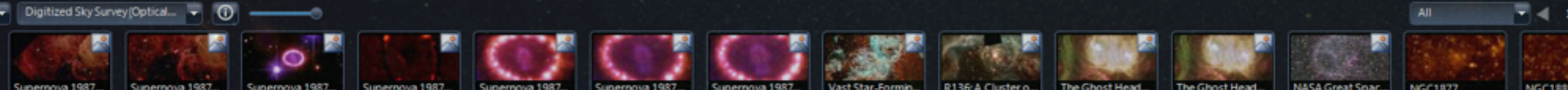
WWWT/ADS/SIMBAD/NAO

WWWT as API

“Your Data”

3D PDF

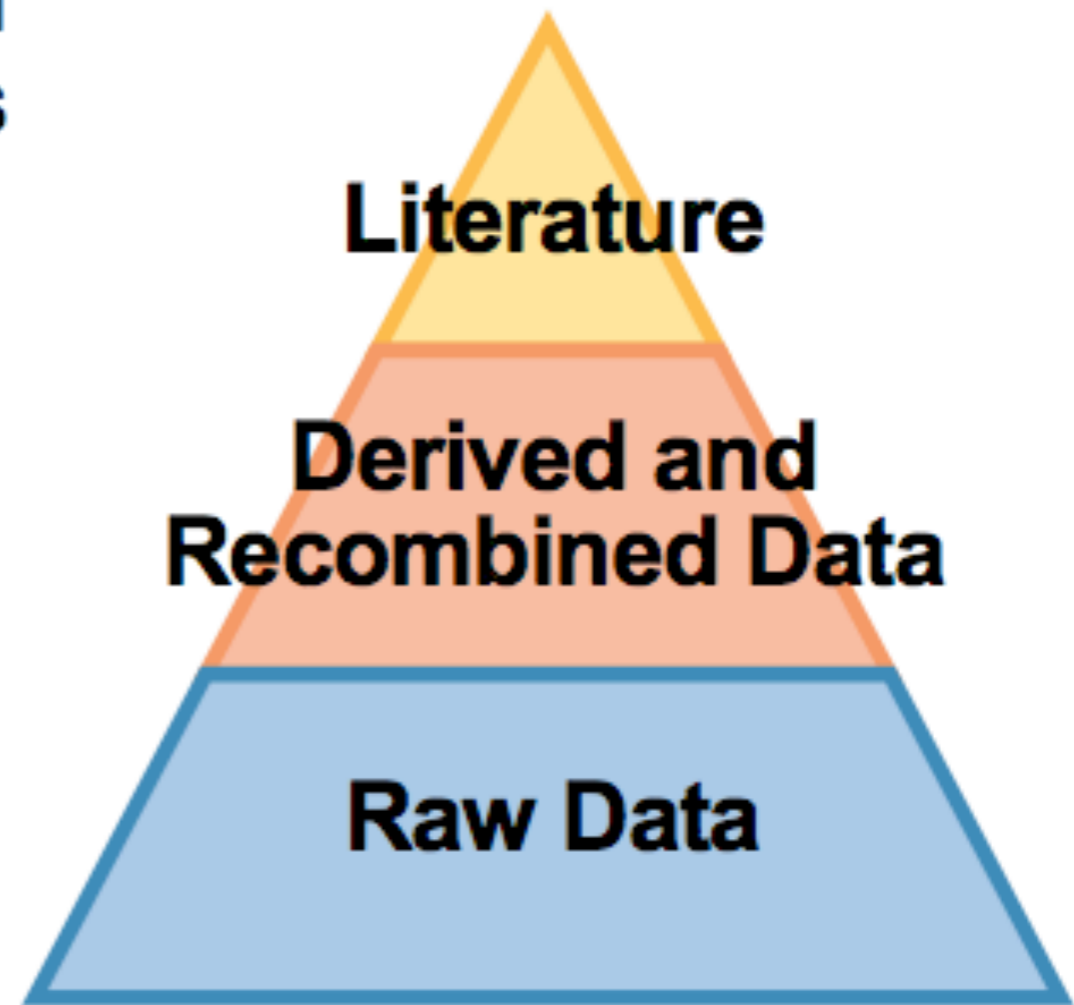
“My Data”



Jim Gray (& Alex Szalay) had it right (in 2004)

All Scientific Data Online

- Many disciplines overlap and use data from other sciences
- Internet can unify all literature and data
- Go from literature to computation to data back to literature
- Information at your fingertips for everyone-everywhere
- Increase Scientific Information Velocity
- Huge increase in Science Productivity



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



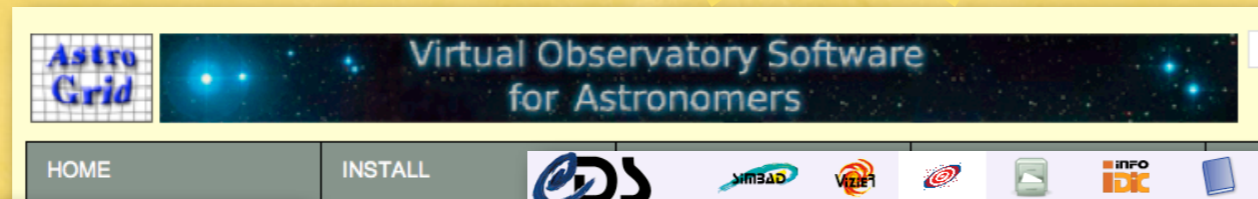
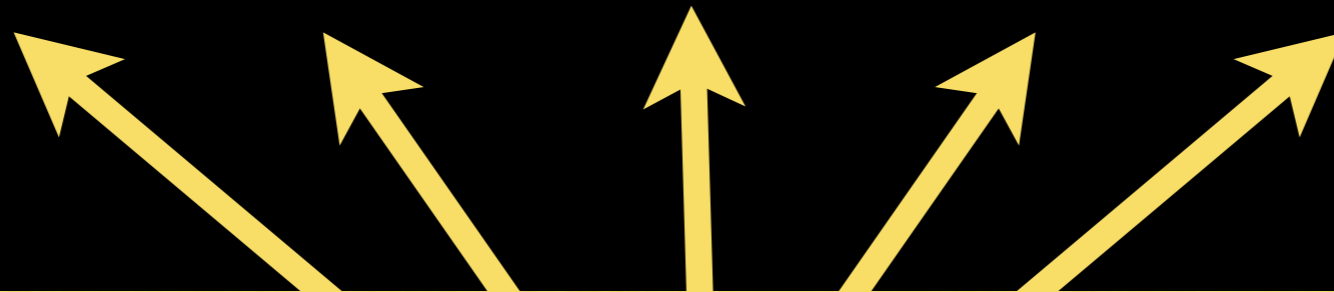
User Groups
(CfA now has one)



+Suggestions?!



User Groups (CfA now has one)



NVO
NATIONAL VIRTUAL OBSERVATORY
...the Universe at your fingertips

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

Discover, retrieve, and analyze astronomical data from archives and data centers around the world.

- Need help? Not sure how to start? [Getting Started with NVO](#)
- Collect all data at a given position. [DataScope](#)
- Count matches between catalog entries and given positions. [Inventory](#)
- Query databases and cross-match object lists. [Open SkyQuery](#)
- Find data collections and catalogs by searching their descriptions. [Directory](#)
- Integrate data from multiple positions and datasets. [VIM](#)
- Query the VO from the command line. [VO-CUI](#)
- Convert text tables to the VOTable format used by VO applications. [Table Tools](#)
- Do more with NVO. [Data Analysis & More](#)

Aladin
CENTRE DE DONNÉES ASTRONOMIQUES DE STRASBOURG

Simbad VizieR Aladin Catalogs Dictionary Biblio Tutorials Developers

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 and paste data 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 | IIG

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.

Home

[Blog](#)
[Calendar](#)
[Contributors](#)
[Description](#)
[Files](#)
[Glossary](#)
[Planning](#)
[Presentations](#)
[Resources](#)
[Surveys](#)
[Workflows](#)
[Sitemap](#)

Discussion (Google Group)



[Join the Discussion](#)

Friends

[Astrobetter](#)
[Astropython](#)
[VOA](#)
[VAO](#)

My recent activity

There are no recent activities.

6

days since
User Group Meeting

Home



This website provides a platform for sharing resources, workflows, and basic organizational information about networked astronomy databases and tools. Its intended audience includes anyone performing astronomical research online. It originated from the activities of scientists at the Harvard Smithsonian Center for Astrophysics in Cambridge, MA.

By Virtual Observatory (VO), we mean all forms of network tools, databases and websites that are utilized for astronomical research.

By Users Group, we mean a group of individuals who meet approximately monthly to discuss their solutions and problems with doing their research online.

Messages

[More on NSF data management...](#) Since the ScienceInsider article, NSF has since issued a press release about requiring data management plans as part of all NSF funding proposals starting in October 2010: "This is the ..."
Posted May 12, 2010 12:23 PM by August Muench

[May 2010 Meeting reminder.](#) This is a reminder that the next VO users group meeting is: Tomorrow, May 7th 10-11am Pratt Conference Room. Data "publishing" is the subject for our meeting and I ...
Posted May 6, 2010 1:41 PM by August Muench

[NSF Guidelines on Data Access](#) ScienceInsider reports that NSF is moving towards requiring that a data management plan to be submitted as part of future NSF grant applications. To quote: "NSF's current policy requires ..."
Posted May 6, 2010 1:23 PM by August Muench

[May 2010 Meeting date/time](#) Our next meeting will be 10-11am Friday May 7th in the Pratt Conference room (60 Garden Street). Our inaugural meeting touched on many topics from software to data archiving ...
Posted Apr 28, 2010 1:14 PM by August Muench

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

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

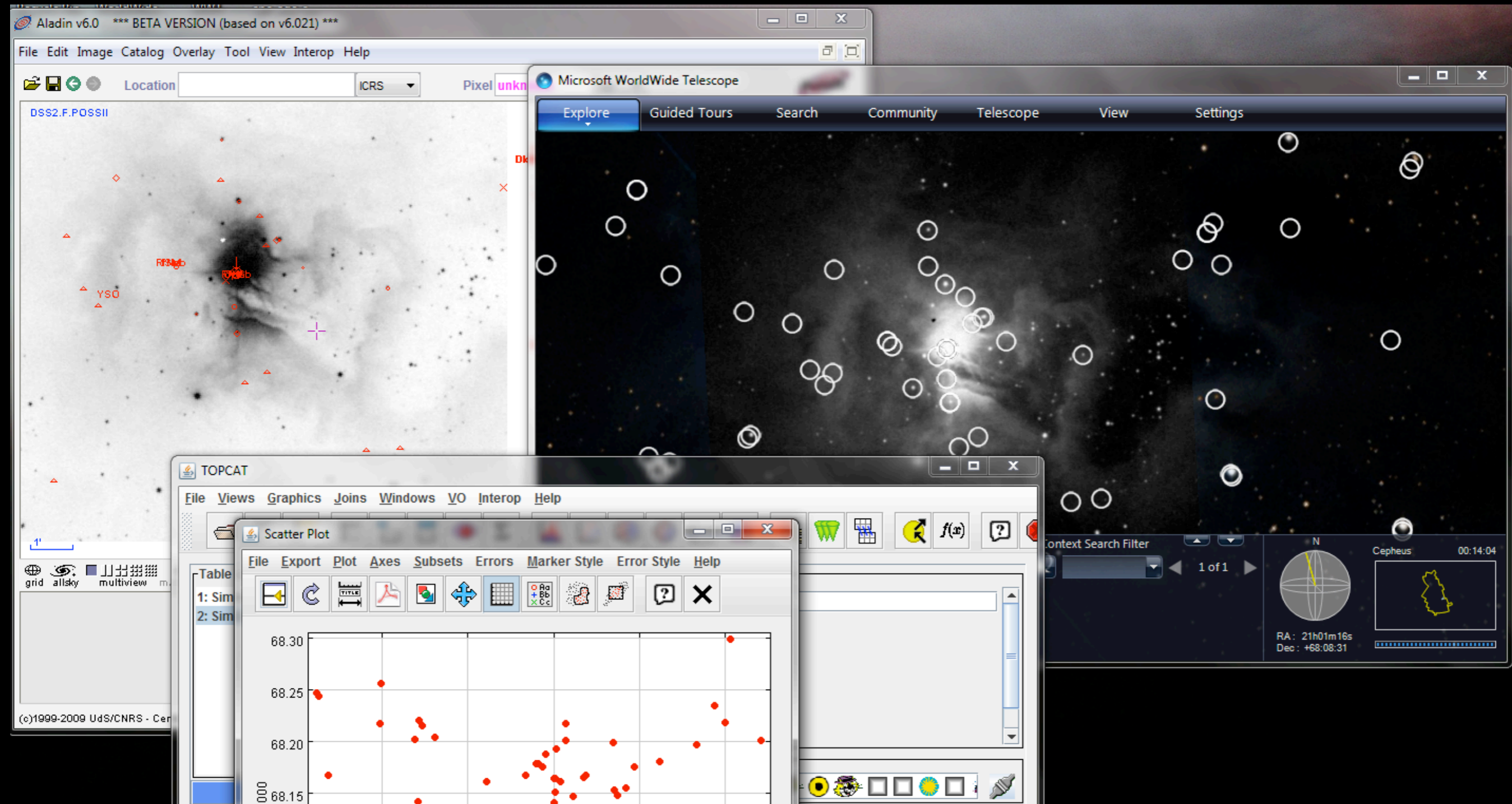
Now being implemented through VAO “Associates”
and WWT Partners.



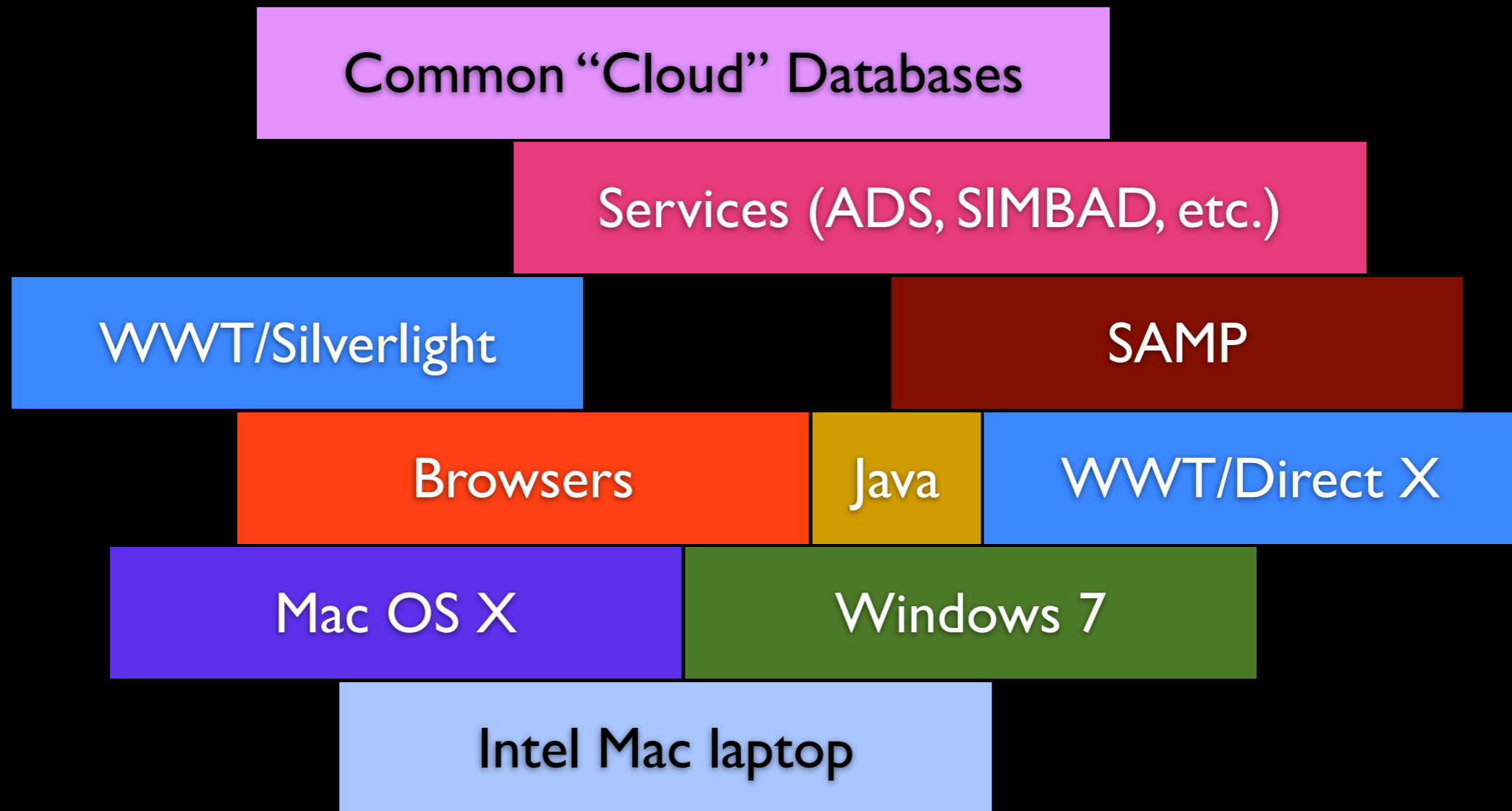
How do we organize such diverse tools, so as to make them interoperably useful?....

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

SAMP



Think about the “modules” needed to make this work...but do the details matter, to your research, if the system works seamlessly?



Seamless Astronomy

AstroNavigator

Literature Viewer

Project 1 Project 2 Project 3 Edit

QSO MgII absorption lines observed

Authors: Drinkwater, Webster R.L., et al.

Description: The results of a large R-band

Fraction of Emission in Self-gravitating Structures vs Scale (pc)

Beam Size

L1448

Simulation

Data Viewer (e.g. WWT)

Ar3Dive Browser

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

Top Stories

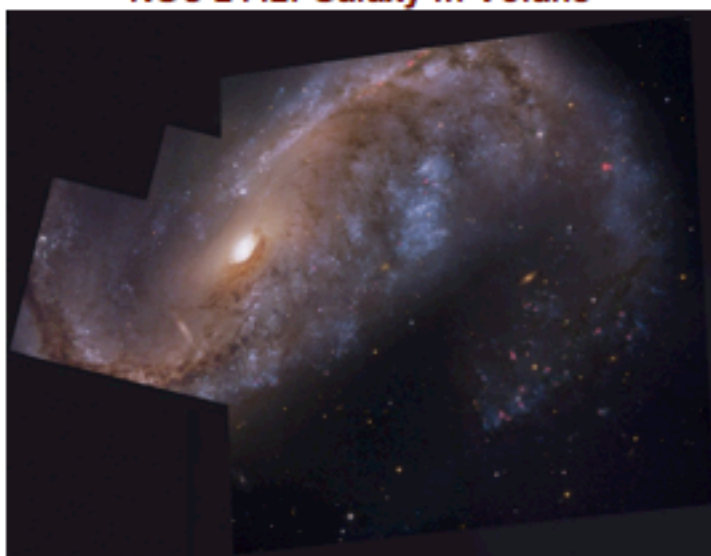
- [Obama Promotes New Health Care Law](#)
Voice of America - [all 26785 related »](#)
- [Waste issue hurting US nuclear revival-panel](#)
Reuters - [all 92 related »](#)
- [Dems, GOP Trade Accusations of Politically Exploiting Threats](#)
FOXNews - [all 900 related »](#)
- [Pope accountable for hiding 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](#) >

Currency Converter

Weather

Cambridge, MA



58°F

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

Thu	Fri	Sat	Sun
65° 39°	39° 22°	41° 31°	50° 44°

College Park, MD



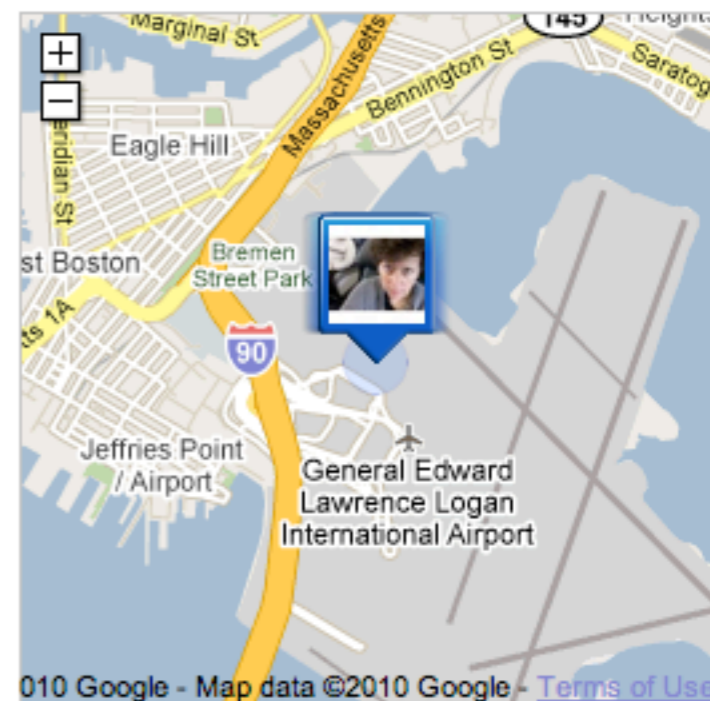
72°F

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

Thu	Fri	Sat	Sun
74° 49°	49° 32°	52° 40°	59° 50°

Google Translate

Google Latitude



AstroNavigator

Project 1 Project 2 Project 3 Edit

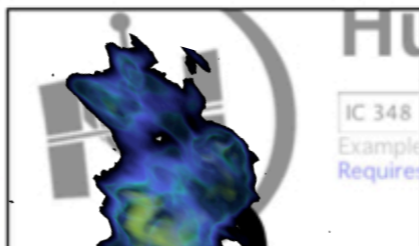
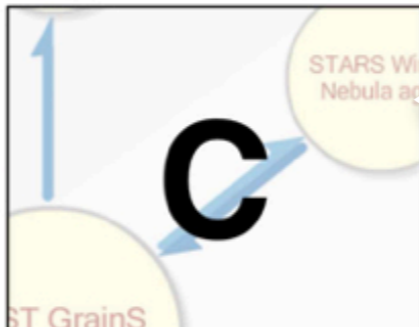
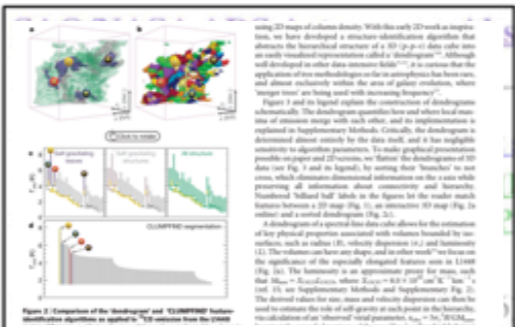
QSO MgII absorption lines observed

Authors **A**

Drinkwater, Webster R.L., et al.

Description

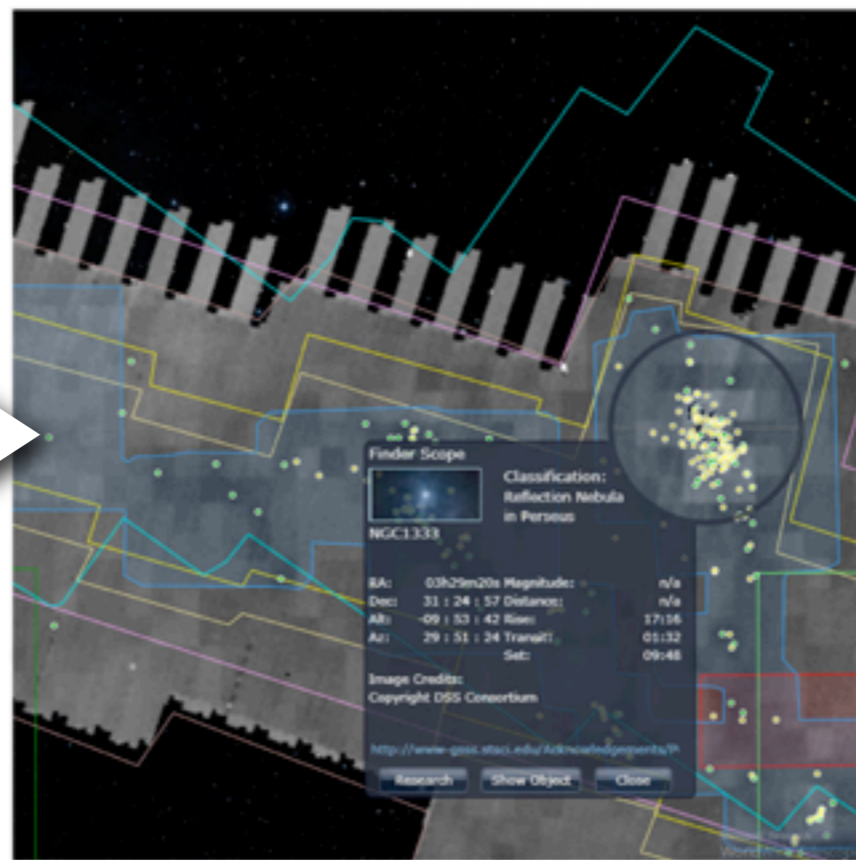
The results of a large R-band



COMPLETE Data Coverage Tool

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

newKodak EXPLO Bing WWTSL Alyssa Good... Home Page Toodledo Harvard IC: Projects Wikis Etc... Google Calendar \$\$\$ Image Search* Tbl share Directories* ADS Best RSS (1387)* BeyondADS*



COMPLETE Data Available

Control Panels: Control Panels Control Servers

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,Ks)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
IRAM 30-m: N2H+ 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/MTT: 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

Fiction
(but soon fact!)

Fact
(right now)

Collaborative Astronomy at University of Washington

- **Research in a Browser**

- **“iGoogle” for Astronomy**

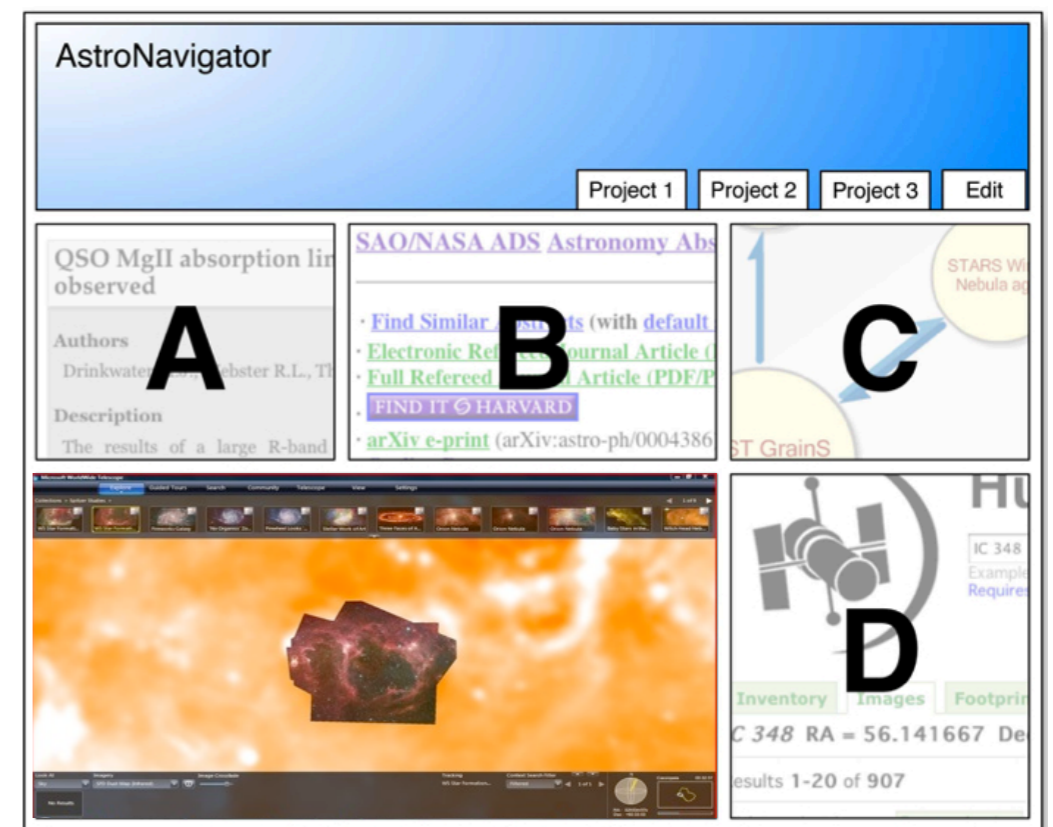
- Collections of simple atomic applications (gadgets)
 - Users choose the view they want
 - All gadgets can communicate with each other

- **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)



Select Gadgets

Rearrange based on your preference

The screenshot displays the SISIS Gadget Server interface. At the top, there is a navigation bar with the SISIS logo and 'Gadget Server' text. On the right, it shows 'Signed-in as ajc | Sign-out | Help'. Below this is a toolbar with buttons for '+ Add Gadgets', '+ Add New Tab', '+ Clone Active Tab', and '+ Remove Active Tab'. The main workspace contains several gadgets: 'Input Coords' with RA and dec input fields 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 is currently empty; and 'Sky Viewport' which displays a star map with constellation labels (Ursa Major, Lynx, Leo Minor, Cancer, Gemini, Leo, Canis Minor, Sextans, Monoceros) and a navigation control. At the bottom of the sky map, it shows coordinates: 'RA 8h40m58.67s, Dec 25°00'00.00'' and a 'Terms of Use' link.



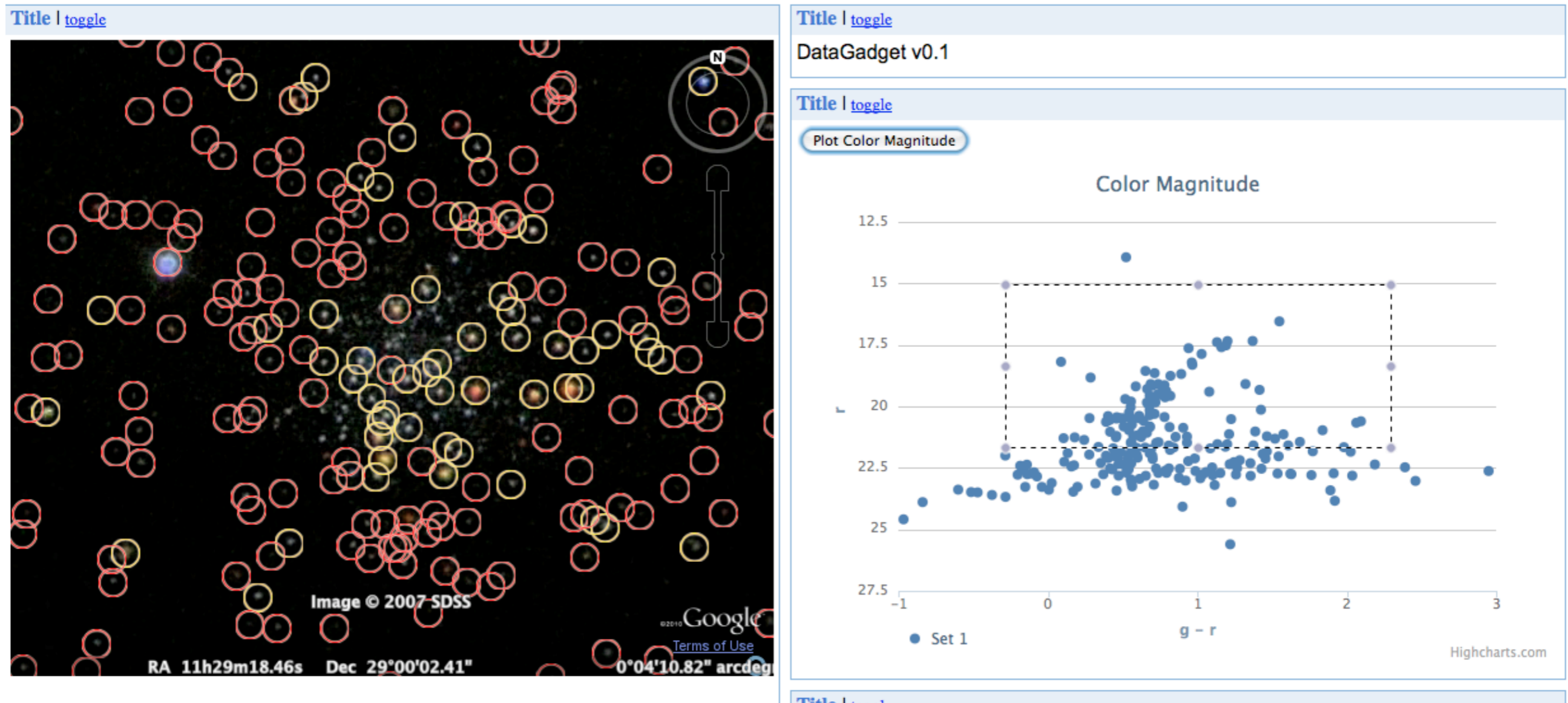
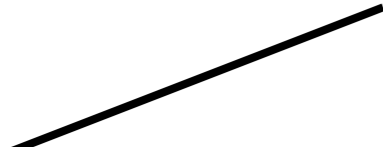
Query the SDSS based on viewport
Name resolver and zoom to field
and return the source overlaid on images

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 features several gadgets: "Sky Viewport" (a star field with red circles and labels like "Messier 87", "IC 3443", "NGC 4478", and coordinates "RA 12h30m10.20s Dec 12°24'55.39" 0°28'24.0"); "DataGadget v0.1" (a central hub); "Get Sky Objects" (with a dropdown for "SDSS", a "Max: 50" field, and a "Get Objects" button); "Input Coords" (with "RA:" and "dec:" input fields and a "GO" button); and "Name Resolve" (with an "m87" input field and a "Go" button). Arrows from the text above point to the Sky Viewport, DataGadget, Get Sky Objects, and Input Coords gadgets. A large arrow at the bottom points from the text "All gadgets communicate through the data gadget" to the DataGadget.

All gadgets communicate through the data gadget



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*

Pat Udomprasert

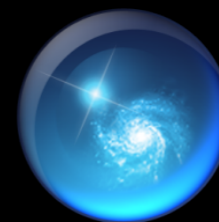
WWTA Program Coordinator

Annie Valva

WGBH Interactive, Director of Research & Development

Curtis Wong

Microsoft Research, WWT & More



WWT Ambassadors

Who?

Harvard/CfA, WGBH and Microsoft Research staff in collaboration with Volunteer Ambassadors

What?

Future-leaning way to teach and learn STEM concepts

How?

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

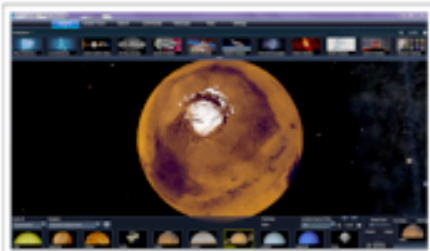
Where?

Public spaces and schools in a variety of regions

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-leaning 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

www.cfa.harvard.edu/WWTAmbassadors/

WorldWide Telescope Ambassadors Program

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

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. [\[www.teachersdomain.org\]](http://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.

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

How?

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

data,
literature,
media



WWWT Ambassadors Program
Recruiting, Vetting, Coordination

Community

Presentations




hosted/
promoted by



In-school
programs





WorldWide Telescope Scavenger Hunt Name _____
Mac Web Client version
Grade 6 Science

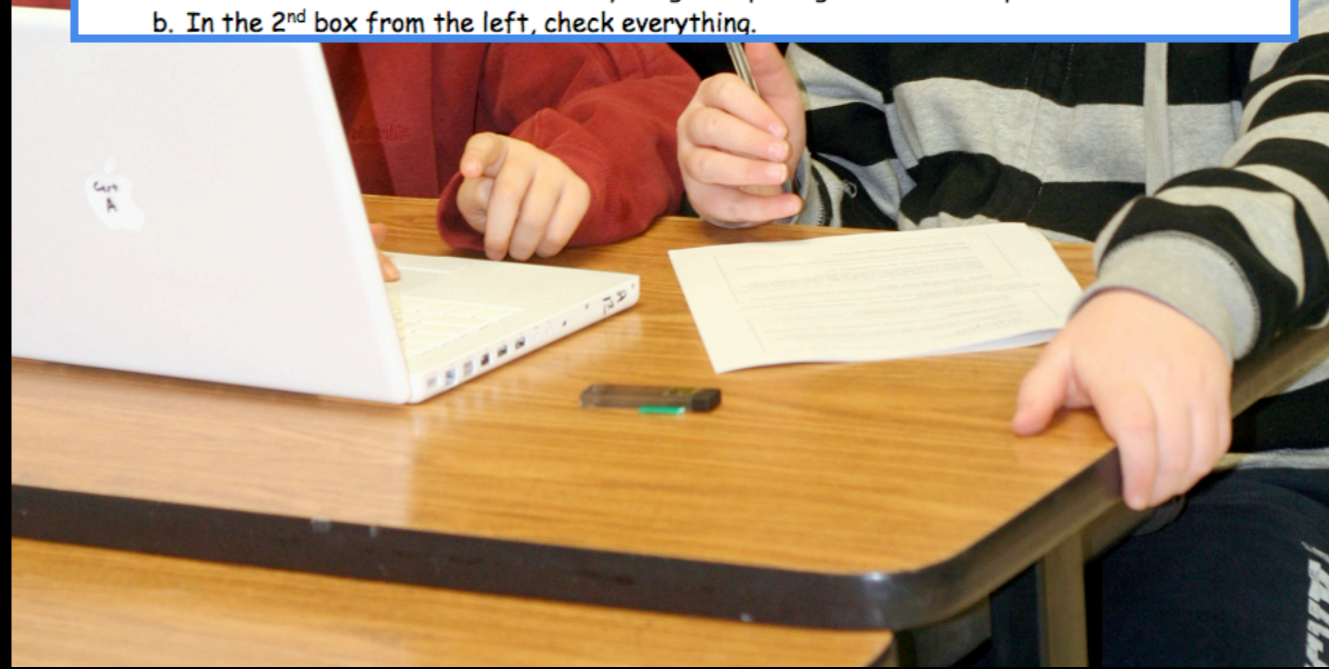
This Scavenger Hunt is designed to help you learn how to navigate around and research objects in the night sky using the WorldWide Telescope Web Client.

You and your partner(s) will search within WorldWide Telescope for various items, and answer questions about the things that you find.

Some Tips:

"Home" settings.
If, on your explorations, you find yourself in a state where what you see doesn't match up with what's described in this sheet, please verify that the settings are as follows:

1. Along the top row, click "View." (note that you should click the top part of the button, not the lower part with a little downward pointing triangle in it.)
 - a. In the lefthand box: uncheck everything except "Figures" and "Ecliptic."
 - b. In the 2nd box from the left, check everything.



Clarke Middle School, Lexington, MA (WWT Ambassadors **Pilot** School)

“Why is one polar ice cap on Mars bigger than the other?”
– Clarke Middle School 6th Grader

The screenshot displays the Microsoft WorldWide Telescope interface. The main window shows a 3D view of Mars, highlighting its polar ice cap. The interface includes a top navigation bar with options like 'Explore', 'Guided Tours', 'Search', 'Community', 'Telescope', 'View', and 'Settings'. Below this is a 'Collections' bar with various categories such as 'My Collections', 'Constellations', 'Solar System (Sky)', 'All-Sky Surveys', 'Spitzer Studies', 'Chandra Studies', 'Hubble Studies', 'Astrophotography', 'Radio Studies', 'NOAO Studies', 'Gemini Studies', and 'Messier Catalog'. At the bottom, there is a 'Look At' section with a dropdown menu set to 'SolarSystem' and a '3D Solar System View' dropdown. A row of planet icons is visible, with 'Saturn' highlighted. To the right, there are controls for 'Tracking' (set to 'Mars'), 'Context Search Filter' (set to 'All'), and 'Planet Size' (set to 'Ursa Major' with a value of 8187 km). The bottom right corner shows coordinates: 'Lng: 20:32:48' and 'Lat: +51:11:21'.



Michelle Bartley interviews her 6th-grade science class about WWT
December 19, 2009



“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.”

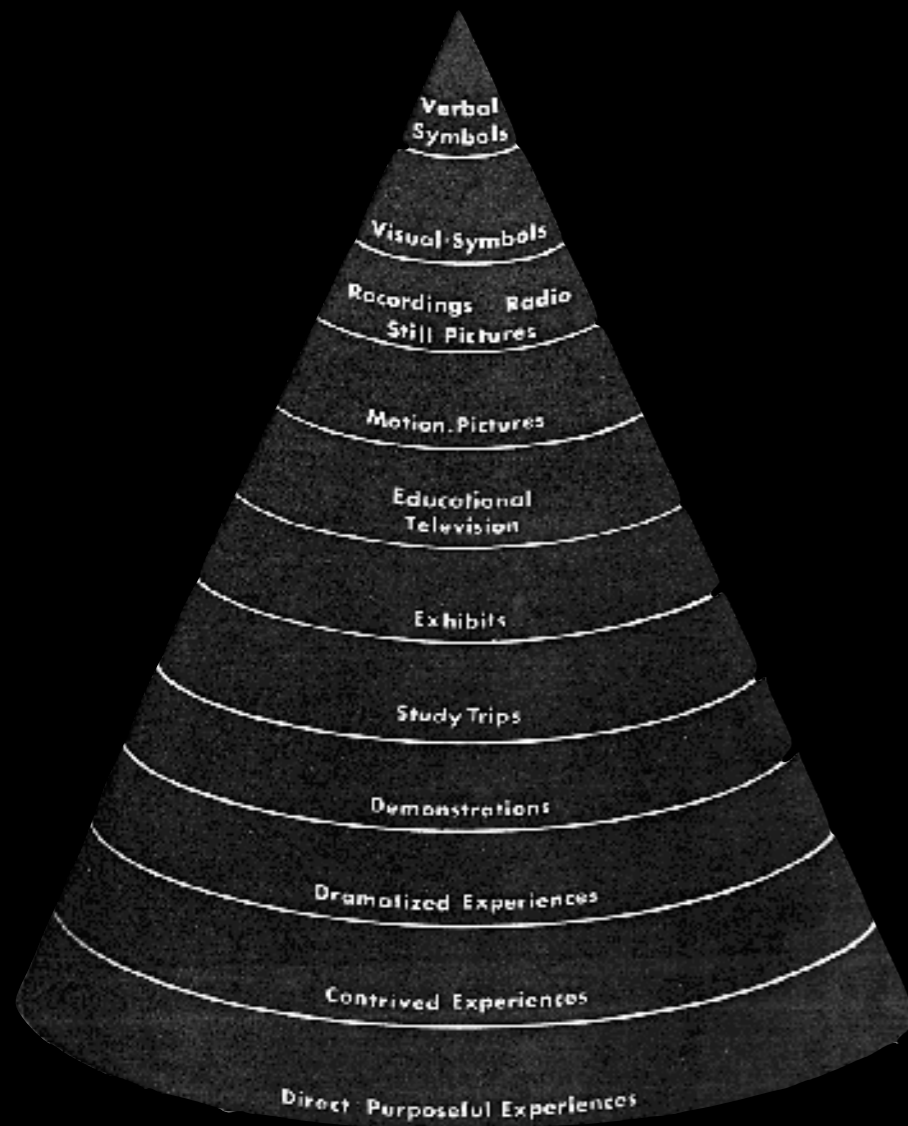
“It gave me a better mental map of the universe.”

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

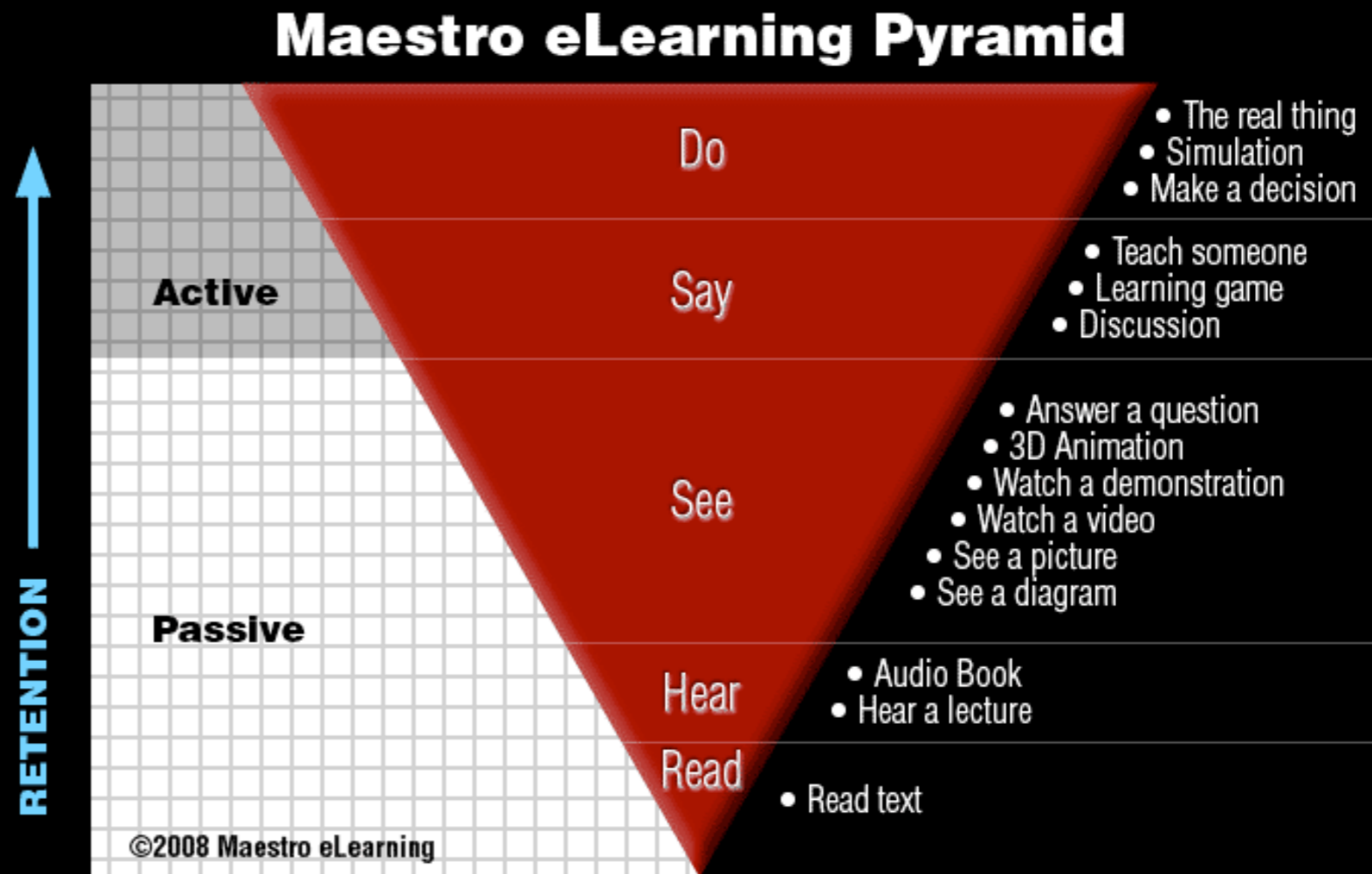
Why?

Increase STEM literacy in US now.

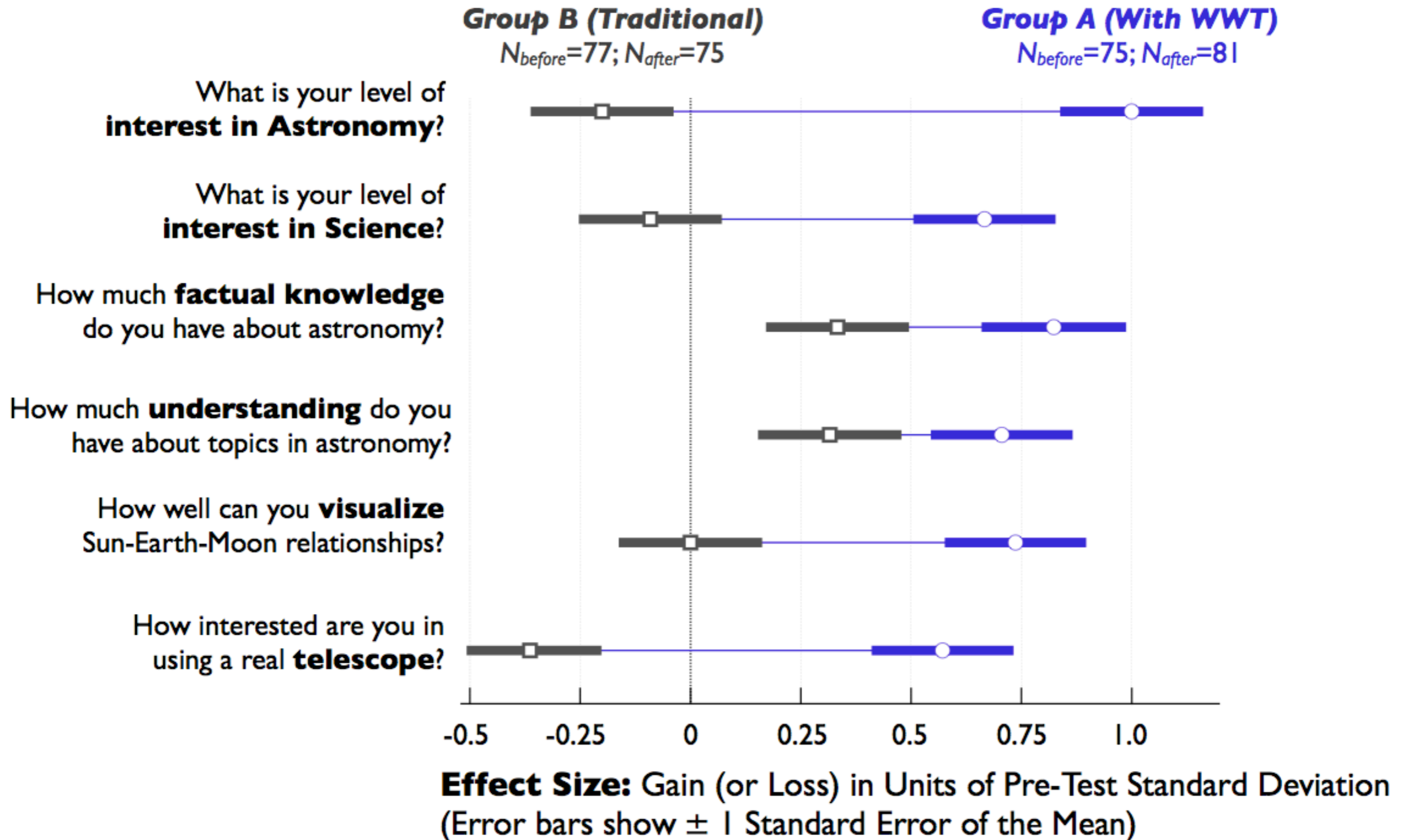
Demonstrate cyberlearning's value to the “Cone of Experience”



Edgar Dale, “Audio Visual Methods in Teaching”, 1946-69



WWTA Pilot Results

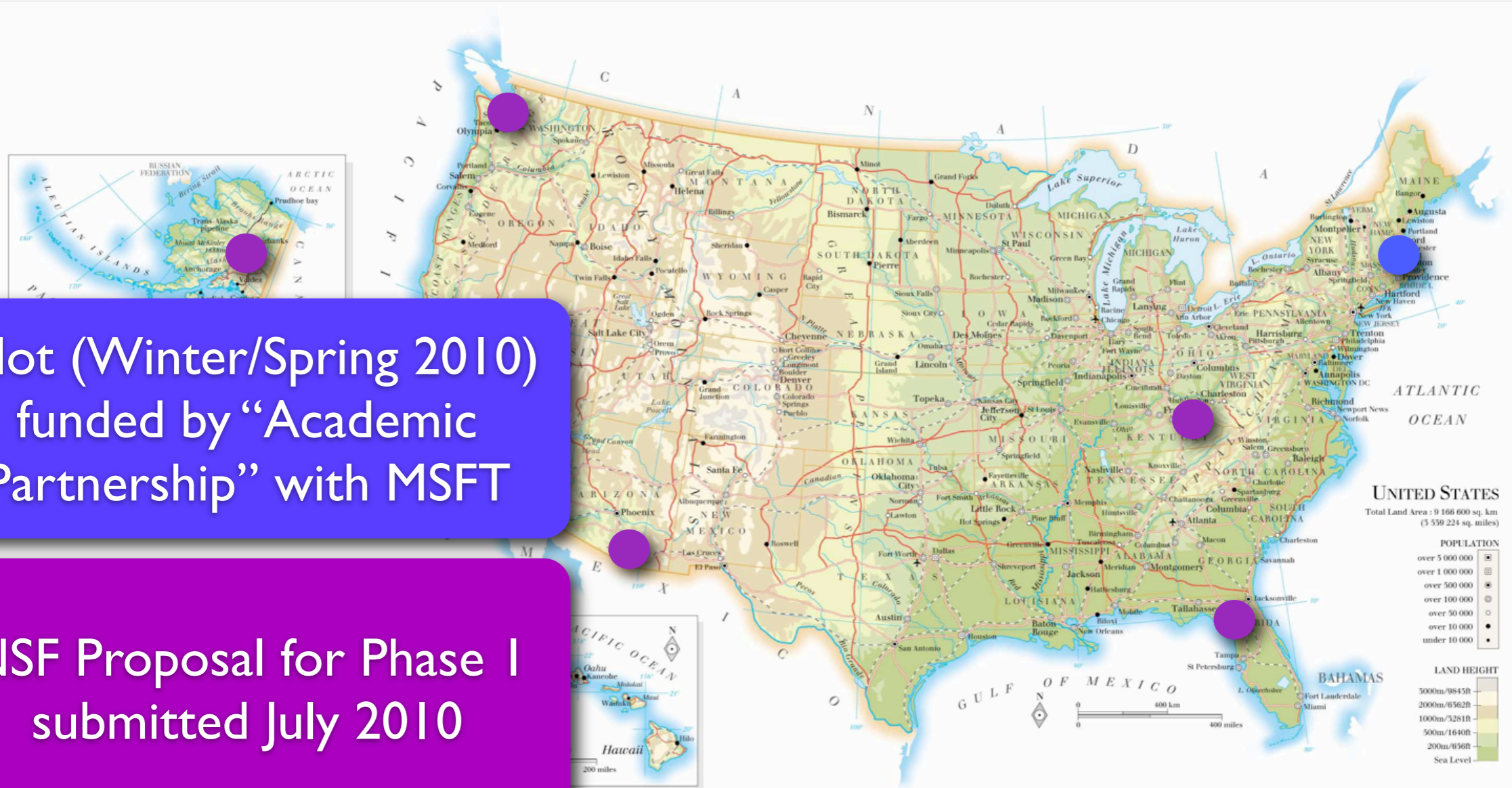


Where? ... and When?

Public spaces and schools in a variety of regions

Pilot ● *Boston Area*

Phase I candidates ● *Tucson, AZ; Seattle, WA; Appalachia; Gainesville, FL; Fairbanks, AK*



Pilot (Winter/Spring 2010)
funded by “Academic
Partnership” with MSFT

NSF Proposal for Phase I
submitted July 2010

Phase II: US-wide; Phase III: International