

# Part I

# Seamless Astronomy

Alyssa A. Goodman  
*Harvard-Smithsonian Center for Astrophysics*

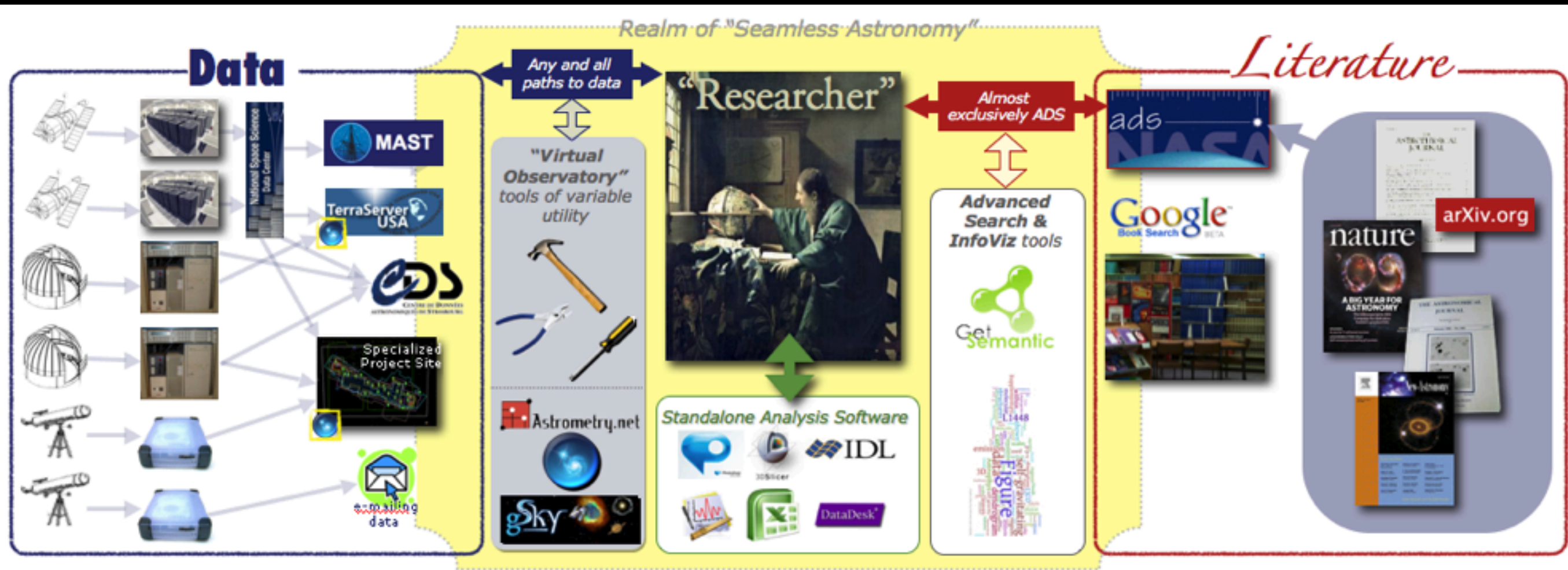
with Alberto **Accomazzi**, Rahul **Davé**,  
Gus **Muench** & Michael **Kurtz** (Harvard-Smithsonian CfA);  
Tim **Clark** (Massachusetts General Hospital/Harvard Medical School);  
Jonathan **Fay** & Curtis **Wong** (Microsoft Research)

+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)





# Realm of Seamless Astronomy



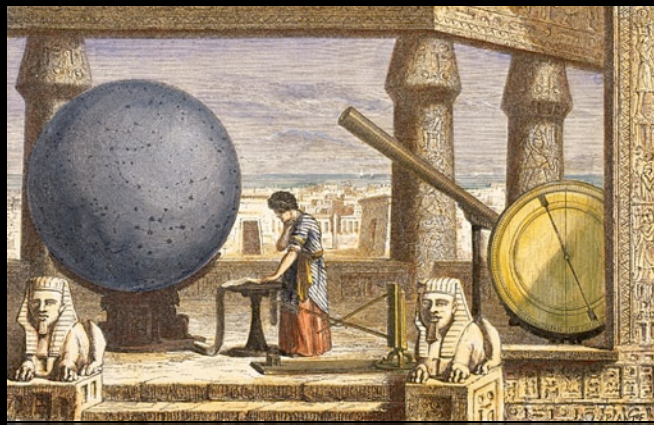


# 3500 years of Observing

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 IC Projects Wikis Etc. Google Calendar \$\$\$ Image Search Fbk share Directories ADS Best RSS (3387) BeyondADS

**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

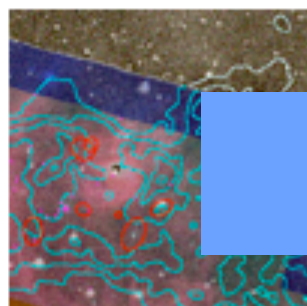
Done



# 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."



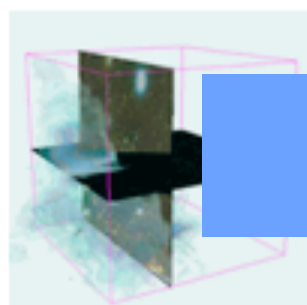
COMPLETE  
The COordinated Molecular Probe

Data



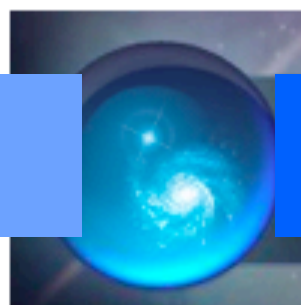
Star Formation Taste Tests  
A community of theorists, numericists, and

Simulation



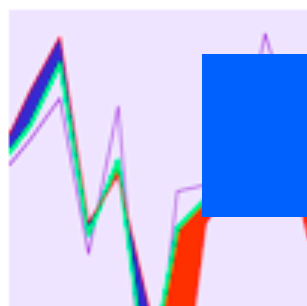
Astronomical Medicine  
Exploiting the intersection of

Publishing



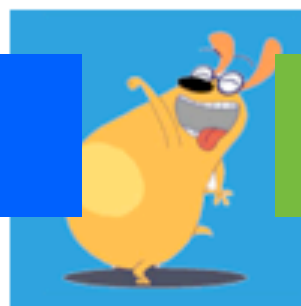
WorldWide Telescope  
A beautiful portal to all of Astronomy for

e-Science Tools



Visualization

Viz



Science for Everyone

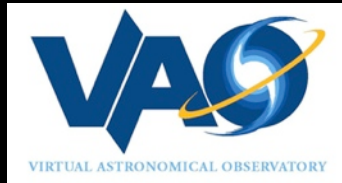
Outreach



# 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 Astrophysical 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.

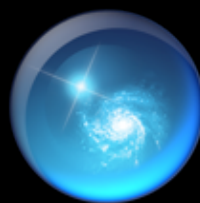
A critical goal of this project is to create a **full astronomy curriculum using WWT Tours created by our Ambassadors**. These Tours will be vetted by the astronomy and science education professionals within our collaboration, and they will be freely available, centrally managed, and searchable, through 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 | VАО | WGBH | External Research | Microsoft Research





# 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*

**The World Wide Telescope  
an Archetype for Online-Science**

Jim Gray (Microsoft)

Alex Szalay (Johns Hopkins University)

Microsoft Academic Days in Silicon Valley

<http://research.microsoft.com/~gray/talks>

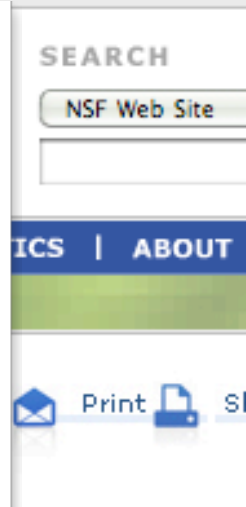
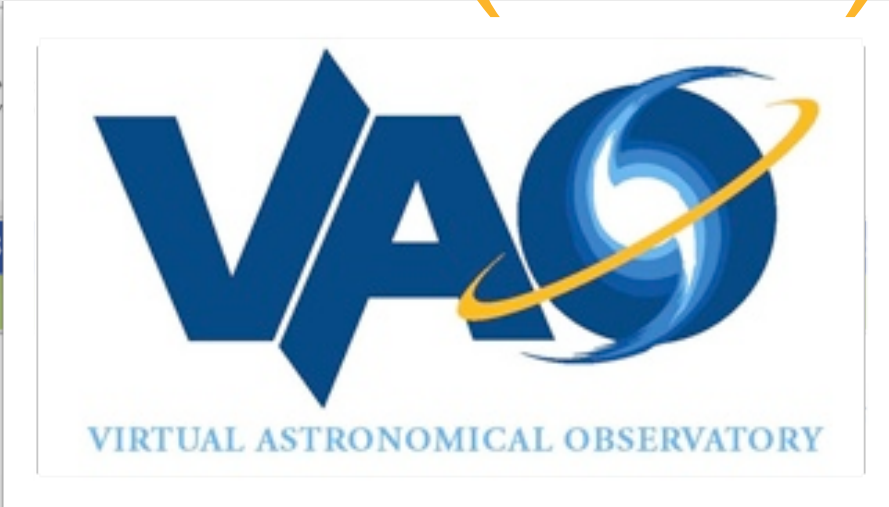
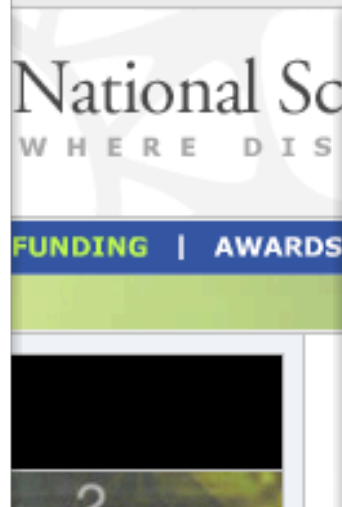
*Created by Curtis Wong and Jonathan Fay at MSR; AG is “Academic Partner” on the WWT Project*



# The (US) Backstory

2001 ..... 2008 (2010)

Science News  
\$10 Million N  
ScienceDaily (O  
its users the worl  
research instituti  
starting an ambiti  
universe online.



See Also: (NVO), headed by astronomer Alex F

NVO senior personnel:  
Charles Alcock, University of Pennsylvania Kirk Borne, Astro  
Tim Cornwell, NSF National Radio Astronomy Observatory L  
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  
STScI Nicholas White, NASA Goddard Space [Flight Center](#) R  
of Technology

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[How to Prepare Your Proposal](#)  
[About Funding](#)

Proposals and Awards  
[Proposal and Award Policies and Procedures Guide](#)  
[Introduction](#)  
[Proposal Preparation and](#)

## Management and Operation of the Virtual Astronomical Observatory

**CONTACTS**

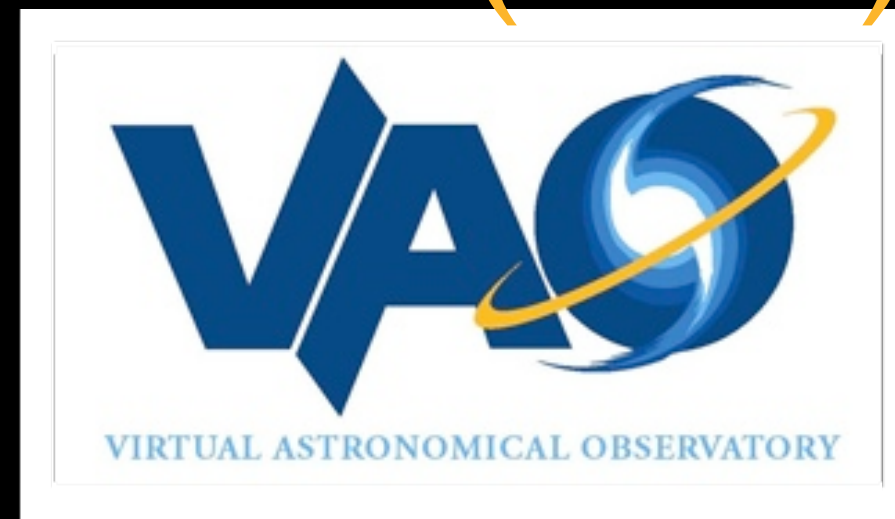
Name	Email
Nigel Sharp	<a href="mailto:nsharp@nsf.gov">nsharp@nsf.gov</a>
Eileen D. Friel	<a href="mailto:efriel@nsf.gov">efriel@nsf.gov</a>

**PROGRAM GUIDELINES**  
Solicitation [08-537](#)

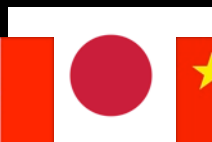
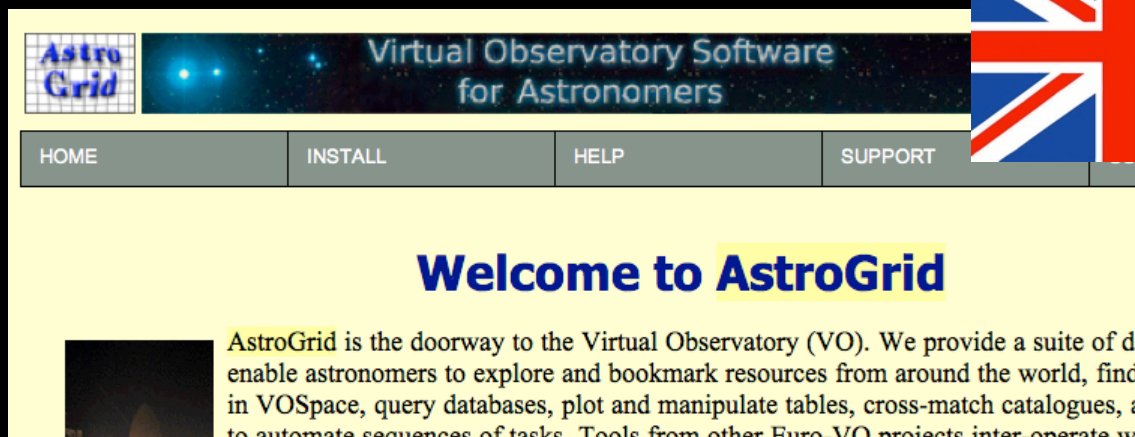
Please be advised that the NSF Proposal & Award Policies & Procedures (PAPPG) includes revised guidelines to implement the mentoring pro the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) specified in the ACA, each proposal that requests funding to support postdoctoral researchers must 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).

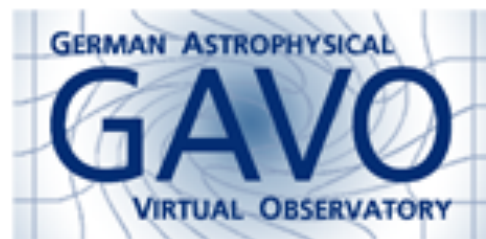
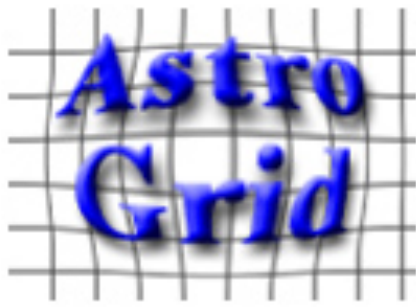


2001 ..... 2008 (2010)



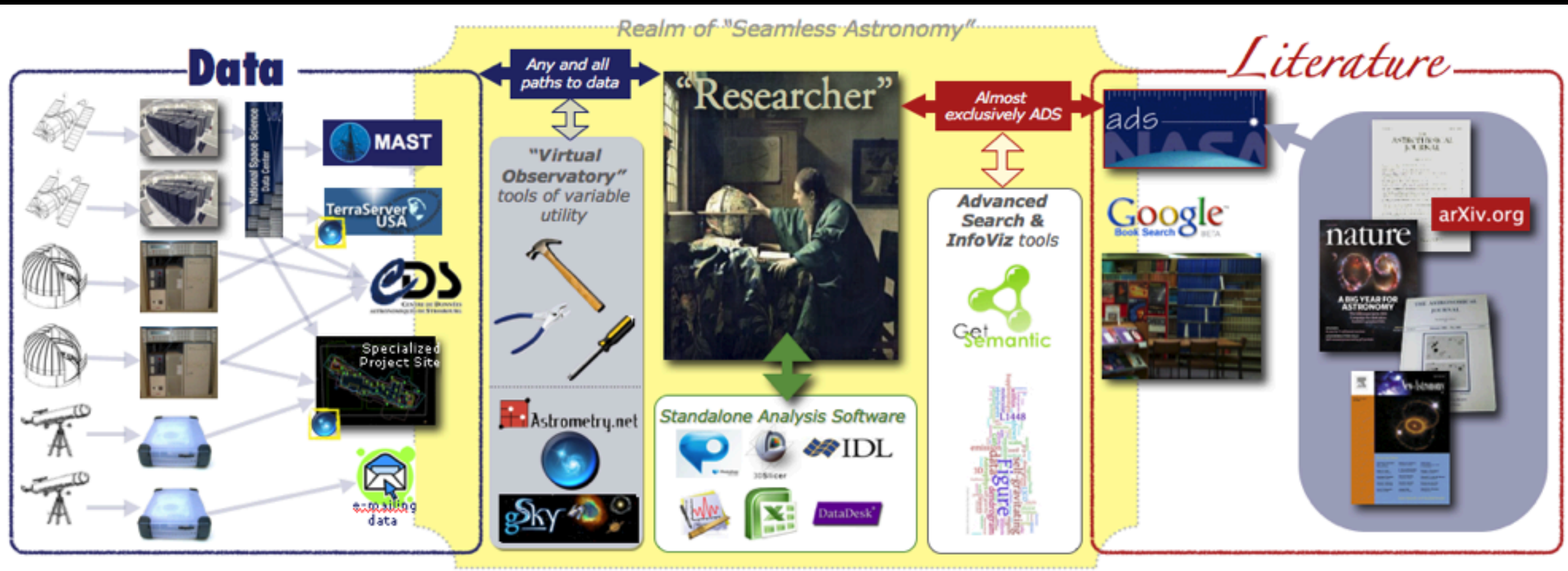
and meanwhile...







# Seamless Astronomy

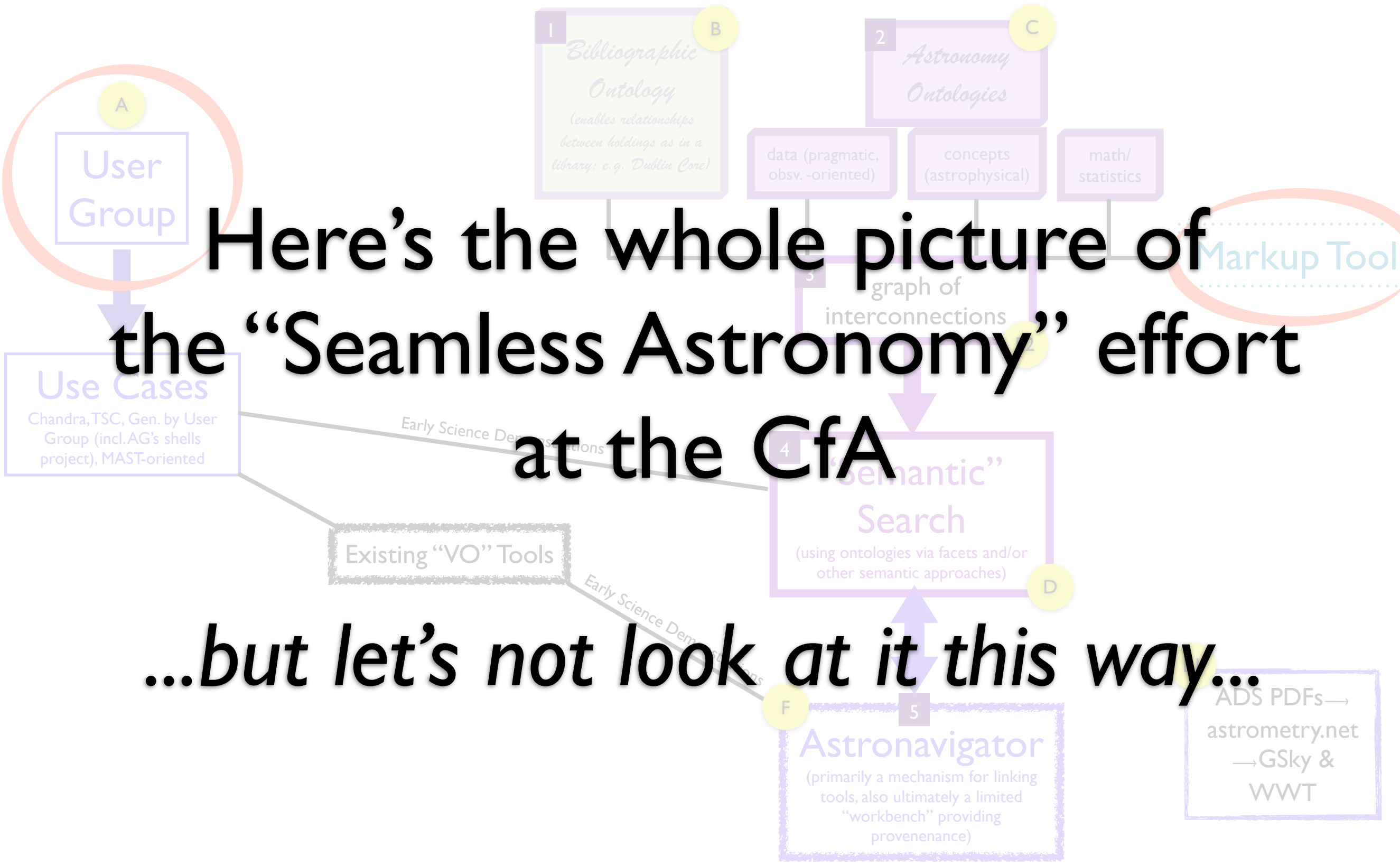


*But, that was 2009...*



Discourse Ontology

Workflow Ontology  
(e.g. myexperiment)



Here's the whole picture of the "Seamless Astronomy" effort at the CfA

*...but let's not look at it this way...*



*Realm of "Seamless Astronomy"*

**Data**



2010  
Evermore  
Seamless  
Astronomy

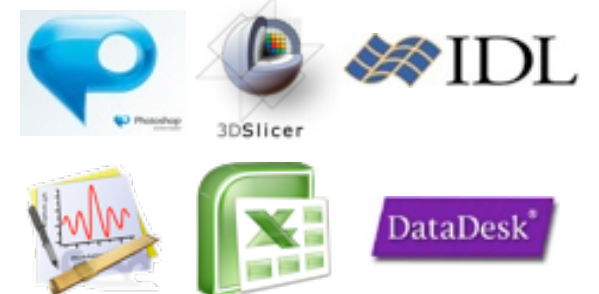
**Advanced  
Search &  
InfoViz tools**



*Literature*



*Standalone Analysis Software*





This simple argument, first made at the 2009 WWT session at AAS, 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
  - [FAQ](#) **2010ApJ...713..269F: Federrath,+:** Collapse and Accretion in Turbulent Molecular Clouds: Implementation and Comparison
  - [What's new](#) **2010ApJ...712.1403P: Pech,+:** Constraints on a Recent Bipolar Ejection in the Hierarchical Multiple System IRAS 04301-2422
- Current Tables of Contents**
- [Astronomical Journal](#)
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- Favorite Authors - Recent Papers**
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- 2010A&A...511A..90B: Breddels,+:** Distance determination for RAVE stars using stellar

From: Kayak Alert <alert@kayak.com>  
 Subject: **Your KAYAK Fare Alert: Boston (BOS) > Munich (MUC)**  
 Date: March 26, 2010 3:52:30 AM EDT  
 To: Alyssa Goodman  
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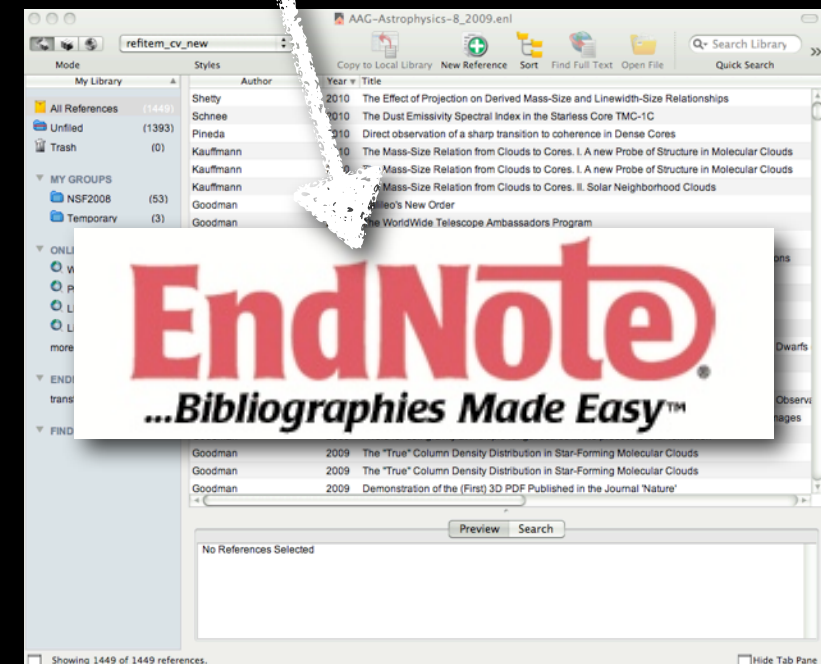
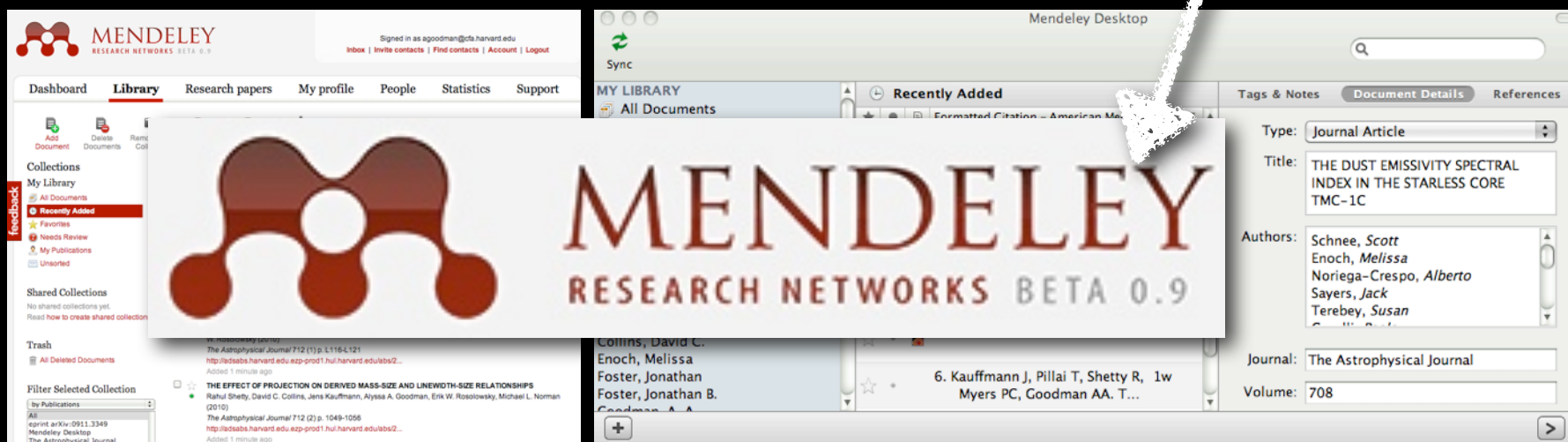
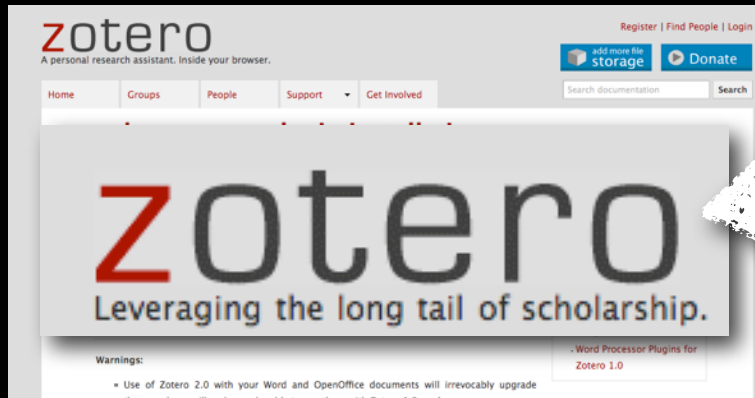
**Low Fares\* found from Boston (BOS) to:**

- \$99+ [Baltimore](#)
- \$144+ [Orlando](#)
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- \$152+ [Atlanta](#)
- \$184+ [Fort Lauderdale](#)

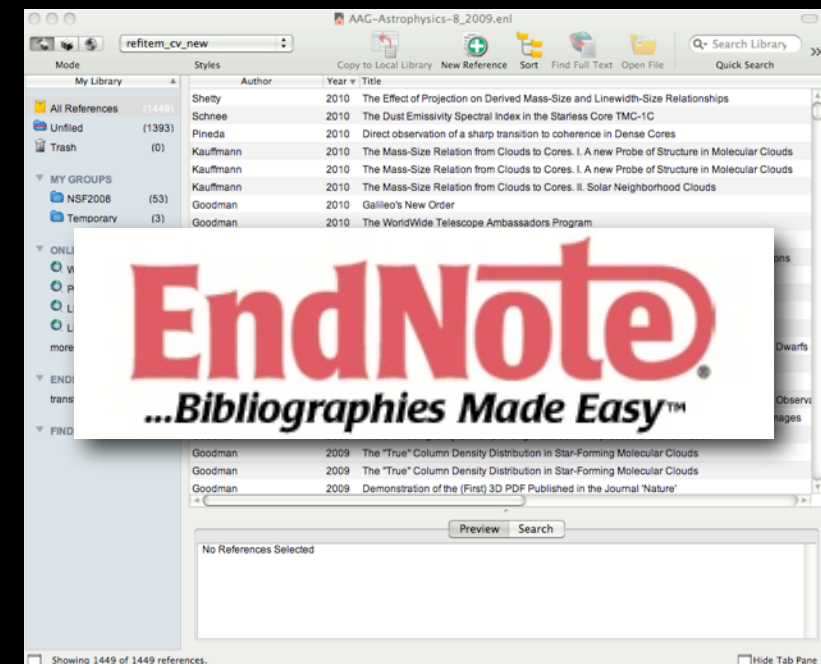
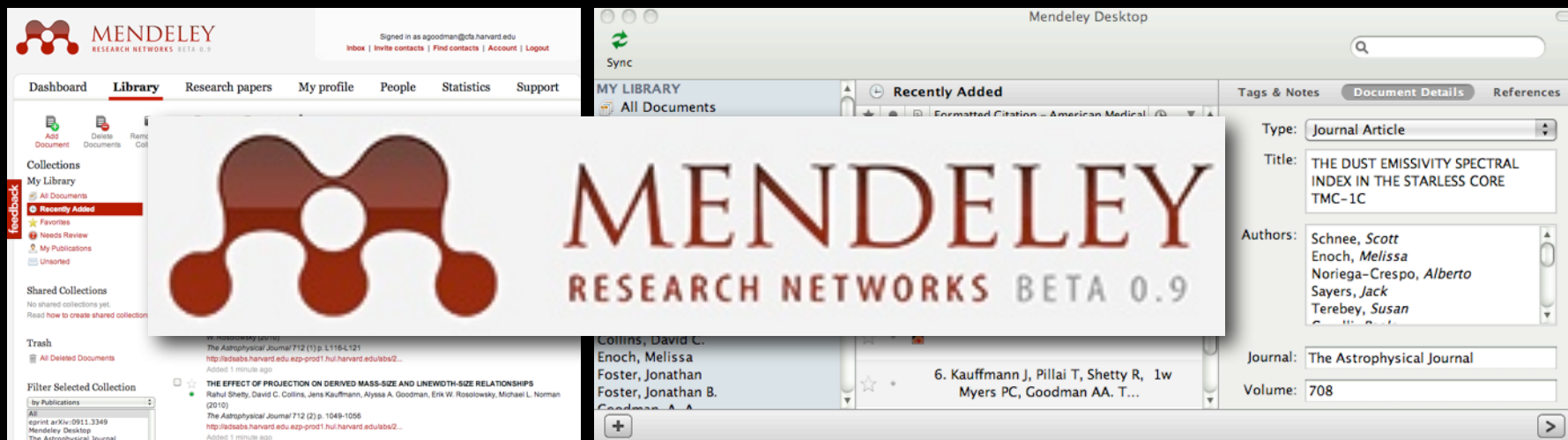
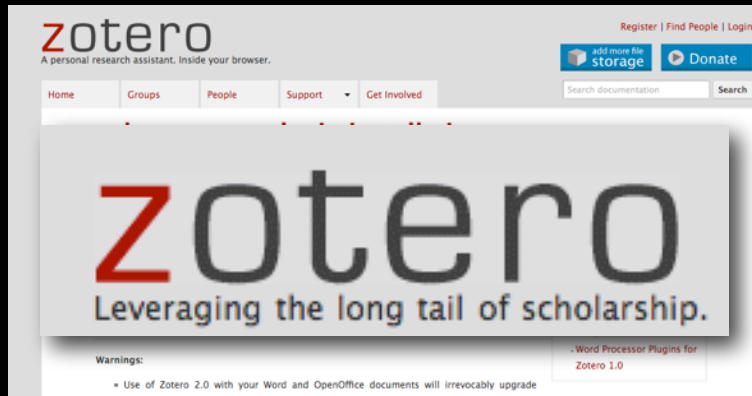
Astronomers  
 can see  
 parallels...



# Literature Handling: *Diverse Apps, Common Data*



# What fraction of astronomy researchers know about these tools?





# “writemypaper.org?”

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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  $\sim 5$  solar luminosities, reducing the luminosity problem to a factor  $\sim 3$ . 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.

results are

# “writemypaper.org?”

## SAO/NASA Astrophysics Data System (ADS)

### Query Results from the ADS Database

#### Related Objects

[NAME LMC \(26\)](#)  
[NGC 292 \(15\)](#)  
[SN 1987A \(13\)](#)  
[M 31 \(9\)](#)  
[NGC 7293 \(6\)](#)  
[NGC 6888 \(6\)](#)  
[NGC 6543 \(6\)](#)  
[M 33 \(6\)](#)  
[HIP 54283 \(6\)](#)  
[HIP 33165 \(6\)](#)  
[VV 344a \(5\)](#)  
[V\\* eta Car \(5\)](#)  
[V\\* CW Leo \(5\)](#)  
[NGC 7027 \(5\)](#)  
[SNR G111.7-02.1 \(4\)](#)  
[NGC 6826 \(4\)](#)  
[NGC 2438 \(4\)](#)  
[NAME BUTTERFLY NEBULA \(4\)](#)  
[MCG+12-08-033 \(4\)](#)  
[GSC 06253-02182 \(4\)](#)  
[WR 147 \(3\)](#)  
[V\\* V1302 Aql \(3\)](#)  
[V\\* V1042 Cyg \(3\)](#)  
[SNR J052501-693842 \(3\)](#)  
[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 \(3\)](#)

Selected and retrieved 200 abstracts.

#	Bibcode	Score	Date	List of L	Access
1	<input type="checkbox"/> <a href="#">1995RvMP...67..661B</a> Bisnovatyi-Kogan, G. S.; Silich, S. A. Shock-wave propagation in the	19.000	Jul 1995	<a href="#">A</a> <a href="#">E</a>	
2	<input type="checkbox"/> <a href="#">1999NewAR..43...31F</a> Frank, A. Bipolar outflows and the evolution of stars	18.000	May 1999	<a href="#">A</a> <a href="#">E</a>	
3	<input type="checkbox"/> <a href="#">2007ARA&amp;A..45..177C</a> Crowther, Paul A. Physical Properties of Wolf-Rayet Stars	13.000	Sep 2007	<a href="#">A</a> <a href="#">E</a> <a href="#">F</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">U</a>
4	<input type="checkbox"/> <a href="#">2002ARA&amp;A..40..439B</a> Balick, Bruce; Frank, Adam Shapes and Shaping of Planetary Nebulae	13.000	n/a 2002	<a href="#">A</a> <a href="#">E</a> <a href="#">F</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">U</a>
5	<input type="checkbox"/> <a href="#">2008A&amp;ARv..16..209P</a> Puls, Joachim; Vink, Jorick S.; Najarro, Francisco Mass loss from hot massive stars	12.000	Dec 2008	<a href="#">A</a> <a href="#">E</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">U</a>
6	<input type="checkbox"/> <a href="#">2005ApJ...631..435R</a> Ramirez-Ruiz, Enrico; García- Segura, Guillermo; Salmonson, Jay D.; Pérez-Rendón, Brenda The State of the Circumstellar Medium Surrounding Gamma-Ray Burst Sources and Its Effect on the Afterglow Appearance	12.000	Sep 2005	<a href="#">A</a> <a href="#">E</a> <a href="#">F</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">U</a>
7	<input type="checkbox"/> <a href="#">1992ARA&amp;A..30..235C</a> Chiosi, Cesare; Bertelli, Gianpaolo; Bressan, Alessandro New developments in understanding the HR di	12.000	n/a 1992	<a href="#">A</a> <a href="#">G</a>	<a href="#">T</a> <a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">U</a>



#### ADS Faceted Topic Search (alpha)

Enter one or more keywords on your subject of interest, sit back and relax.

winds and shells from stars

Search

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

#### Keyword Search:

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- Most recent
- Most important

#### Subject Area Search:

- Most popular
- Most useful
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Explore

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Search

View

Settings

ngc 7023

Plot Results

VO Search

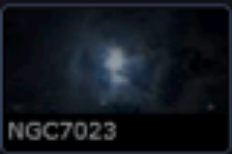
J2000

RA

Dec

Go

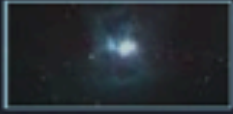
1 of 2



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

**Image Credits:**  
Jack Newton

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

Research Show Object Close

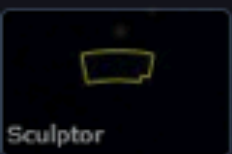
Look At

Imagery

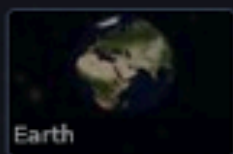
Sky

Digitized Sky Survey (Opt)

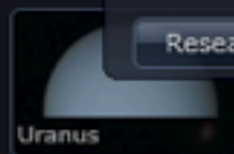
<http://www.jacknewton.com/>



Sculptor



Earth



Uranus



Hubble Sees 'Coma'



NGC 300



Sculptor Galaxy



Cartwheel Galaxy

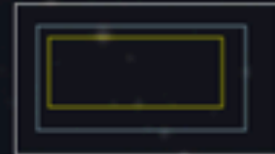


Cartwheel Galaxy



Cepheus

00:14:04



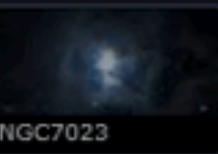
RA : 21h01m36s

Dec : 68:10:11

1 of 23

Explore Guided Tours Search View Settings


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

**Name: NGC 7023**

- Information
- Imagery
- Virtual Observatory Searches
- Set as Foreground Imagery
- Set as Background Imagery
- Properties
- Copy Shortcut

- Look up on SIMBAD
- Look up on SEDS
- Look up on Wikipedia
- Look up publications on ADS**
- Look up on NED
- Look up on SDSS




Look At Imagery

Sky Digitized Sky Survey (Optical)

Sculptor Earth Uranus

1 of 23



Cepheus 00:1

RA : 21h01m36s  
Dec : 68:10:11

Sculptor Galaxy Cartwheel Galaxy Cartwheel Galaxy



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Sort options

#	Bibcode Authors	Score	Date	<a href="#">List of Links</a> <a href="#">Access Control Help</a>				
1	<input type="checkbox"/> <a href="#">2009ApJ...700.1609M</a> Myers, Philip C.	1.000	08/2009	<a href="#">A</a> <a href="#">Z</a> <a href="#">E</a> <a href="#">F</a> <a href="#">L</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a>	<a href="#">S</a>	<a href="#">U</a>	
2	<input type="checkbox"/> <a href="#">2009ApJ...700.1190D</a> 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.; <b>and 8</b> <b>coauthors</b>	1.000	08/2009	<a href="#">A</a> <a href="#">Z</a> <a href="#">E</a> <a href="#">F</a> <a href="#">L</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a>	<a href="#">S</a>	<a href="#">U</a>	
3	<input type="checkbox"/> <a href="#">2009MNRAS.396.1851N</a> Nutter, D.; Stamatellos, D.; Ward- Thompson, D.	1.000	07/2009	<a href="#">A</a> <a href="#">Z</a> <a href="#">E</a> <a href="#">F</a> <a href="#">L</a> <a href="#">X</a>	<a href="#">R</a>	<a href="#">S</a>	<a href="#">U</a>	
4	<input type="checkbox"/> <a href="#">2009A&amp;A...502..175B</a> 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 href="#">A</a> <a href="#">Z</a> <a href="#">E</a> <a href="#">F</a> <a href="#">L</a>	<a href="#">R</a>	<a href="#">S</a>	<a href="#">U</a>	
5	<input type="checkbox"/> <a href="#">2009MNRAS.395.1695H</a> 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 href="#">A</a> <a href="#">Z</a> <a href="#">E</a> <a href="#">F</a> <a href="#">L</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a>	<a href="#">S</a>	<a href="#">U</a>	

ngc 7023

Plot Results

VO Search

J2000

RA

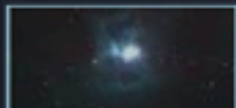
Dec

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: 10.9 Circumpolar

- Name: NGC 7023
- Information
- Imagery
- Virtual Observatory Searches
- Set as Foreground Imagery
- Set as Background Imagery

- Look up on SIMBAD
- Look up on SEDS
- Look up on Wikipedia
- Look up publications on ADS
- Look up on NED
- Look up on SDSS



Look At

Imagery

Sky

Digitized Sky Survey (Optical)

Sculptor

Earth

Uranus

Properties

Copy Shortcut

Hubble Sees 'Comet'

NGC 300

Sculptor Galaxy

Cartwheel Galaxy

Cartwheel Galaxy

N

Cepheus

00:1

1 of 23



RA : 21h01m36s  
Dec : 68:10:11

Done





## SIMBAD query result

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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

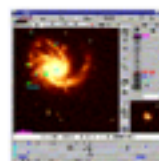
 with radius  arcmin

Other object types: **C1\*** (C,C1,[BDB2003]) ,**OpC** (OCISM) ,**MII** (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) :

<a href="#">NGC 7023</a>	<a href="#">IRAS 20599+6755</a>	<a href="#">LBN 487</a>	<a href="#">IBDB2003</a> G104.06+14.19
<a href="#">C 2059+679</a>	<a href="#">IRAS F20599+6755</a>	<a href="#">OCISM 50</a>	<a href="#">AAVSO 2044+67</a>
<a href="#">C1 VDB 139</a>	<a href="#">LBN 104.08+14.21</a>	<a href="#">OCl 235</a>	

## Plots and Images

 radius  arcmin


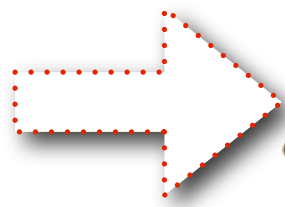
## References (371 between 1983 and 2009)

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

 
from:  to:



**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

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



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Related Objects

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- [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 \(3\)](#)

#	Bibcode	Score	Date	List of Links	Access Control Help
1	<input type="checkbox"/> <a href="#">2007ApJ...657..810D</a> Draine, B. T.; Li, Aigen	100.000	Mar 2007	<a href="#">A</a> <a href="#">E</a> <a href="#">F</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">N</a> <a href="#">O</a> <a href="#">U</a>
2	<input type="checkbox"/> <a href="#">2007ApJ...663..866D</a> 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 href="#">A</a> <a href="#">E</a> <a href="#">F</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">N</a> <a href="#">U</a>
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4	<input type="checkbox"/> <a href="#">2005ApJ...628L..29E</a> Engelbracht, C. W.; Gordon, K. D.; Rieke, G. H.; Werner, M. W.; Dale, D. A.; Latter, W. B.	95.090	Jul 2005	<a href="#">A</a> <a href="#">E</a> <a href="#">F</a> <a href="#">X</a>	<a href="#">R</a> <a href="#">C</a> <a href="#">c</a> <a href="#">S</a> <a href="#">N</a> <a href="#">U</a>

Open "http://www.worldwidetelescope.org/wwtweb/goto.aspx?object=NGC%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 viewing area shows a large, detailed image of the star cluster NGC 7023, which is a blue-white star cluster with a prominent central star. 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 side of the control panel, there is a '1 of 1' indicator, a compass rose, and a map of the constellation Cepheus with a yellow box indicating the current view. The coordinates for the view are RA : 21h01m37s and Dec : 68:09:48. The bottom left corner of the control panel has a 'Done' button.



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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)

Instr: visible light (IRAC) bsc2003-064

Uploaded on January 6, 2009 by Alyssa\_Goodman

### Alyssa\_Goodman's photostream

16 uploads



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This photo also belongs to:

+ astrometry (Pool) x

### Tags

- Astrometrydotnet:version=10145 x
- Astrometrydotnet:id=alpha-200901-20629873 x
- Astrometrydotnet:status=solved x

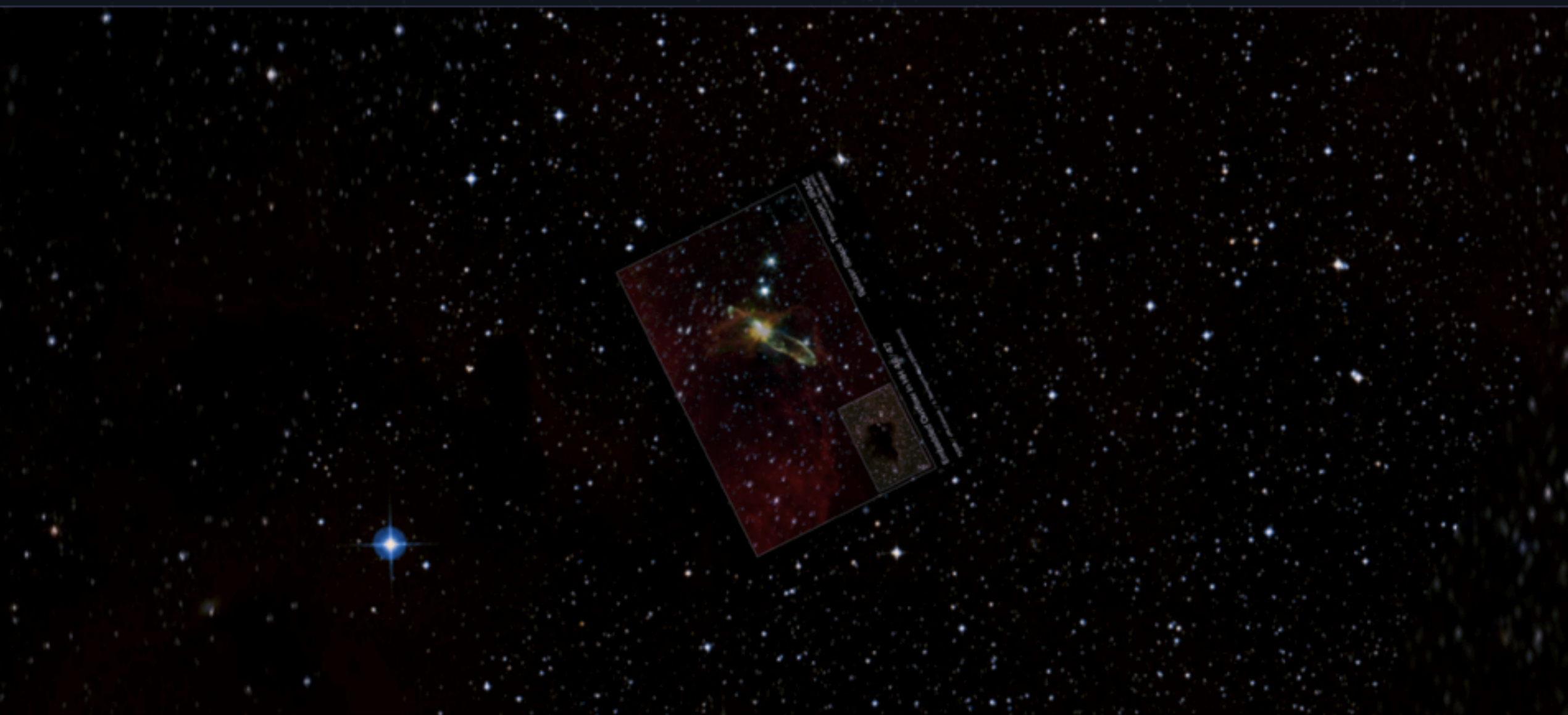
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Look At: Sky | Imagery: Digitized Sky Survey (Optical) | Info: ⓘ | Image Crossfade: [Slider]

1 of 1

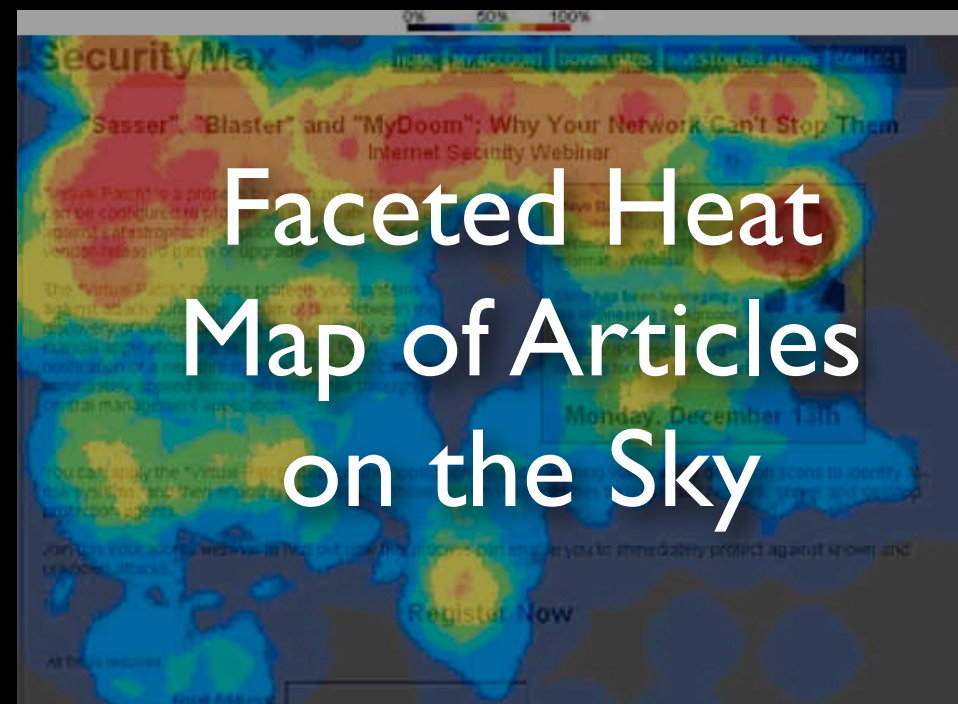
Vela 00:35:33

RA : 08h25m39s  
Dec : -51:01:10

Vela [Map]

# Coming (Very) Soon...

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

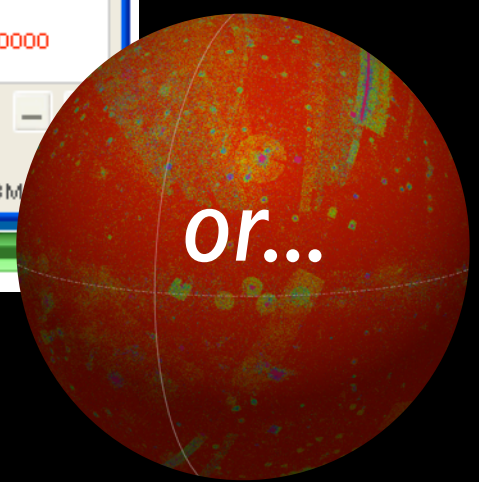
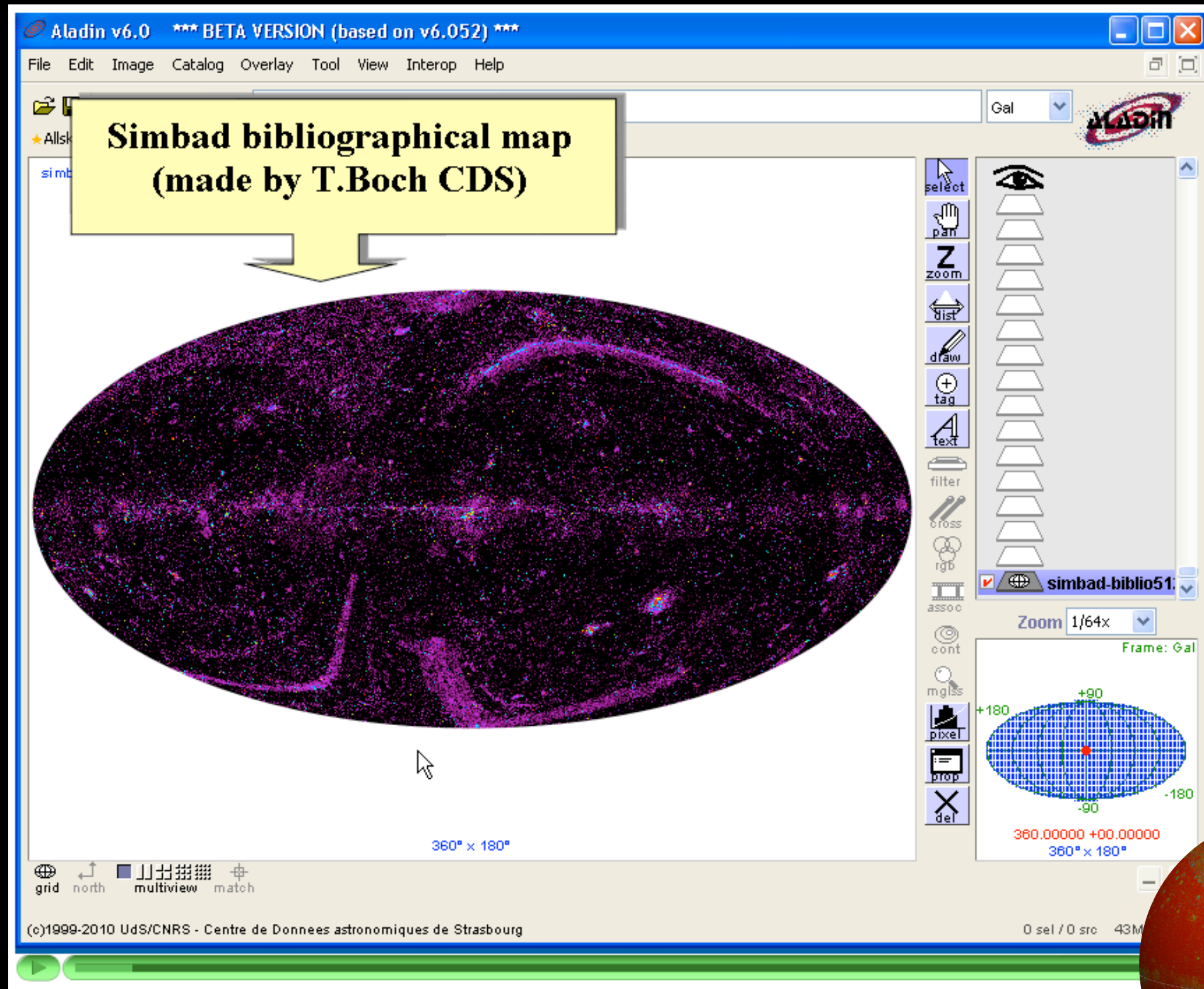


Faceted Heat  
Map of Articles  
on the Sky

[e.g. ADS-CDS-WWT]



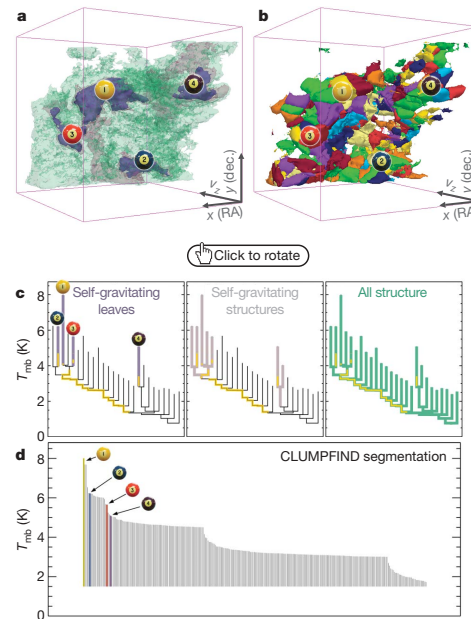
# Prototype of Articles on the Sky (April 2010)



*with thanks to CDS/Pierre Fernique*

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

Note: This work came from the "AstroMed" project [am.iic.harvard.edu](http://am.iic.harvard.edu)



**Figure 2 | Comparison of the 'dendrogram' and 'CLUMPFIND' feature-identification algorithms as applied to  $^{13}\text{CO}$  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  $T_{\text{mb}}$  (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 ( $-0.5 \text{ km s}^{-1}$ ) to back ( $8 \text{ km s}^{-1}$ ).

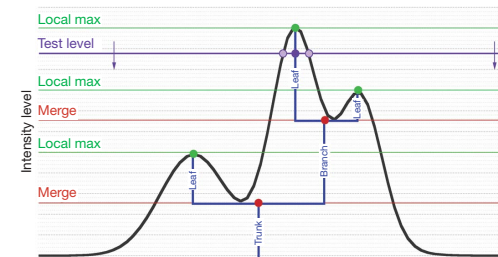
data, CLUMPFIND typically finds features on a limited range of scales, above but close to the physical resolution of the data, and its results can be overly dependent on input parameters. By tuning CLUMPFIND's two free parameters, the same molecular-line data set<sup>8</sup> can be used to show either 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'<sup>9</sup> 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'<sup>10</sup>. Although well developed in other data-intensive fields<sup>11,12</sup>, 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 frequency<sup>13</sup>.

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 ( $\sigma_v$ ) and luminosity ( $L$ ). The volumes can have any shape, and in other work<sup>14</sup> 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  $\alpha_{\text{obs}}$  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 fields<sup>16</sup>, its measured value should only be used as a guide to the longevity (boundedness) of any particular feature.

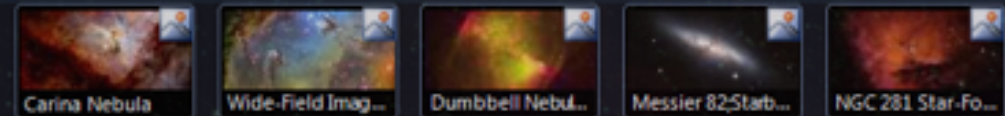


**Figure 3 | Schematic illustration of the dendrogram process.** Shown is the construction of a dendrogram from a hypothetical one-dimensional emission profile (black). The dendrogram (blue) can be constructed by 'dropping' a test constant emission level (purple) from above in tiny steps (exaggerated 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.





Studies >



**“Old Data”**

[astrometry.net/flickr/WWWT](http://astrometry.net/flickr/WWWT)

**“New Data”**

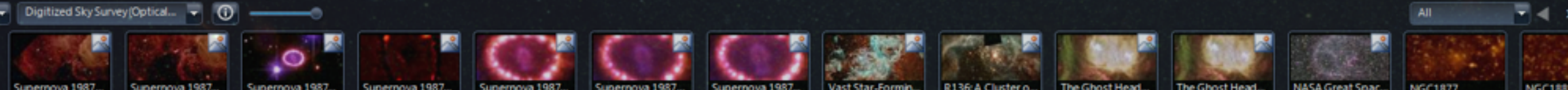
WWWT/ADS/SIMBAD/NAO

WWWT as API

**“Your Data”**

3D PDF

**“My Data”**

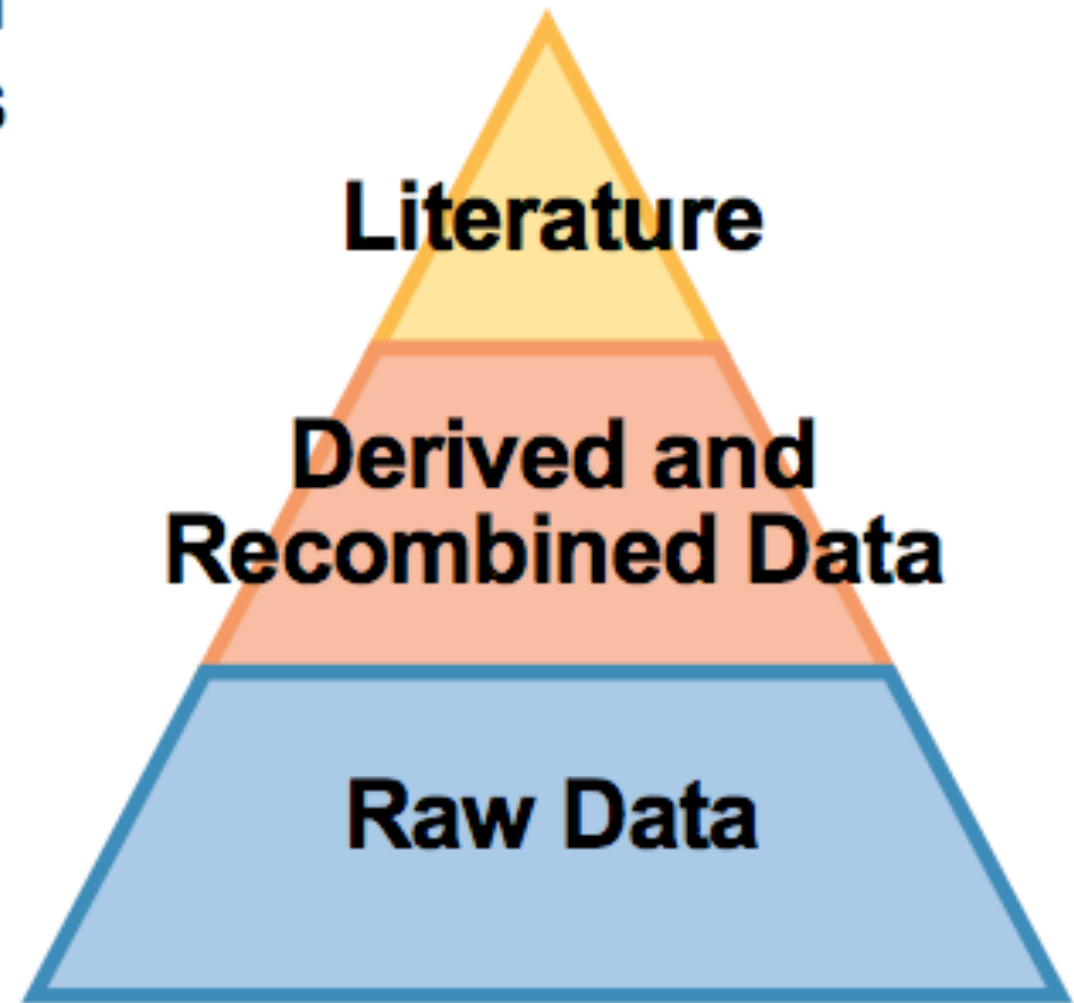




Jim Gray (& Alex Szalay) had it right (in 2004)

## 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





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

## The World Wide Telescope an Archetype for Online-Science

Jim Gray (Microsoft)

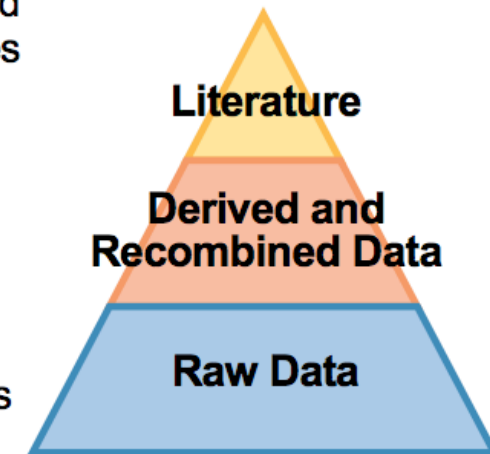
Alex Szalay (Johns Hopkins University)

Microsoft Academic Days in Silicon Valley

<http://research.microsoft.com/~gray/talks>

## All Scientific Data Online

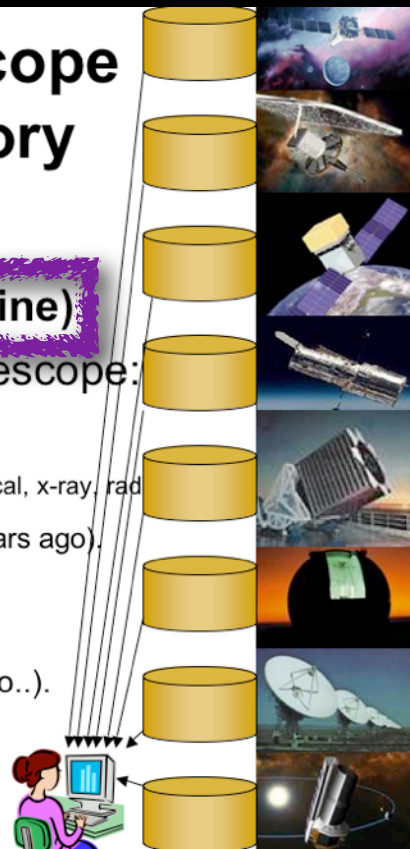
- Many disciplines overlap and use data from other sciences
- Internet can unify all literature and data
- Go from literature to computation to data back to literature
- Information at your fingertips for everyone-everywhere
- Increase Scientific Information Velocity
- Huge increase in Science Productivity



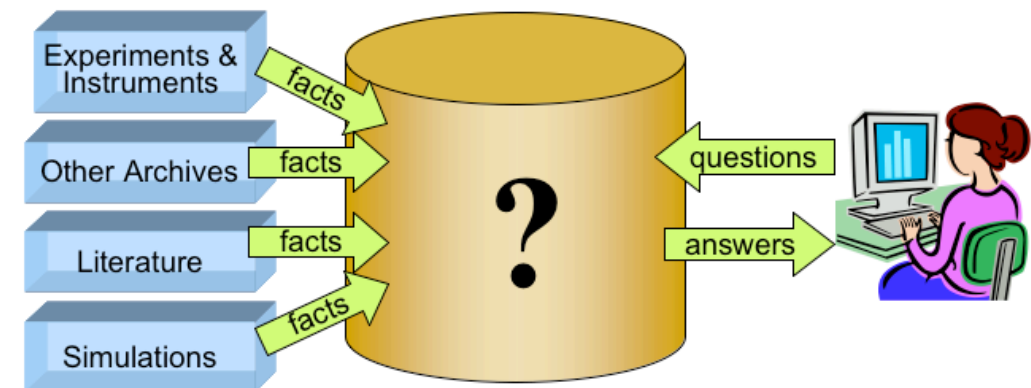
## World Wide Telescope Virtual Observatory

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

- Premise:
  - **Most data is (or could be online)**
- The Internet is the world's best telescope:
  - It has data on every part of the sky
  - In every measured spectral band: optical, x-ray, rad
  - As deep as the best instruments (2 years ago).
  - It is up when you are up. The "seeing" is always great (no working at night, no clouds no moons no..).
  - **It's a smart telescope: links objects and data to literature on them.**



## The Big Picture



## The Big Problems

- Data ingest
- Managing a petabyte
- Common schema
- How to organize it?
- How to reorganize it
- How to coexist with others
- **Query and Vis tools**
- **Support/training**
- Performance
  - Execute queries in a minute
  - Batch query scheduling

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



User Groups  
(CfA now has one)

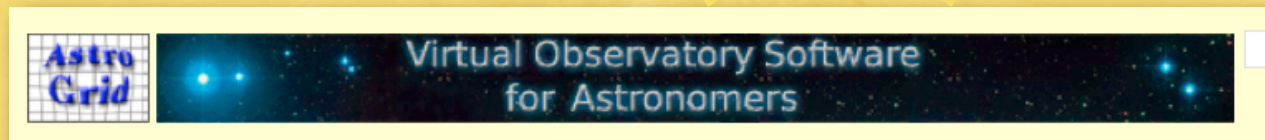
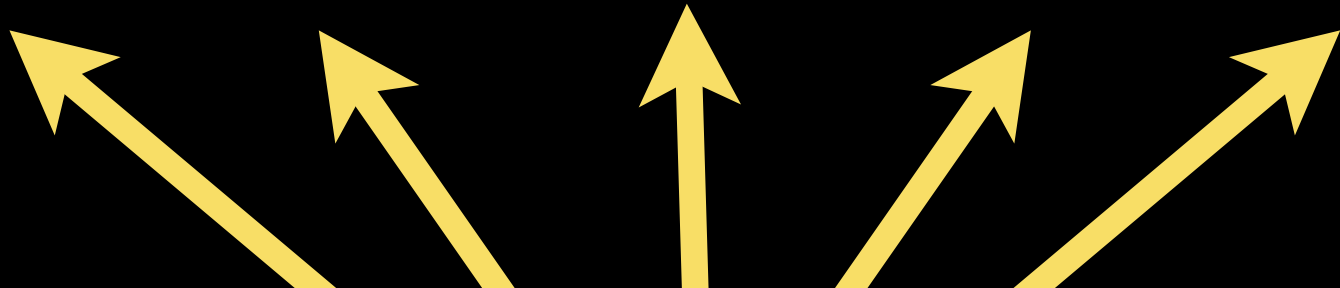


*+Suggestions?!*





# 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-CLI](#)
- Convert text tables to the VOTable format used by VO applications. [Table Tools](#)
- Do more with NVO. [Data Analysis & More](#)

**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.

**Want to hear more? Please see Gus Muench!**

## Home

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

## Discussion (Google Group)



[Join the Discussion](#)

## Friends

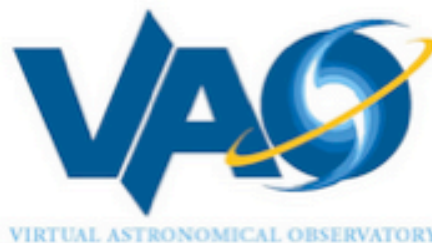
[Astrobetter](#)  
[Astropython](#)  
[VOA](#)  
[VAO](#)

## My recent activity

There are no recent activities.

**6**

days since  
User Group Meeting



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...

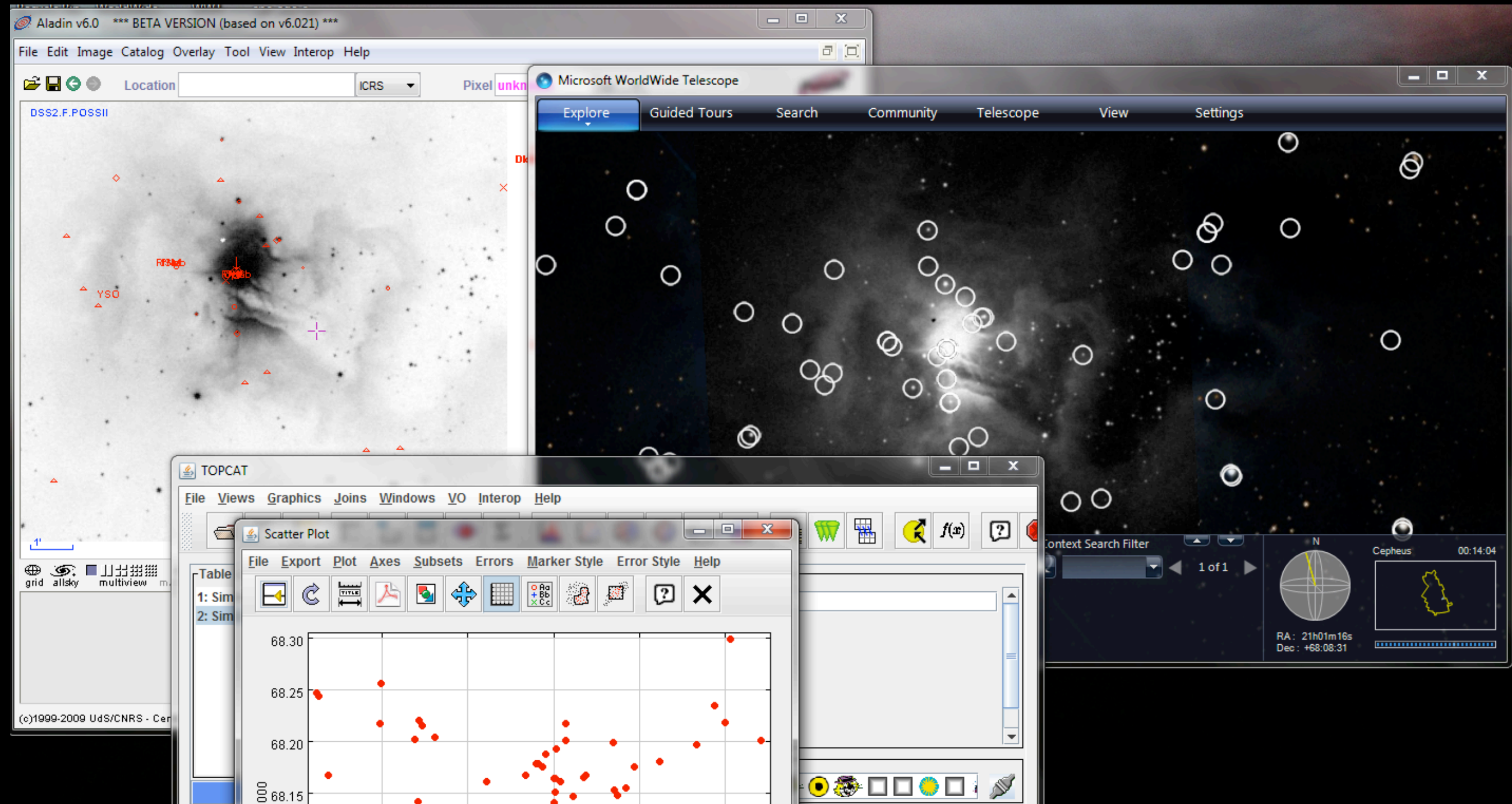
Now being implemented through VAO “Associates”  
and WWT Partners.

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

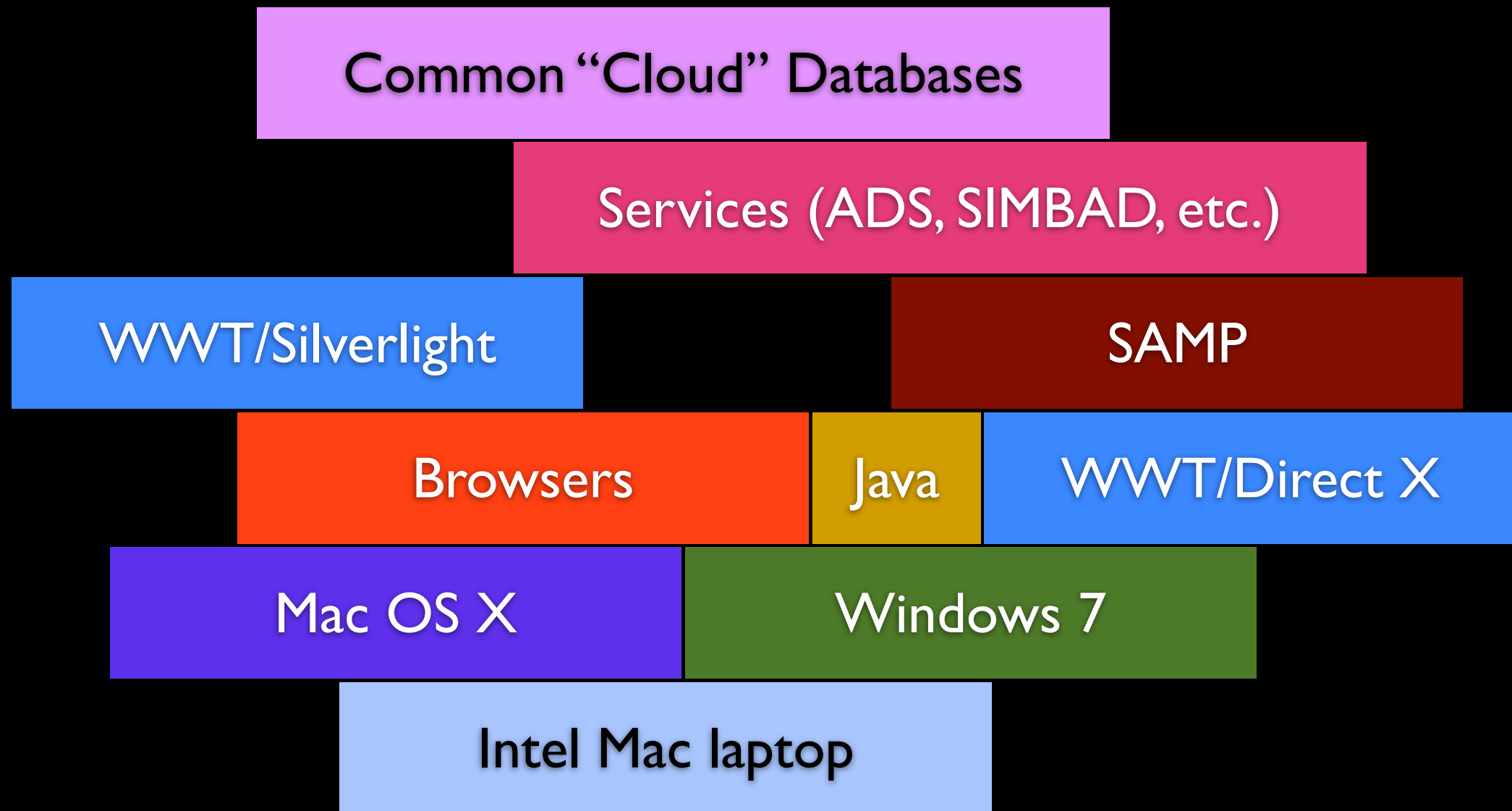
“SAMP” is a great technical start, but offers a very significant user interface challenge.



# 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

The AstroNavigator interface is divided into several sections:

- Header:** "AstroNavigator" with navigation tabs for "Project 1", "Project 2", "Project 3", and "Edit".
- Literature Viewer:** A central window displaying a scientific article snippet about "QSO MgII absorption lines observed". It includes fields for "Authors" (listing "Drinkwater" and "Webster R.L., et al.") and a "Description" starting with "The results of a large R-band".
- Analytics:** A graph titled "Fraction of Emission in Self-gravitating Structures" showing "Beam Size" vs "Scale (pc)". It compares "Simulation" (grey circles) and "L1448" (black circles) data points.
- Data Viewer (e.g. WWT):** A large window showing a 3D visualization of a galaxy or nebula, overlaid with a red, multi-lobed structure.
- Ar3Dive Browser:** A window showing a 3D visualization of a galaxy or nebula, overlaid with a blue, multi-lobed structure. It includes text like "IC 348 Example Requires" and "results 1-20 of 907".

Semantic Search

Literature Viewer

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



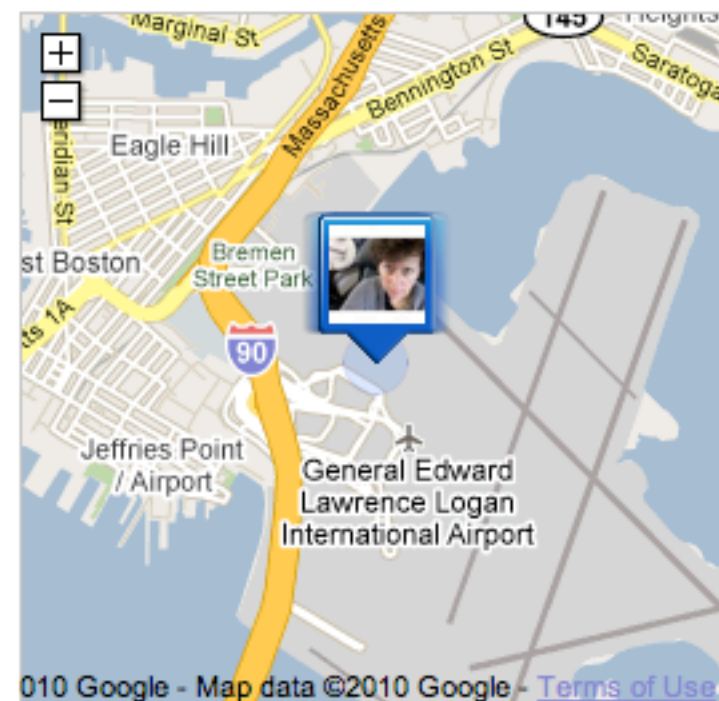
72°F

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

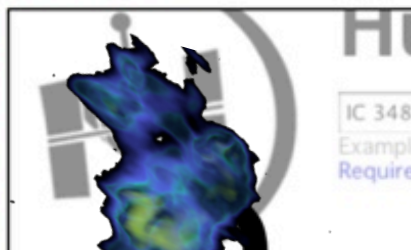
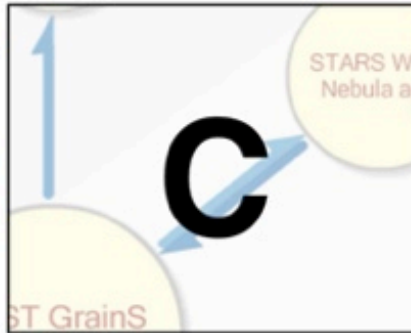
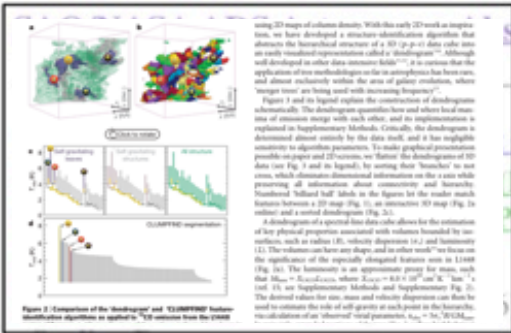
## QSO MgII absorption lines observed

Authors **A**

Drinkwater Webster R.L., et al.

Description

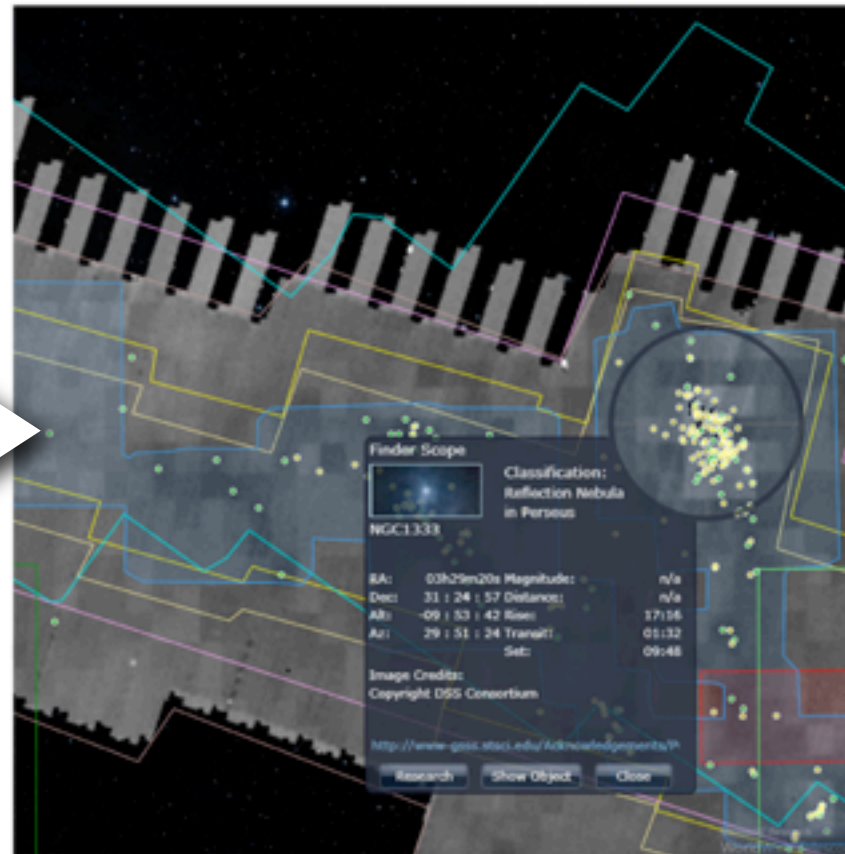
The results of a large R-band



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 on Desktop Control on Screen

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/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

Fiction  
(but soon fact!)

Fact  
(right now)

ADS Query Results

SAO/NASA Astrophysics Data System (ADS)

Query Results from the ADS Database

Selected and retrieved 200 abstracts.

#	Bibcode	Score	Date	Title	List of Links	Access Control Help
1	2006glsw.book..269S	81.000	n/a 2006	Weak Gravitational Lensing	A E X R C e U	
3	2003ARA&A..41..645R	61.000	n/a 2003	Weak Gravitational Lensing by Large-Scale Structure	A E E X R C e U H	
4	2008ARNPS..58..99H	51.000	Nov 2008	Weak Gravitational Lensing and Its Cosmological Applications	A X R C e U	
5	2003astro.ph..6465S	44.000	Jun 2003	Gravitational lensing as a probe of structure	A X R C e U H	
6	2006MNRAS..368.1323H	41.000	May 2006	The Shear Testing Programme - I. Weak lensing analysis of simulated ground-based observations	A E G X R C e 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.
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

### 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

Mechos 1367

DGLE lmc.sci

Object One

Object Two

Object Three

Microensing in the LMC

OGLE Variables in the LMC

Object One

Object Two

Object Three

Variability

Wavelength

Optical

Xray

Shape

Light curves?

Spectra?

Modular Functionality

Download!

created with Balsamiq Mockups - www.balsamiq.com

Ongoing “ADS Labs” Work: Rahul Davé, Alberto Accomazzi, Michael Kurtz, AG  
Thanks to ADS (NASA)/VAO(NASA+NSF)/MSFT funding.



# Article Markup via ADS will be similar to working Life Sciences Tool (thanks IIC!)



SCF Annotation

The neural stem cell microenvironment

Save Annotations Original Listings

Enter term to search for:  Go

Terms: neurogenesis :59 ( x d a s o ) growth :30 ( x d a h o ) cell-cell signaling :28 ( x d a s o )

Annotation id 6. Updated at 2009-07-20 19:47:51.020766 by Mining Robot.

- Ilias Kazanis<sup>1,4</sup>,
- Justin Lathia<sup>1,2</sup>,
- Lara Moss<sup>1,3</sup>,
- Charles French-Constant<sup>1,3</sup>

<sup>1</sup>Department of Pathology, University of Cambridge, Tennis Court Road, CB2 1QP, Cambridge, UK  
<sup>2</sup>Current address: Dept. of Surgery, Division of Neurosurgery, Duke University Medical Center, Durham, NC 27710, USA  
<sup>3</sup>Current address: MRC Centre for Regenerative Medicine, The Queen's Medical Research Institute, 47 Little France Crescent

In mammals, neural stem cells appear early in development and remain active within the central nervous system for the whole life span and reside within changing microenvironments whilst retaining the basic properties of a stem cell: multipotentiality and the ability to self-renew along with the fundamental structural components and signalling molecules of their microenvironments. In early neural development, neural stem cells; they are situated among other neuroepithelial cells and they are exposed to various signals such as retinoic acid, sonic hedgehog, and glial cells and the complexity of their microenvironment increases due to the emergence of various types of neuronal progenitor cells. Astroglial morphology and reside in specific microenvironments that are called neurogenic niches; small neurogenic islands which are operating during embryonic development.

## 1. The embryonic neural stem cell (NSC) microenvironment

Central nervous system (CNS) development is an intricate process relying on a series of mechanisms precisely regulated in time and space to ensure that cells reach their respective destination within an approximately one-week period during embryogenesis. The embryonic CNS is a dynamic structure, constantly increasing in size due to mitogenesis, while the stem cell population is present in the adult

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 Schneider, P.	81.000	n/a 2006	A E X R C c U	
3	2003ARA&A..41..645R Refregier, Alexandre	61.000	n/a 2003	A E F X R C c U H	
4	2008ARNPS..58..99H Hoekstra, Henk; Jain, Bhuvnesh	51.000	Nov 2008	A X R C c U	
5	2003astro.ph..646SS Schneider, Peter	44.000	Jun 2003	A X R C c U H	
6	2006MNRAS.368.1323H Heymans, Catherine; Van Waerbeke, Ludovic; Bacon, David	41.000	May 2006	A E G X R C c U	

“Faceted Browsing”

Annotate

Delete All | Add Mapping

- go : nervous system development [Delete](#) | [Alter](#)
- go : cell growth [Delete](#) | [Alter](#)
- go : growth pattern [Delete](#) | [Alter](#)
- go : cell-cell signaling [Delete](#) | [Alter](#)
- go : system development [Delete](#) | [Alter](#)
- go : growth [Delete](#) | [Alter](#)
- go : stem cell development [Delete](#) | [Alter](#)
- go : cell development [Delete](#) | [Alter](#)

# Collaborative Astronomy at University of Washington

- **Research in a Browser**

- **“iGoogle” for Astronomy**

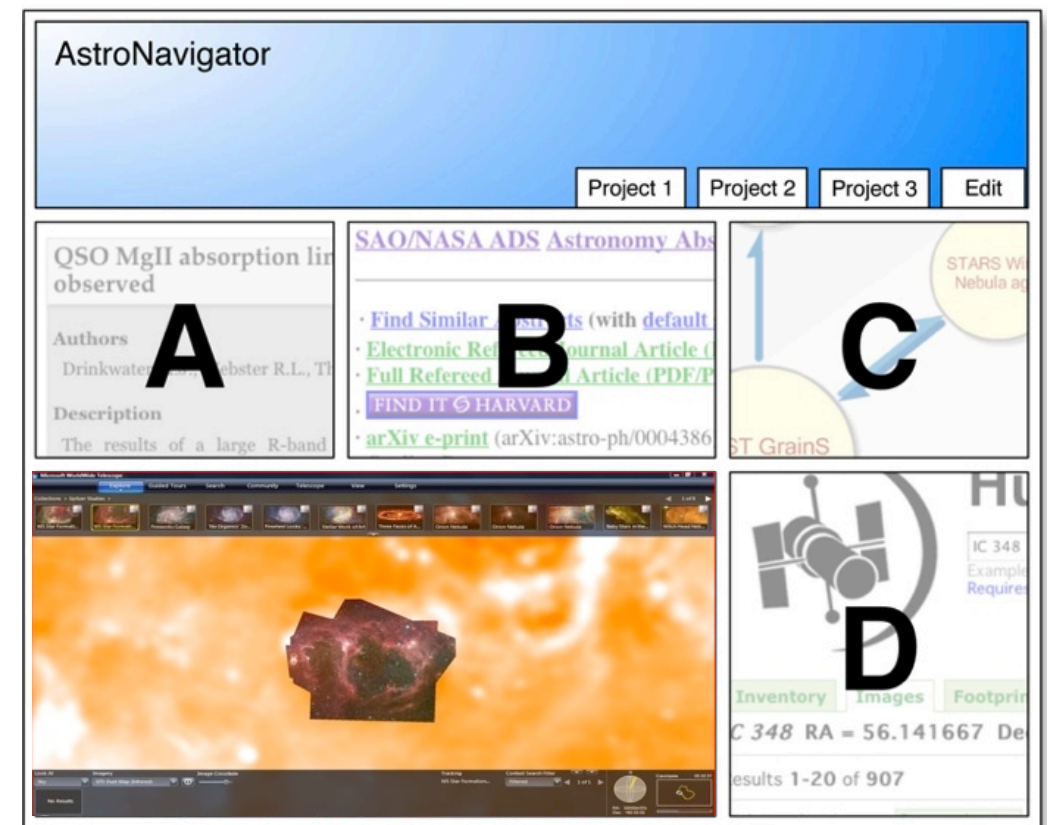
- Collections of simple atomic applications (gadgets)
    - Users choose the view they want
    - All gadgets can communicate with each other

- **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 shows a web-based astronomy interface. At the top, there is a header with the text "SISTE Gadget Server" and "Signed-in as ajc | Sign-out | Help". Below the header is a navigation bar with buttons: "Add Gadgets", "Add New Tab", "Clone Active Tab", and "Remove Active Tab". The main content area is divided into several sections. On the left, there are three vertical panels: "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; and "Name Resolve" with an "Input Object Name" field and a "Go" button. In the center, there is a "DataGadget v0.1" panel. On the right, there is a "Sky Viewport" panel displaying a star chart with constellation names: Ursa Major, Lynx, Leo Minor, Cancer, Gemini, Leo, Canis Minor, Sextans, and Monoceros. The chart includes a compass rose, a zoom slider, and coordinates at the bottom: "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

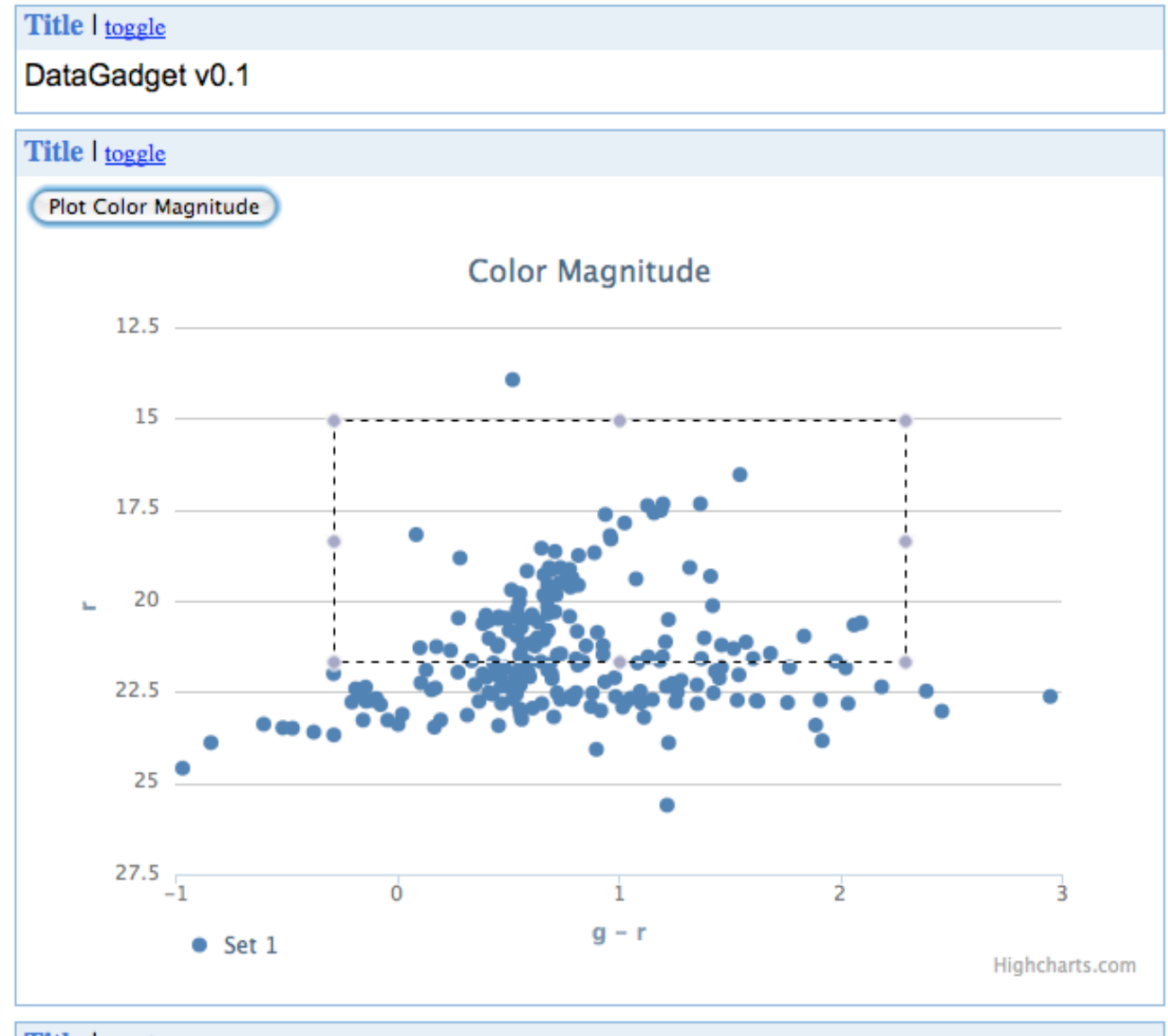
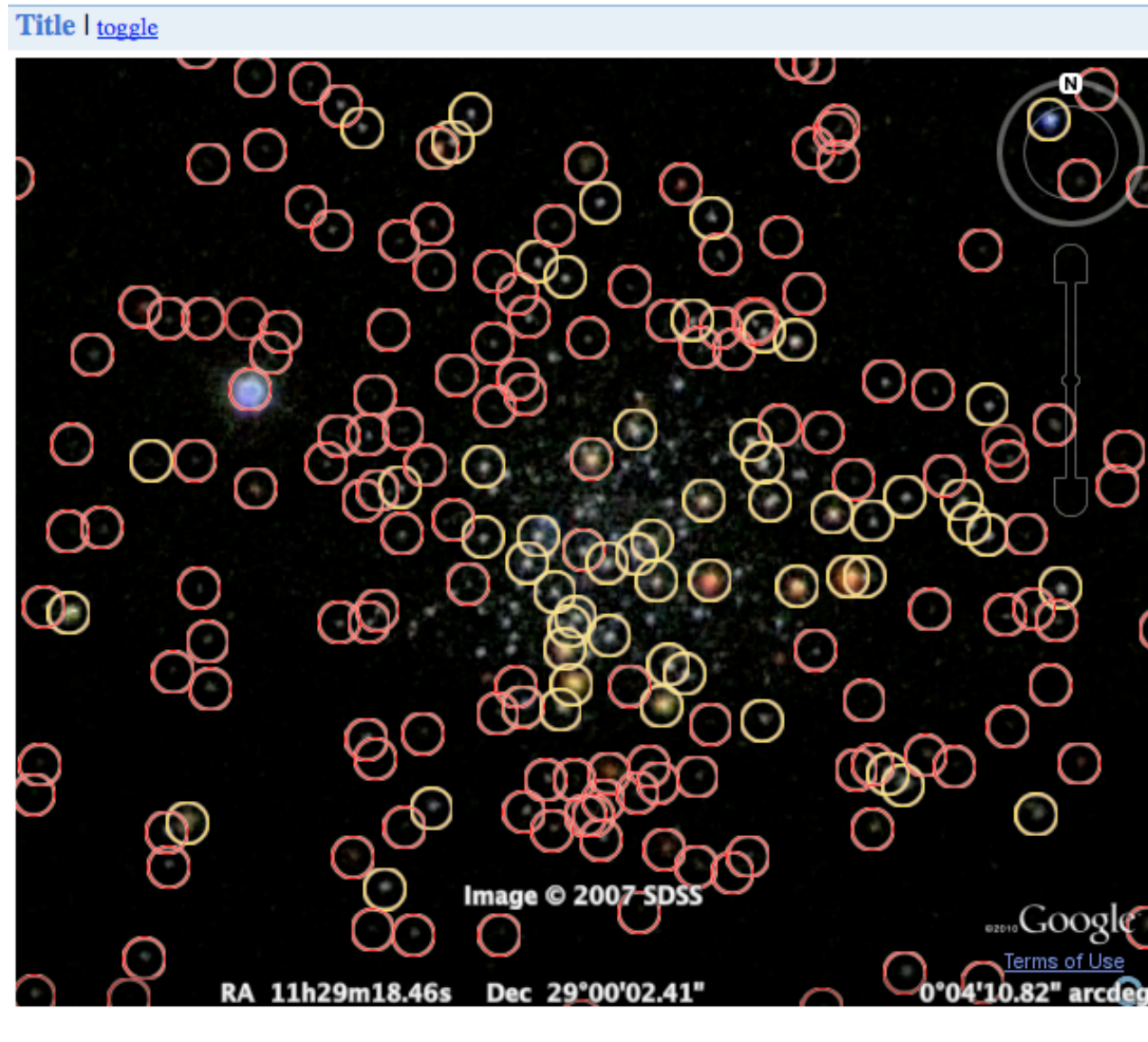
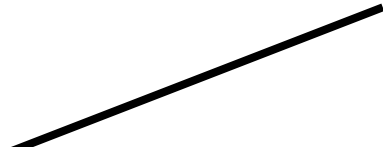
The screenshot shows a web browser window titled "Gadget Server" with a navigation bar containing "Add Gadgets", "Add New Tab", "Clone Active Tab", and "Remove Active Tab". The main content area features several gadgets: "Sky Viewport" on the left showing a star field with red circles and labels like "Messier 87", "IC 3443", and "NGC 4478"; "DataGadget v0.1" in the center with a "Get Sky Objects" section containing a dropdown for "SDSS", a "Max: 50" input, and a "Get Objects" button; "Input Coords" on the right with "RA:" and "dec:" input fields and a "GO" button; and "Name Resolve" at the bottom right with an input field containing "m87" and a "Go" button. Black arrows point from the text above to the Sky Viewport, DataGadget, Input Coords, and Name Resolve gadgets. A larger arrow points from the text below 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



# Part 2

## WorldWide Telescope Ambassadors Program

**Alyssa Goodman**

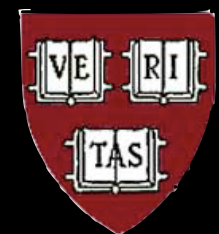
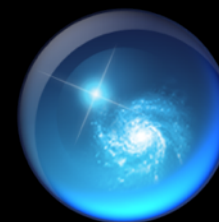
*Harvard University Professor of Astronomy,  
WGBH Scholar-in-Residence, Microsoft Academic Partner*

**Annie Valva**

*WGBH Interactive, Director of Research & Development*

**Pat Udomprasert**

*WWT Program Coordinator*





# 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?

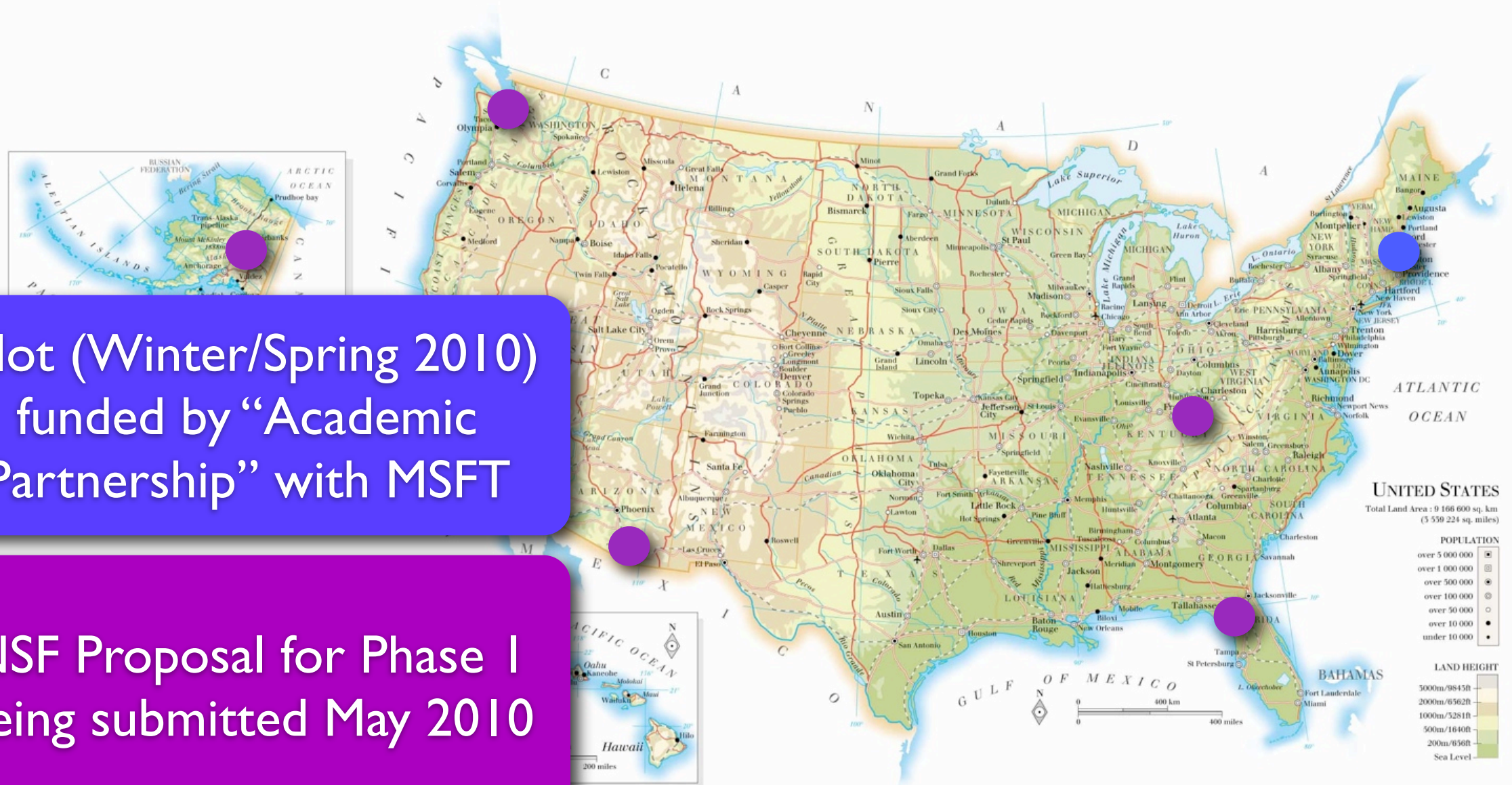
Public spaces and schools in a variety of regions

# 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  
being submitted May 2010

*Phase II: US-wide; Phase III: International*



To find out more...

Please see Pat Udomprasert, Sarah Block, Jeremy Cushman, Sana Sharma, me and the web and the wall outside this room...

**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

**WorldWide Telescope Ambassadors Program**

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

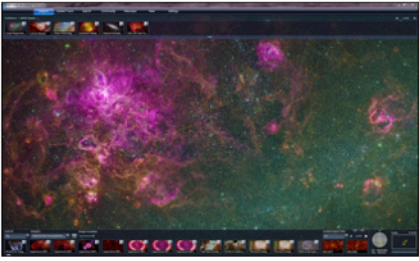
WorldWide Telescope (WWT) is a rich visualization environment that functions as a virtual telescope, allowing anyone to make use of professional astronomical data to explore and understand the universe. As of early 2010, the new WWT Ambassadors Program is recruiting astronomically-literate volunteers, 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.

# What?

## Future-leaning way to teach and learn STEM concepts

**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 2<sup>nd</sup> box from the left, check everything.

*WWT Tours,  
including creation by  
Ambassadors &  
learners + hosting*

*Guided WWT  
Exploration  
activities created by program  
staff & Ambassadors/teachers*



# How?

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



# WWWT Ambassadors Program


*Recruiting, Vetting, Coordination*



hosted/  
promoted by

The WGBH logo, consisting of the letters 'WGBH' in a stylized, bold font.





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

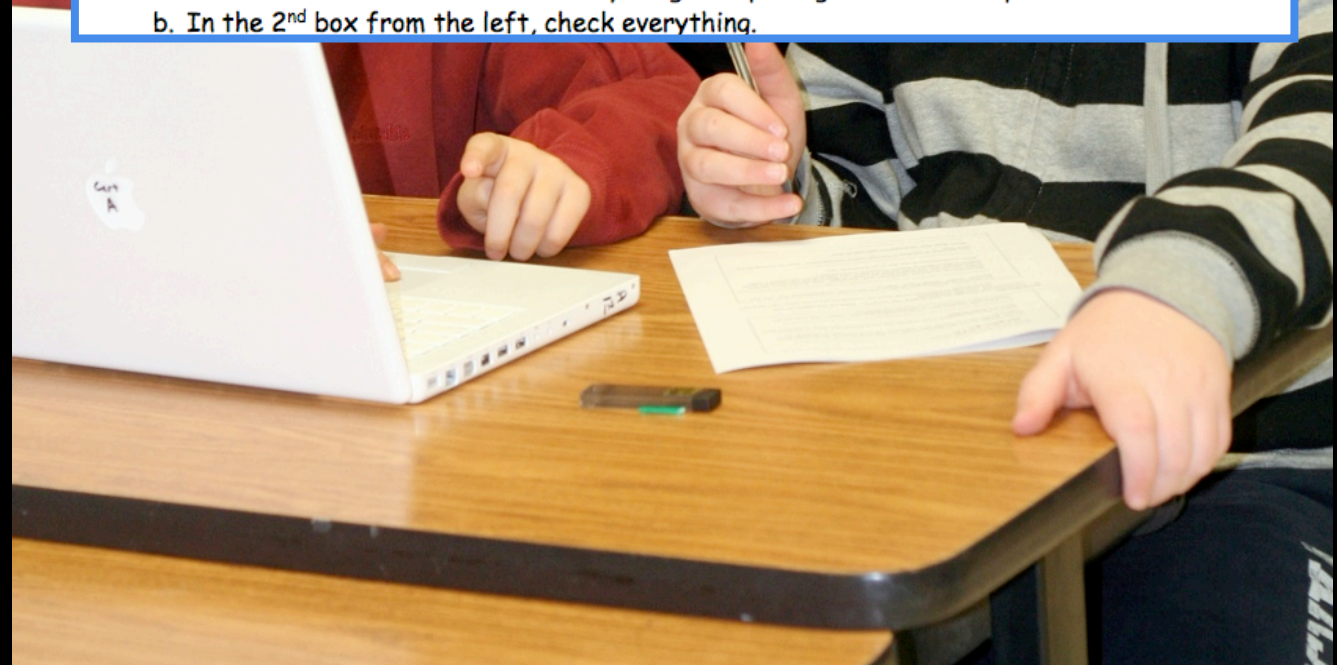
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  - a. In the lefthand box: uncheck everything except "Figures" and "Ecliptic."
  - b. In the 2<sup>nd</sup> box from the left, check everything.



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



*“Why is one polar ice cap on Mars bigger than the other?”*  
– Clarke Middle School 6<sup>th</sup> 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' button. A row of planet thumbnails 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: 'Lnq: 20:32:48' and 'Lat: +51:11:21'.



*Michelle Bartley interviews her 6<sup>th</sup>-grade science class about WWT*  
*December 19, 2009*





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

*–Clarke Middle School 6<sup>th</sup> grade student*

### More quotes from Clarke 6<sup>th</sup> 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.)*

# Spring 2010 Pilot Results

**15 WWT Tours** Created by groups of 4 to 5 students in 4 sixth-grade Science Classes (of M. Bartley, Clarke MS)

**Facilitated** by 4 WWT **Ambassadors**: 1 Ph.D. Astrophysicist (Udomprasert); 1 Harvard Undergrad Physicist (Cushman); 1 retired Ph.D. Physicist (Post); 1 planetarium-show writer (Becker)

Students, parents & teachers report creating WWT Tours is a better vehicle for learning than PPT presentations, papers

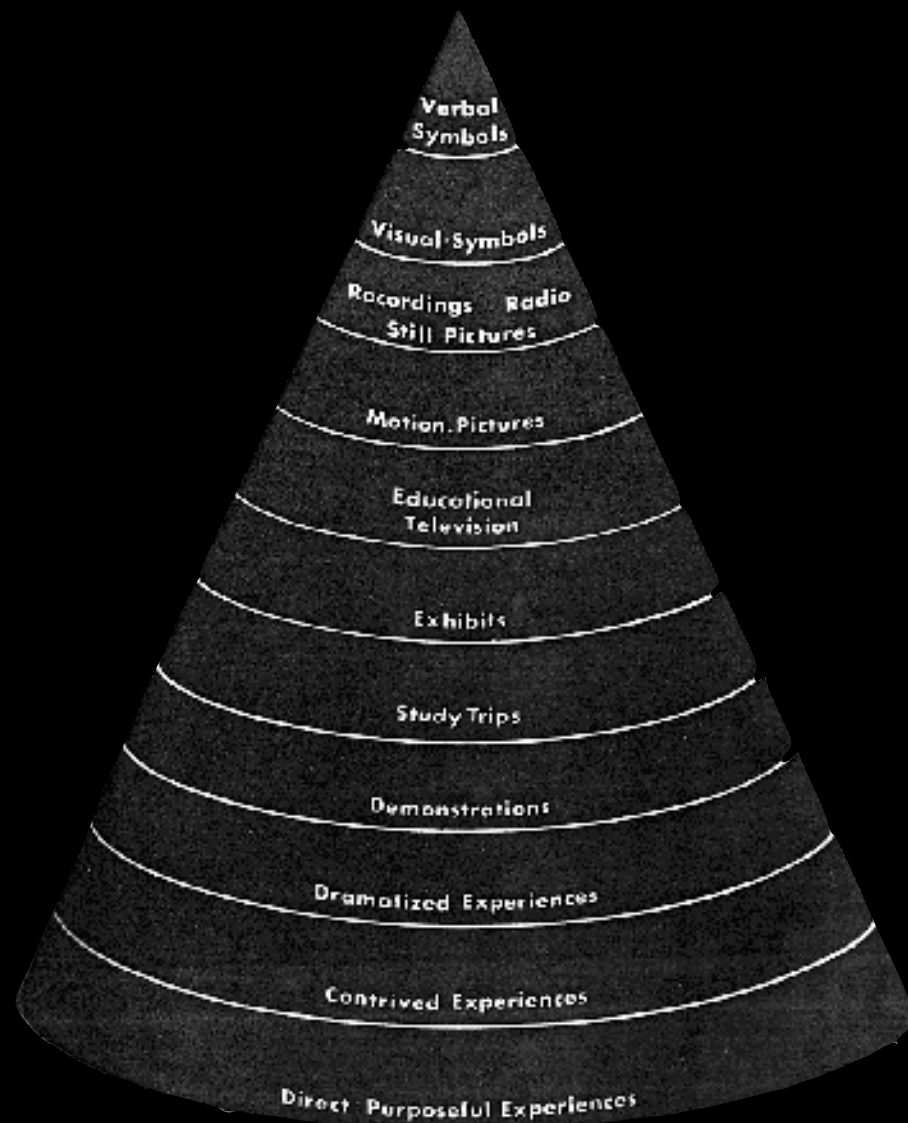
*Unexpected finding: Tour creation is a non-threatening way to reveal students' understanding/mis-understanding of concepts*



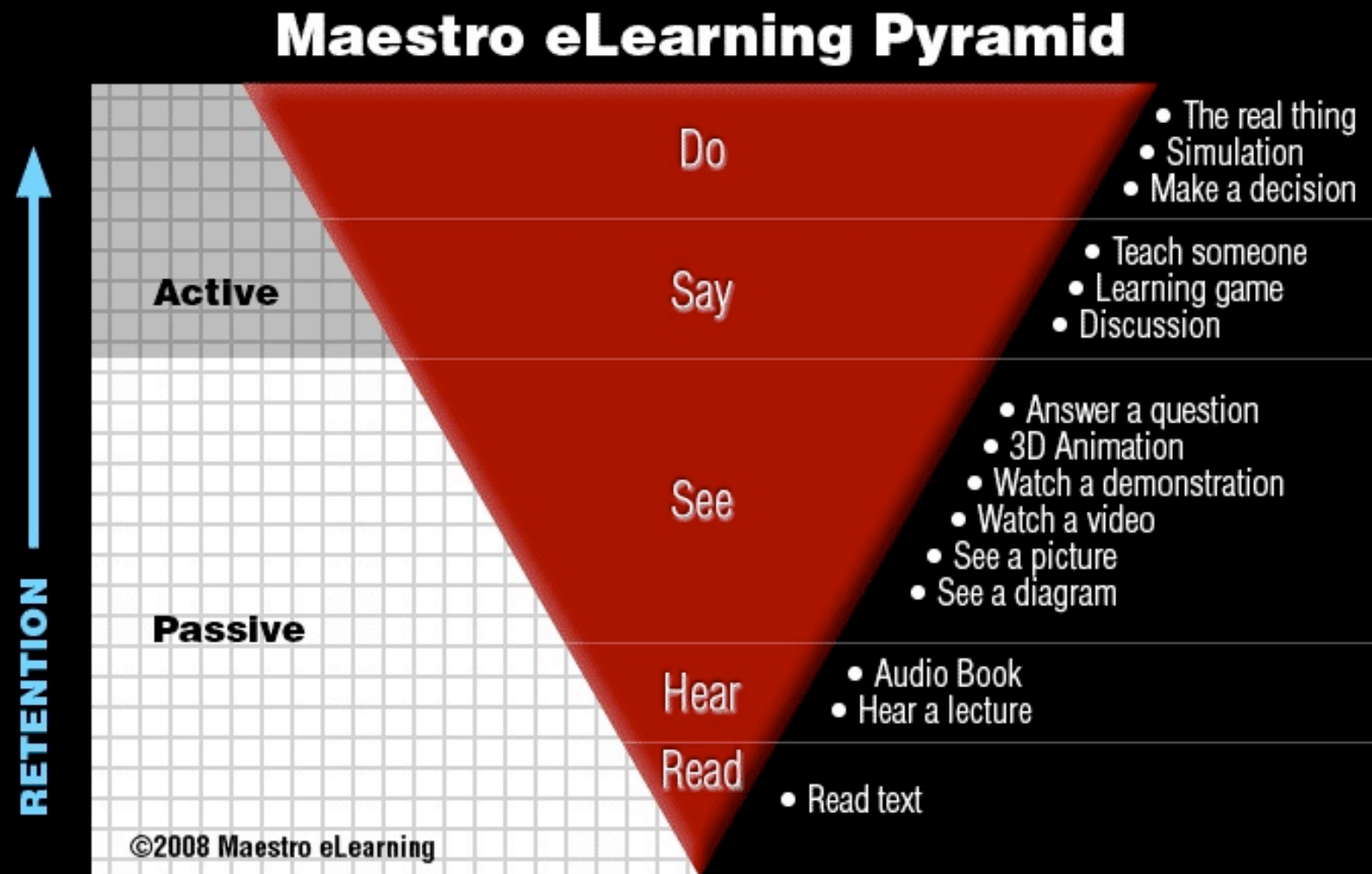
# Why?

Increase STEM literacy in US now.

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



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



Tour:  
Dust & Us

Planets

Stars

Galaxies

Gas

Exotica  
(Black Holes,  
etc.)

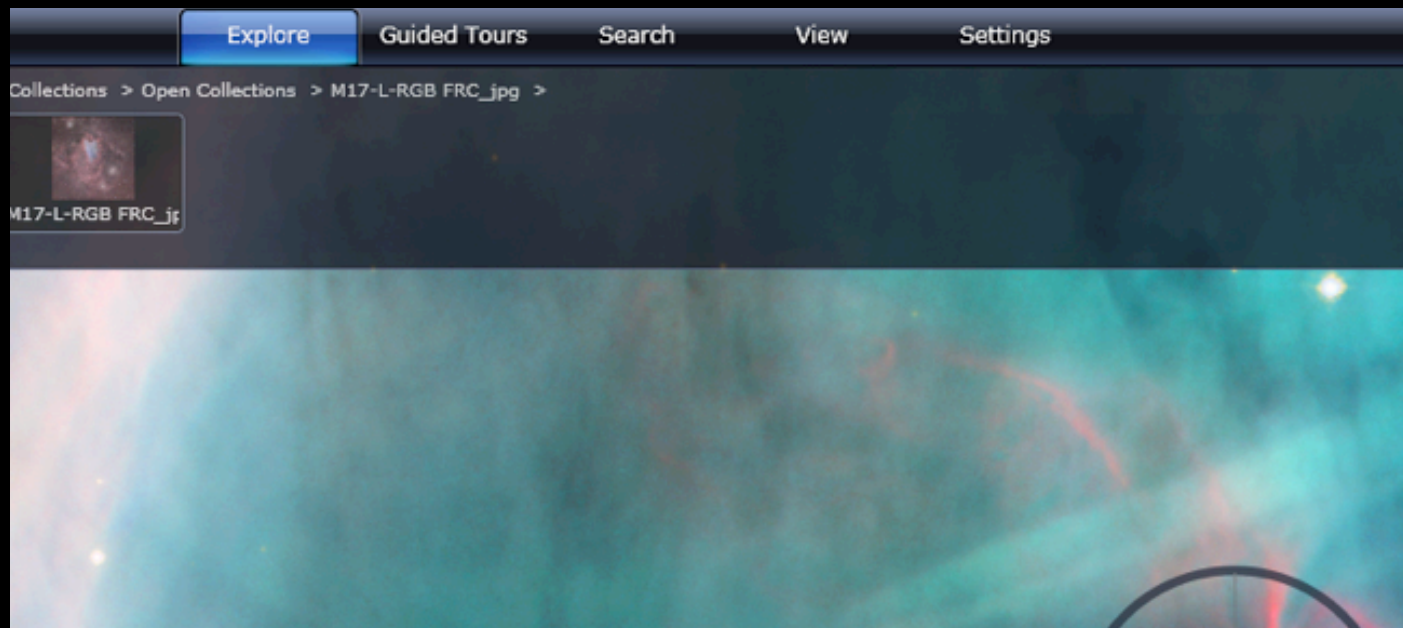
- ◆ PROPOSED INDEX & SEARCH SCHEME FOR WWT AMBASSADORS
- ◆ WWT TIPS AND TRICKS
- ◆ POPULAR INTERESTS
  - ◆ Beauty in the Night Sky
  - ◆ Space Exploration
  - ◆ Exotic Objects and Events
  - ◆ Collisions and Explosions
  - ◆ For and By Kids
- ◆ NIGHT SKY OBSERVING
  - ◆ Beauty in the Night Sky
  - ◆ Constellations
  - ◆ Finding Objects in the Sky
  - ◆ Brightness and Magnitudes
  - ◆ Telescopes and Technology
- ◆ OBJECTS IN THE SKY
  - ◆ Solar System - Ours and Beyond
  - ◆ Stars and Their Evolution
  - ◆ Between the Stars - Gas and Dust
  - ◆ Galaxies
  - ◆ Cosmology
  - ◆ Exotic Objects
- ◆ ASTROPHYSICAL CONCEPTS
  - ◆ Light
  - ◆ Scales in the Universe
  - ◆ Physical Properties of Matter
  - ◆ Changes with Time
  - ◆ Big Theories in Physics
- ◆ SCIENTIFIC PROCESSES AND SKILLS
  - ◆ How We Know
  - ◆ Limitations to What We Can Know
- ◆ SCIENCE AND SOCIETY
  - ◆ Current Research
  - ◆ History of Science
  - ◆ Cultural Influences and Perspectives
  - ◆ Space Exploration

We'd **need** more  
**astrophysicists** as  
WWT Ambassadors  
to create STEM-  
oriented Tours  
(hint, hint...  
and we'll help you!)

Temperature



1:30



**View annotations on [BFT2007] 749 object**

or view last annotations
 agoodman Preferences Logout

## Annotations on [BFT2007] 749 object

[View object in Simbad](#)

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 [Subscribe to this page](#) | 
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1 annotation(s) currently in list

**View:** Hierarchic  include archived **Threads:** unexpand

Sort by: Date ▾

# **agoodman** (Alyssa Goodman) on 2010-05-13 at 14:47

This X-ray source is very near a red "bulbous" features in the Hubble Image of M17, online at [http://hubblesite.org/newscenter/archive/releases/2002/11/image/g/format/large\\_web/](http://hubblesite.org/newscenter/archive/releases/2002/11/image/g/format/large_web/). Is there an association?

©UDS/CNRS Contact:

**SIMBAD query result**

01-May-2010: Reminder: On web pages displaying individual objects, users can post annotations, which remain visible to other users. See full documentation [here](#).

**other query modes:**
[Identifier query](#)
[Coordinate query](#)
[Criteria query](#)
[Bibliography query](#)
[Basic query](#)
[Script submission](#)
[Output options](#)
[Help](#)

Object query : @5278000 C.D.S. - SIMBAD4 rel 1.150 - 2010.05.13CEST20:49:25

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

**Basic data :**

**[BFT2007] 749 -- X-ray source** query around with radius  arcmin

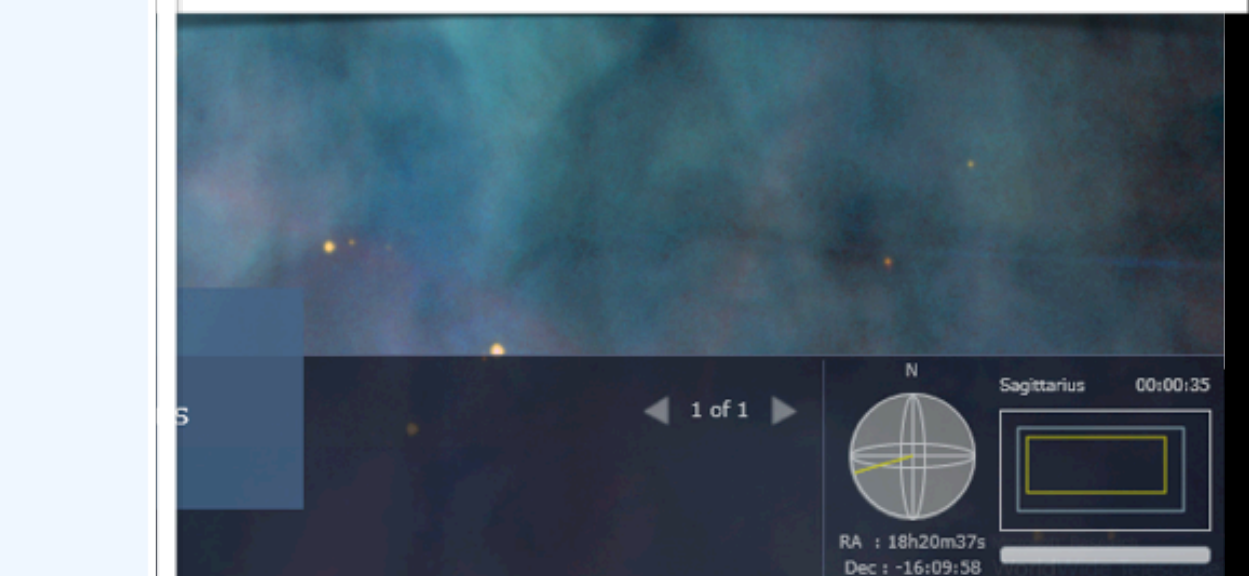
Other object types: X ([BFT2007],CXOU)

ICRS coord. (ep=2000) : 18 20 37.073 -16 10 04.55 ( X-ray ) [ 200 200 89 ] C [2007ApJS..169..353B](#)

FK5 coord. (ep=2000 eq=2000) : 18 20 37.073 -16 10 04.55 ( X-ray ) [ 200 200 0 ] C [2007ApJS..169..353B](#)

FK4 coord. (ep=1950 eq=1950) : 18 17 43.97 -16 11 28.3 ( X-ray ) [ 200 200 90 ] C [2007ApJS..169..353B](#)

Gal coord. (ep=2000) : 015.0798 -00.7086 ( X-ray ) [ 200 200 0 ] C [2007ApJS..169..353B](#)



Look At: Sky

Imagery: Digitized Sky

Sagittarius

1 of 1

Sagittarius 00:00:35

RA : 18h20m37s  
 Dec : -16:09:58





### Skyalert Worldwide Telescope Display



These events are dynamically retrieved from [Skyalert](#).

SWIFT last 50

Fermi last 50

CRTS last 50

CSS\_NEO last 50

Clear All

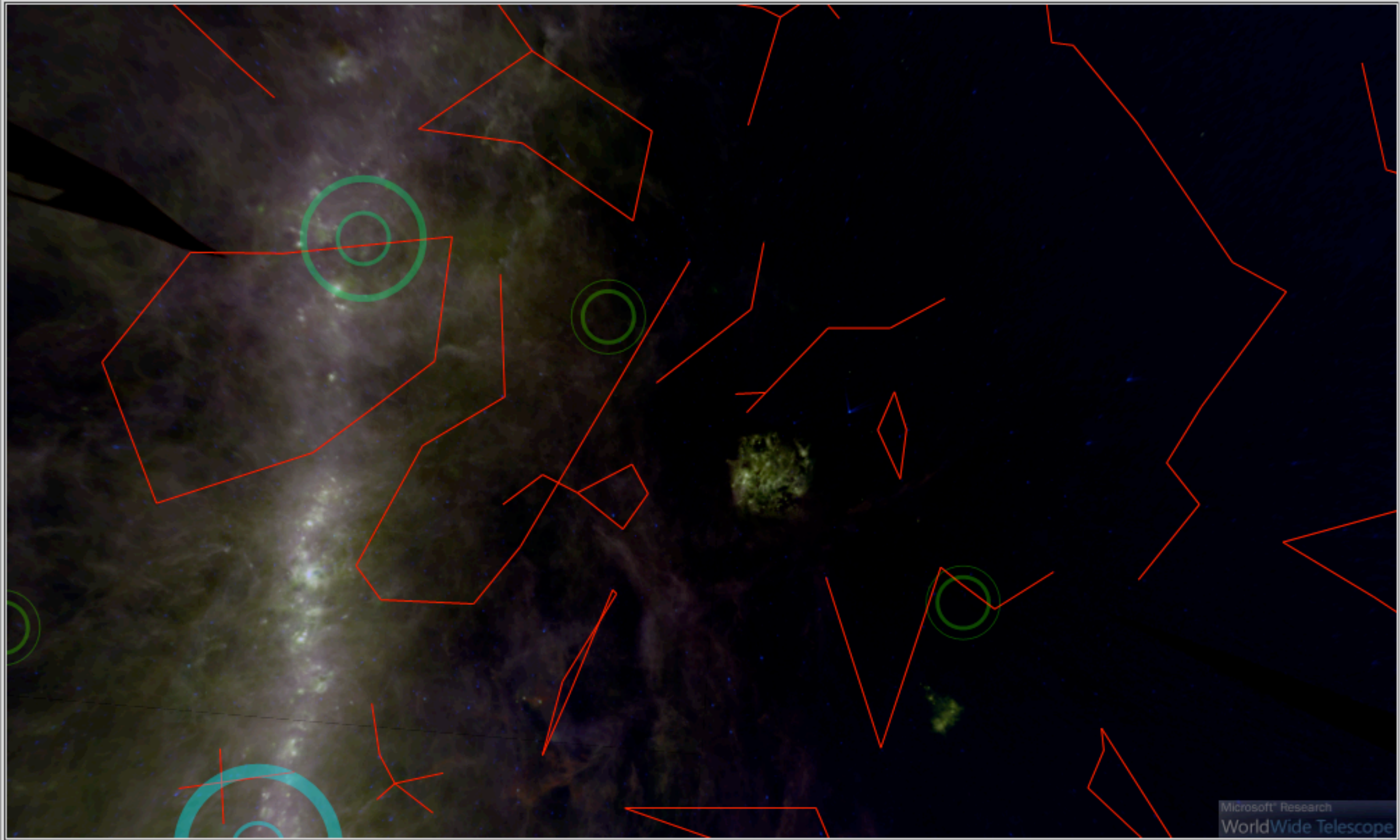
Select image background here:

IRAS/IRIS Infrared



Built with the web-client of  
[Microsoft WorldWide Telescope](#)

Click in the center of any event for window with detailed data.  
Initial display is [CRTS](#) most recent 50 events.



How best to work with NSF  
OCI, MPS/AST, EHR & CISE  
simultaneously?

## Proposals/Phases

- > RAPID/EAGER?
- > Unsolicited?
- > Cyberlearning?
- > Other?

We are *ready-to-go* in 2010 on Phase I.  
Phase II possible in 2011-12.

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