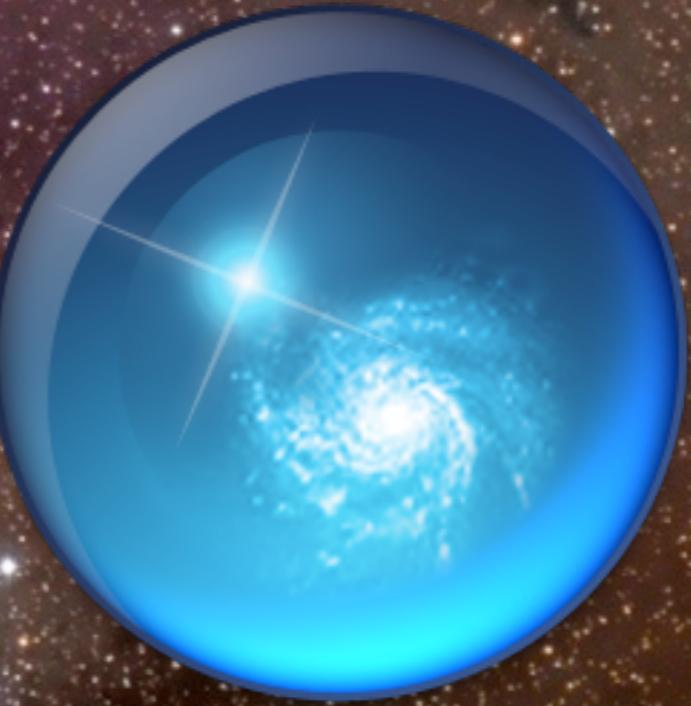


WorldWide Telescope

Microsoft  
Research



# The WorldWide Telescope

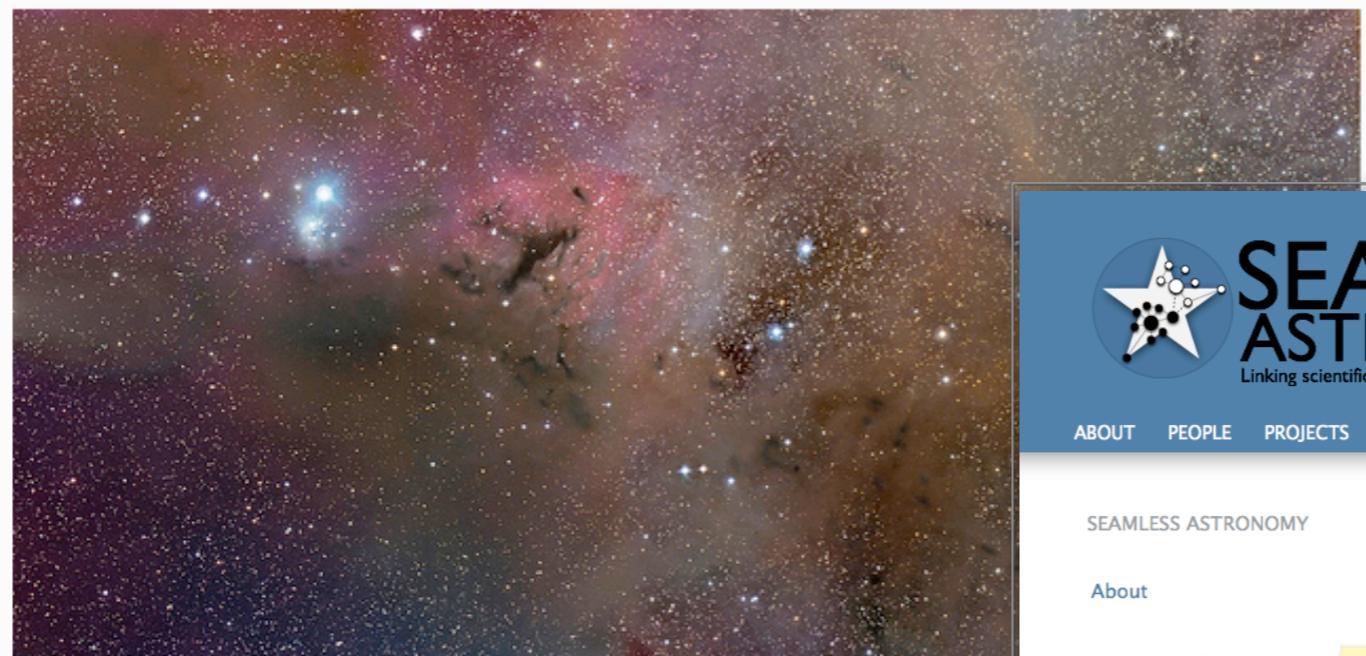
Alyssa A. Goodman

*Professor of Astronomy  
Harvard University*



WWT software created by Curtis Wong & Jonathan Fay at Microsoft Research

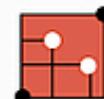
Actions ▾



## perseus\_optical

Wide field image of Perseus star-forming clouds.

### Comments and faves



[astrometry.net](#) (12 months ago)

Hello, this is the blind astrometry solver. Your results are:  
 (RA, Dec) center:(54.3378035839, 31.6779385177) degrees  
 (RA, Dec) center (H:M:S, D:M:S):(03:37:21.073, +31:40:40.579)  
 Orientation:179.64 deg E of N

Pixel scale:9.32 arcsec/pixel

Parity:Reverse ("Left-handed")  
 Field size :5.55 x 2.68 degrees

Your field contains:

The star oPer  
 NGC 1333  
 IC 348

[View in World Wide Telescope](#)



# SEAMLESS ASTRONOMY

Linking scientific data, publications, and communities



ABOUT PEOPLE PROJECTS PUBLICATIONS PRESENTATIONS SOFTWARE CFA DATA (BETA) EVENTS

### SEAMLESS ASTRONOMY

#### About



The **Seamless Astronomy Group** at the Harvard-Smithsonian Center for Astrophysics brings together astronomers, computer scientists, information scientists, librarians and visualization experts involved in the development of tools and systems to study and enable the next generation of online astronomical research.

Current projects include research on the development of systems that seamlessly integrate scientific data and literature, the semantic interlinking and annotation of scientific resources, the study of the impact of social media and networking sites on scientific dissemination, and the analysis and visualization of astronomical research communities. Visit our [project page](#) to find out more.

Sponsors of Seamless Astronomy include NASA, NSF and Microsoft Research.

Contact us. For inquiries or questions, please email Sarah Block at [sblock@cfa.harvard.edu](mailto:sblock@cfa.harvard.edu). Alternatively you can contact or visit us at:  
 SEAMLESS ASTRONOMY TEAM  
 HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS  
 60 GARDEN STREET, MS 42  
 CAMBRIDGE, MA 02138

*The figure (above) diagrams the relationship between astronomical research and the data and literature sources that the research draws upon. The researcher stands between the literature and data, taking information from each, integrating their own analysis tools, and then producing new publications and results that feed back into these source regimes.*

Twitter  
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 Links

Latest Announcements

Latest Feed Items

albertoconti:  
<http://t.co/pdmrdJ5s>  
 (Introducing Evernote Clearly:  
 One Click for Distraction-Free  
 Online Reading)

albertoconti: Evernote Clearly:  
 One Click for Distraction-Free  
 Online Reading « Evernote  
 Blogcast  
<http://t.co/vTOMgWUh>

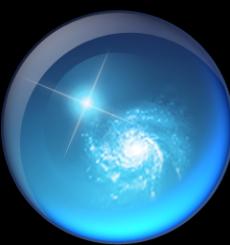
albertoconti: @thenakedshort  
 but your argument can be  
 reversed: supporting  
 commercial crew now would  
 have made #JWST science  
 impossible.

albertoconti: RT @Unstrung: RT  
 @jeff\_foust Bolden says  
 FY2013 NASA budget proposal  
 will "adequately" support key  
 priorities: SLS/MPCV,  
 ISS/Comm'l Crew ...

augustmuench: #feedly just  
 rocked my rss world. (already  
 damaged #greader, you may  
 go now).

augustmuench: google scholar  
 profile: my citations were  
 growing w/nice linear trend  
 right up to 2008 aka when I  
 started working on  
 sw/service/training.

doug\_burke: RT @edsu:  
 Interesting take on responsive  
 UIs and Ajax  
<http://t.co/6s8LUqnv>



# Microsoft® Research WorldWide Telescope

Experience WWT at [worldwidetelescope.org](http://worldwidetelescope.org)

The screenshot shows the Microsoft Research WorldWide Telescope interface. At the top, there's a navigation bar with tabs: Explore (which is selected), Guided Tours, Search, View, and Settings. Below the navigation bar, there's a collection of images from various telescopes, including the Digitized Sky Survey, VLSS: VLA Low-frequency Survey, WMAP ILC 5-Year, SFD Dust Map (Inf), IRIS: Improved Re, 2MASS: Two Micro, and Hydrogen Alpha Full. A text box on the left says: "Seamlessly explore imagery from the best ground and space-based telescopes in the world". Another text box below it says: "Expert led tours of the Universe". A third text box on the right says: "Control time to study how the night sky changes". In the center, there's a large circular view of a spiral galaxy. To the left of the view, there's a "Finder Scope" window showing a smaller image of the same galaxy and providing its classification as a "Spiral Galaxy in Andromeda". It also lists its coordinates: RA: 00h42m42s, Dec: 41° 16' 00", Alt: 70° 06' 26", Az: 275° 42' 17", Set: 00:35. A text box next to this window says: "Finder Scope links to Wikipedia, publications, and data, so you can learn more". At the bottom, there's a "Look At" dropdown set to "Sky", with options like "Andromeda", "Three Faces of the Sun", "Research", "Show Object", and "Close". A text box on the left says: "Much more than 'just' the sky at night! 3D features can take you to other planets, stars & galaxies.". A text box on the right says: "Context bar shows items of interest in current field of view". Another text box on the far right says: "Context globe shows where you're looking.". The bottom right corner shows a small "WorldWide Telescope" logo.

Explore

Guided Tours

Search

View

Settings

Collections > All-Sky Surveys >

Digitized Sky Survey

VLSS: VLA Low-fre

WMAP ILC 5-Year

SFD Dust Map (Inf)

IRIS: Improved Re

2MASS: Two Micro

Hydrogen Alpha Fu

1 of 3

1 of 3

Seamlessly explore imagery from the best ground and space-based telescopes in the world

Expert led tours of the Universe

Control time to study how the night sky changes

View and compare images from across the electromagnetic spectrum

Much more than "just" the sky at night! 3D features can take you to other planets, stars & galaxies.

Finder Scope

Classification: Spiral Galaxy in Andromeda

NGC224

RA: 00h42m42s Magnitude:

Dec: 41 : 16 : 00 Distance:

Alt: 70 : 06 : 26 Rise:

Az: 275 : 42 : 17 Transit:

Set: 00:35

00:35

Image Credits: Data provided by two NASA satellites, the Infrared Astronomy Satellite (IRAS) and the Cosmic Background Explorer (COBE). Processing <http://astro.berkeley.edu/~marc/dust/>

Look At

Sky

Andromeda

Digitiz

Three Faces of the Sun

Research

Show Object

Close

Info

Image Crossfade

1 of 3

1 of 3

N

Andromeda

01:58:26

RA : 00h42m40s

Dec : 41:13:35

WorldWide Telescope

Finder Scope links to Wikipedia, publications, and data, so you can learn more

Context bar shows items of interest in current field of view

Context globe shows where you're looking.



# 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

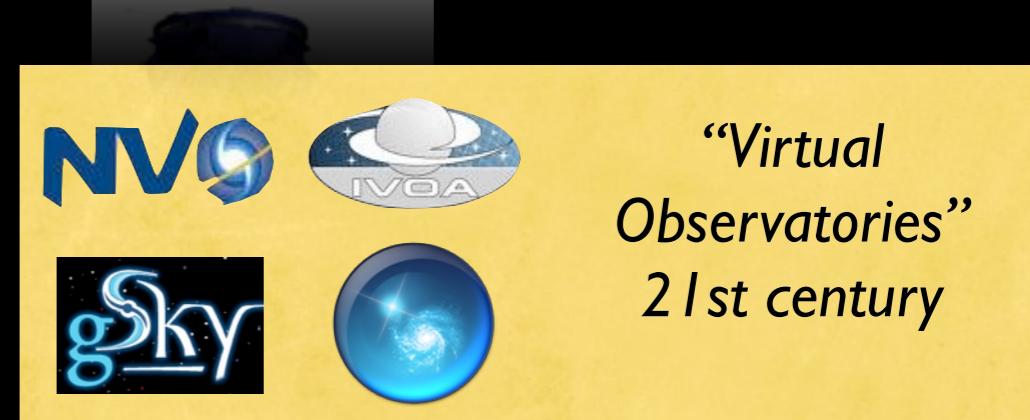


NASA/Explorer 7  
(Space-based  
Observing)  
1959

“The Internet”



Long-distance  
remote-control/  
“robotic”  
telescopes  
1990s



“Virtual  
Observatories”  
21st century

# 2005



*Curtis Wong  
Microsoft Research*

Story mode

**Stellar Evolution**  
SKY SERVER

Story mentions gravitational condensation of protostars from hydrogen and galactic dust. And links to related content appears below.

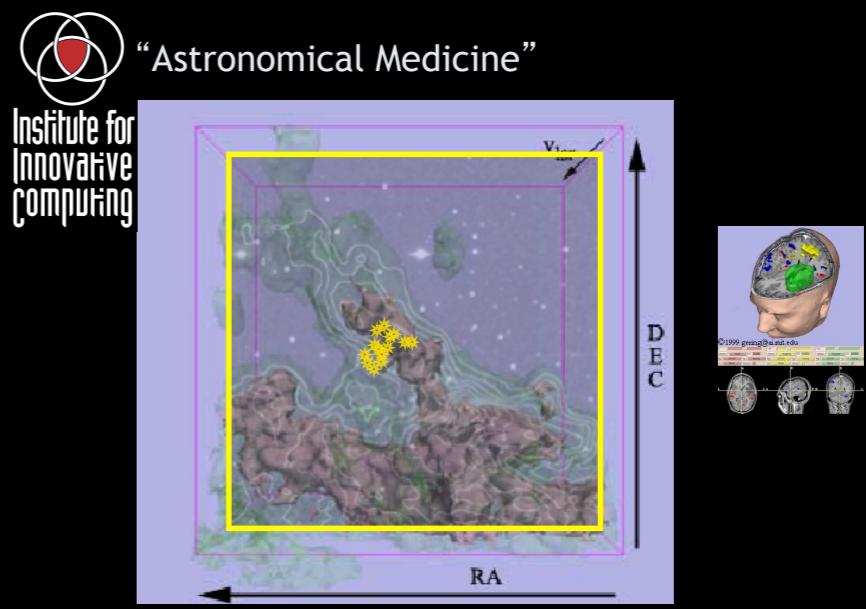
Clicking on the related link below takes you to the object in context of the sky

Nebula

A screenshot of the SkyServer Story mode interface. It shows a star field with several yellow arrows pointing to specific stars. A yellow circle labeled 'Story' is positioned above one of the stars. The interface includes text describing stellar evolution and gravitational condensation, and a navigation bar at the bottom.

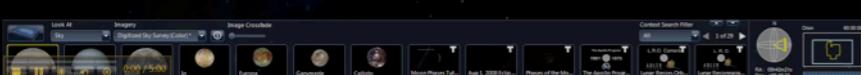
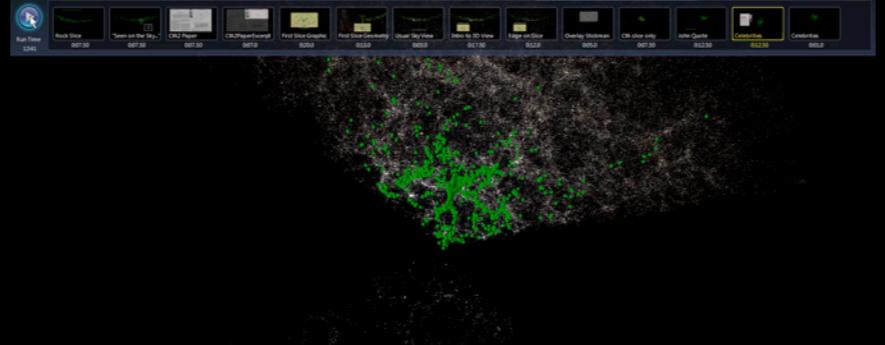
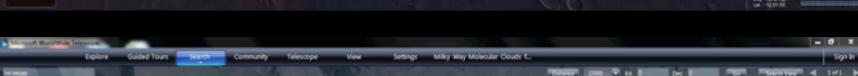
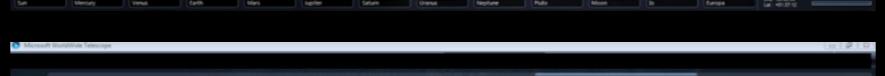
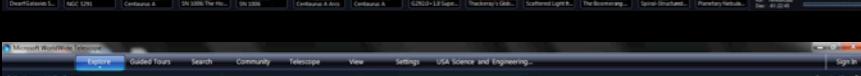
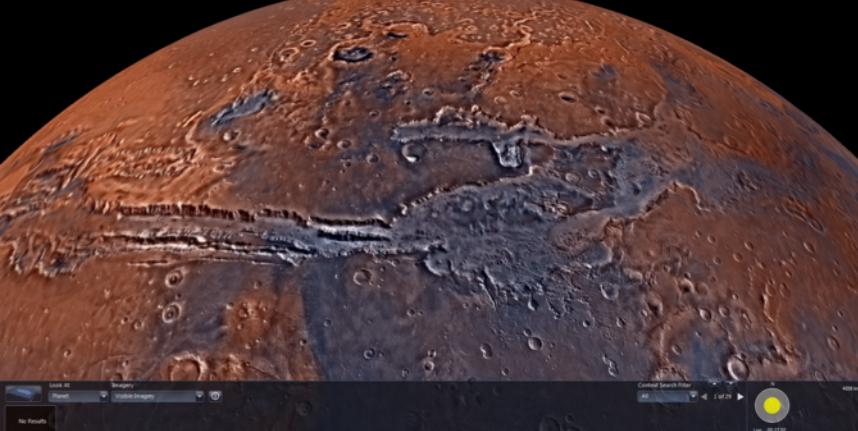
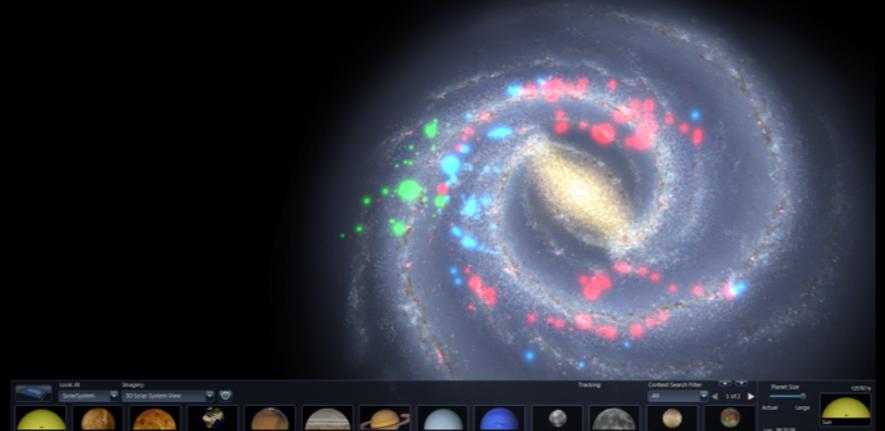
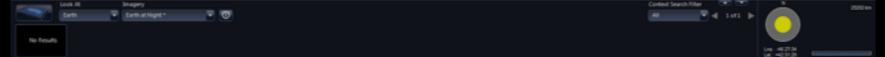


*Alyssa Goodman  
Harvard University*



A joint venture of FAS-Astronomy & HMS/BWH-Surgical Planning Lab.  
Work shown here is from the 2005 Junior Thesis of Michelle Borkin, Harvard College.

# 2013



Experience WWT at [worldwidetelescope.org](http://worldwidetelescope.org)

# WWT Ambassadors

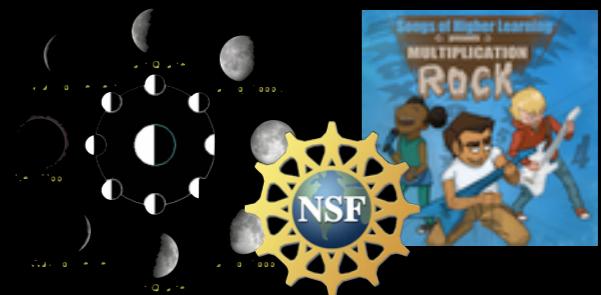


The screenshot shows a group of students gathered around a computer monitor, looking at a virtual tour of the night sky. The website has a blue header with navigation links: HOME, ABOUT, LEARN WWT, FIND TOURS, EDUCATORS, AMBASSADORS, COMMUNITY, GET WWT, and SUPPORT. There is a search bar and a login/register link. Below the header is a large image of four students working together. To the right of the image are three buttons: "Download Tour" (blue arrow icon), "Experience Tour Online" (globe icon), and "Watch as Video" (camera icon). On the left side, there is a sidebar titled "Upcoming Events" with a list of events and a "Read more" link. The main content area contains an "About WWTA" section with text and a small image of students.

“Tours”



# WWTVizLabs



## WWT in Research

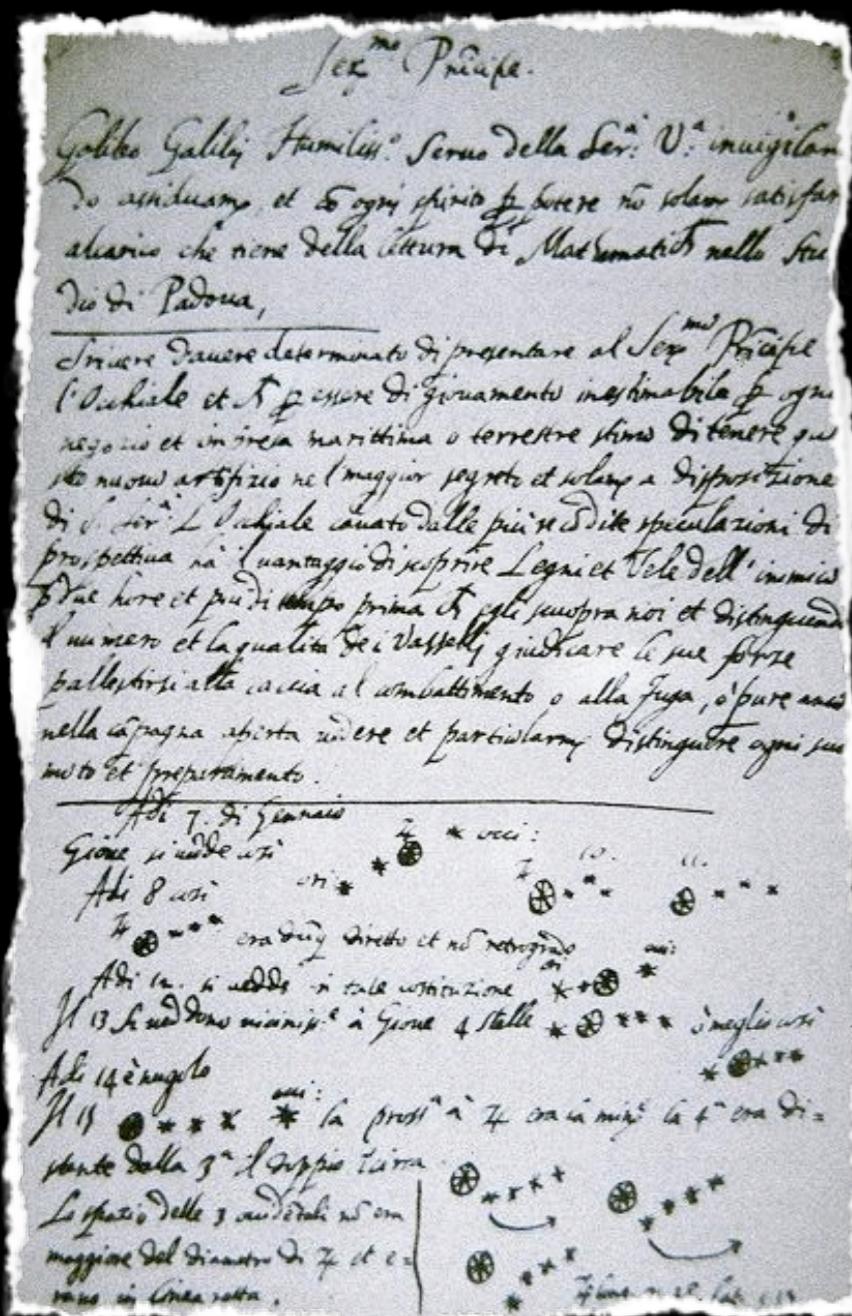


The collage features several research projects. At the top left is the "COMPLETE" logo. Next to it is the "Dataverse Network" logo. To the right is a screenshot of the "Glue" software interface, which is described as "multidimensional data exploration". At the bottom right is the "Viz-e-lab" logo, which includes a Kinect sensor icon.

+Coming Attraction...WWT in edX

# Galileo Galilei

(1564-1642)



7	* * O *	17	* O				
8	O * * *	18	* O				
19	* * O	19	* O *				
"	* * O	19	* * O * *				
20	* O *	20	O * O				
13.	* O **	21	... O				
15	O * * * *	22	* O ..				
15	O .. *	22	O ..				
16	* O *	23	*	23	O		
17	* O *	24	* O	24	*	24	O

On the third, at the seventh hour, the stars were arranged in this sequence. The eastern one was 1 minute, 30 seconds from Jupiter; closest western one 2 minutes; and the other western one wa-

ast \* O \* \* West

On the fourth, at the second hour, there were four stars around it, one to the east and two to the west, and arranged precisely

on a straight line, as in the adjoining figure. The easternmost was distant 3 minutes from the next one, while this one was 40 seconds from Jupiter; Jupiter was 4 minutes from the nearest western one, and this one 6 minutes from the westernmost one. Their magnitude were nearly equal; the one closest to Jupiter appeared a little smaller than the rest. But at the seventh hour the eastern stars were only 9 seconds apart. Jupiter was 2 minutes from the nearer eastern

one, while he was 4 minutes from the next western one, and this one was 3 minutes from the westernmost one. They were all equal and extended on the same straight line along the ecliptic.

On the fifth, the sky was cloudy.

On the sixth, only two stars appeared flanking Jupiter, as is seen

on the adjoining figure. The eastern one was 2 minutes and the western one 3 minutes from Jupiter. They were on the same straight line with Jupiter and equal in magnitude.

On the seventh, two stars stood near Jupiter, both to the east.

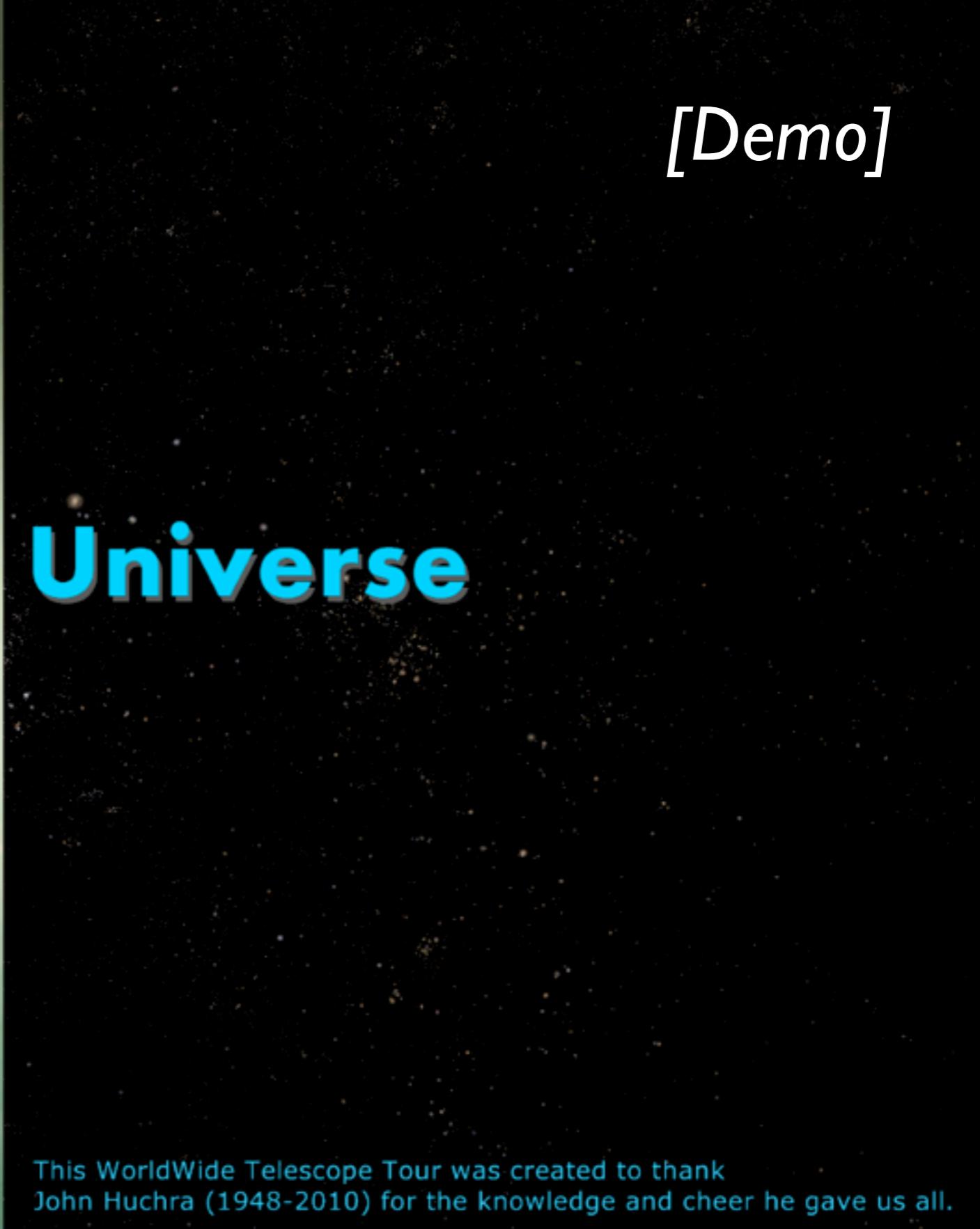


# *Notes for & re-productions of Siderius Nuncius*



[Demo]

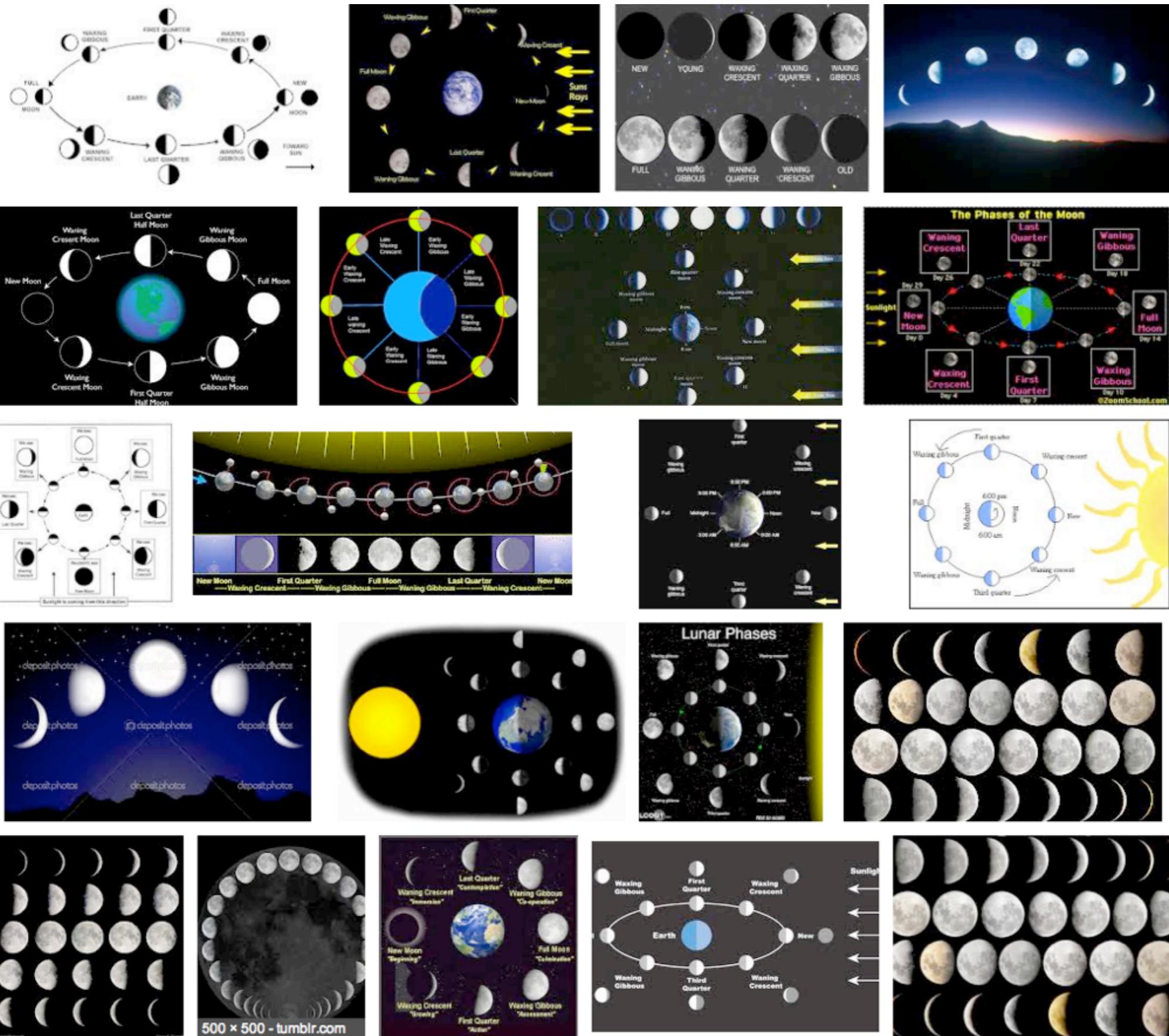
# John Huchra's Universe



This WorldWide Telescope Tour was created to thank  
John Huchra (1948-2010) for the knowledge and cheer he gave us all.

also available on YouTube (search “John Huchra’s Universe”)

# WWT VizLab: (Why) Moon Phases?



# WorldWide Telescope & its Ambassadors

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## Spring 2012 Update

Submitted by patudom on May. 9



[Login or register to post comments](#)  [Read more](#)

WWT Ambassadors have had a busy and productive spring! We demo'd WWT at the [USA Science and Engineering Festival](#) and two local science festival events in Cambridge to engaged and enthusiastic crowds of close to 2000 people. The most common refrain we heard was, "Really? I can download this at home for free?" Ambassadors continue to be impressed by the astute questions and observations made by children who are given the opportunity to explore our universe for the first time. "Why is Pluto's orbit so out of whack from all the other planets?" "Why does Jupiter have so many more moons than other planets?" "How long would it take for us to travel far enough outside the Milky Way to take a picture of it?"

[wwtambassadors.org](http://wwtambassadors.org)

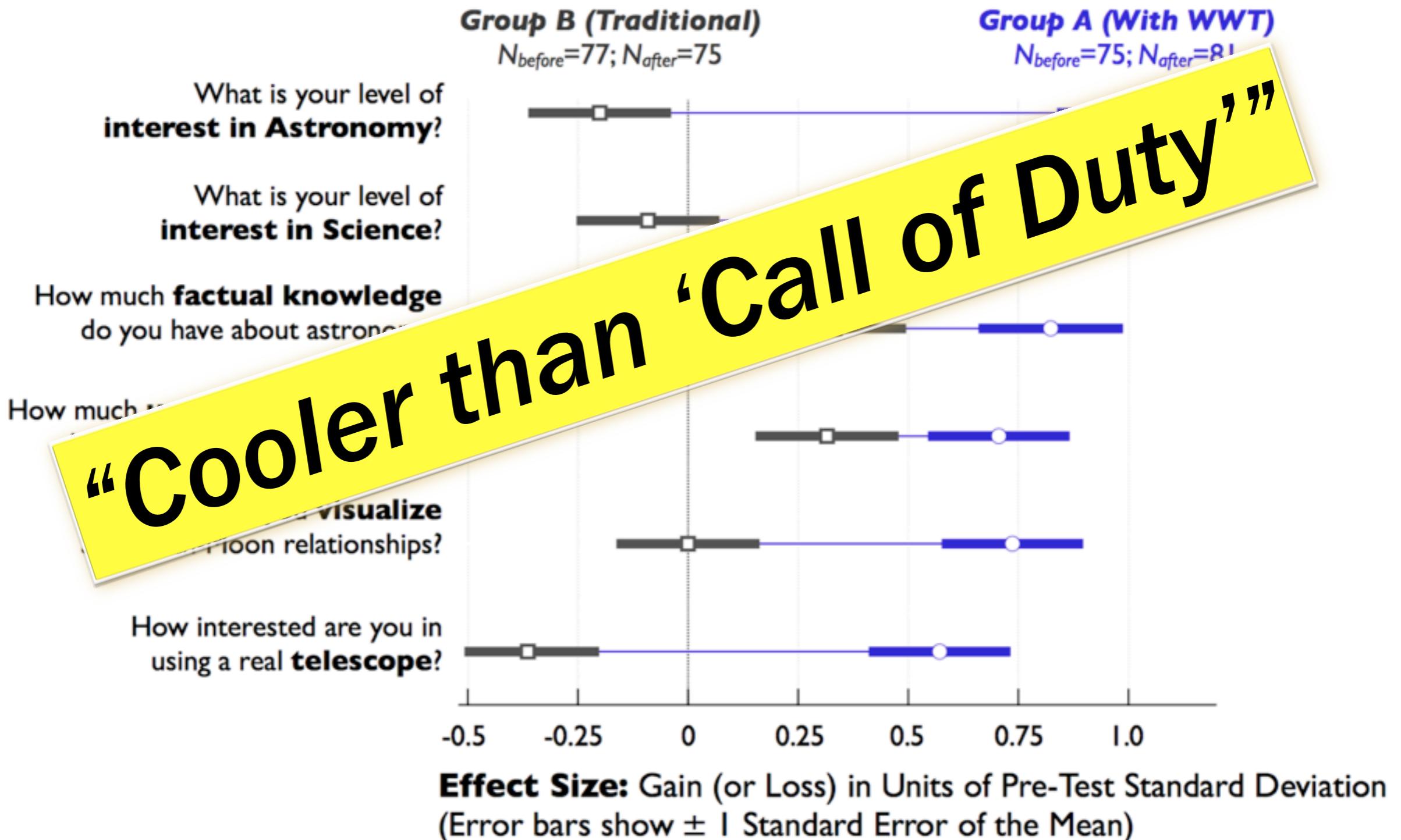


Curtis Wong & Jonathan Fay  
Microsoft Research



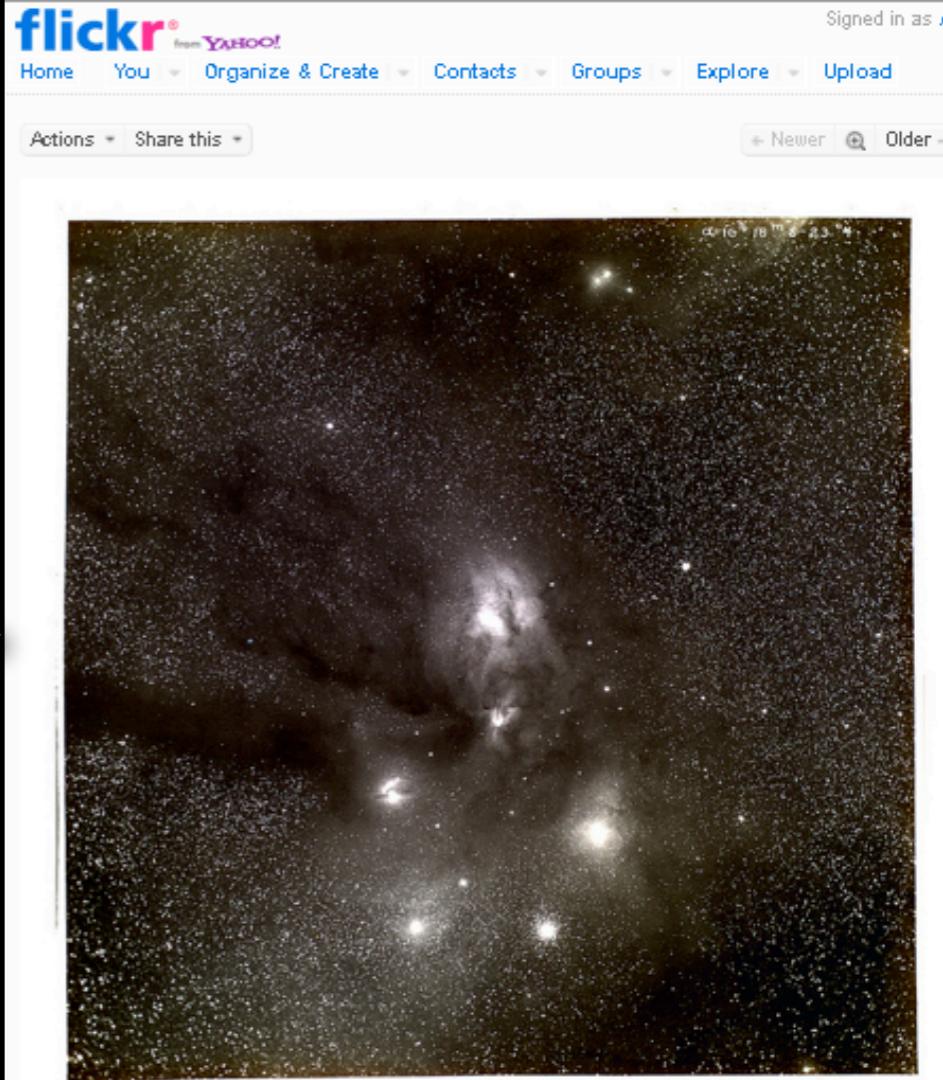
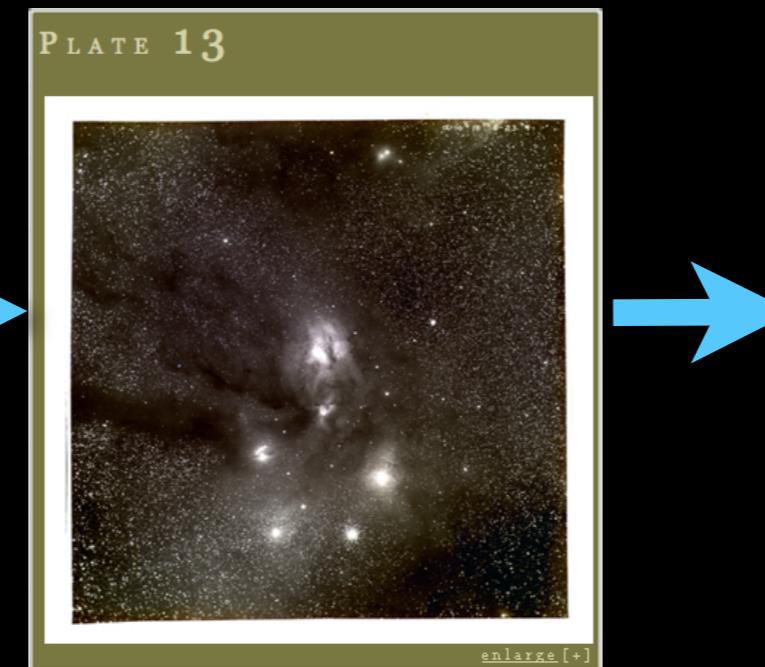
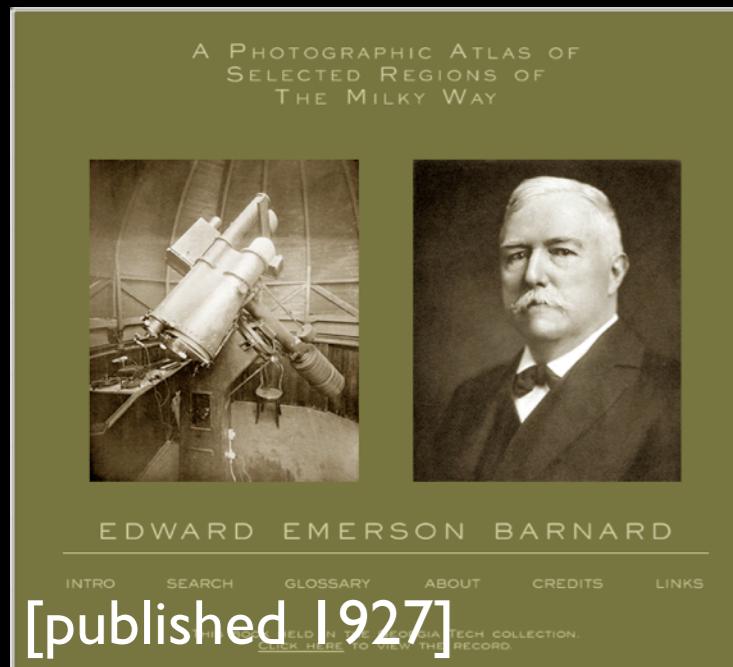
Alyssa Goodman & Patricia Udomprasert  
Harvard-Smithsonian Center for Astrophysics

# Gains in Student Interest and Understanding ("Traditional Way" vs "WWT Way")



# “Seamless Astronomy”...

## astrometry.net + flickr + WWT



Explore Guided Tours Search View Settings

Collections > Open Collections > barnardoph >

barnardoph

1 of 1

← →

ask me about ADSASS...

DIGITAL SKY SURVEY (COLOR)

Ophiuchus IC4634 IC4603 IC4604 M19 NGC6235 NGC6273 NGC6284 N Ophiuchus 09:41:29 RA : 16h25m41s

**View in World Wide Telescope**

barnardoph

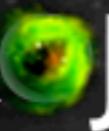
E.E. Barnard's image of Ophiuchus  
[www.library.gatech.edu/bpdi/bpdi.php](http://www.library.gatech.edu/bpdi/bpdi.php)

Comments and faves astrometry.net

astrometry.net (8 days ago | reply | delete)  
Hello, this is the blind astrometry solver. Your results are:  
(RA, Dec) center:(246.421365149, -23.8749819397) degrees  
(RA, Dec) center (H:M:S, D:M:S):(16:25:41.128, -23:40:29.935)  
Orientation:178.34 deg E of N  
Pixel scale:52.94 arcsec/pixel  
Parity:Reverse ("Left-handed")  
Field size :9.41 x 9.41 degrees  
Your field contains:  
The star Antares (α Sco)  
The star Graffias (β1 Sco)  
The star Al Niyat (σ Sco)  
The star τ Sco  
The star ω1 Sco  
The star υ Sco  
The star ω2 Sco  
The star ϕ Oph  
The star 13 Sco  
The star ο Sco  
IC 4592  
IC 4601  
NGC 6121 / M 4  
IC 4603  
IC 4604 / rho Oph nebula  
IC 4605

◀ ▶

# THE MILKY WAY PROJECT



HOME TAKE PART ABOUT TUTORIAL LOG IN GALACTOMETER™



## WELCOME

The Milky Way Project aims to sort and measure our galaxy, the Milky Way. Initially we're asking you to help us find and draw bubbles in beautiful infrared data from the Spitzer Space Telescope.

Understanding the cold, dusty material that we see in these images, helps scientists to learn how stars form and how our galaxy changes and evolves with time.

[Click here to see the full tutorial or browse the site to find out more about the science behind the Milky Way Project.](#)

YOU CAN NOW SEE HOW CLOSE WE ARE TO 1,000,000 DRAWINGS AT [HTTP://WWW.MILKYWAYPROJECT.ORG/G...](http://WWW.MILKYWAYPROJECT.ORG/G...) E 12 DAYS AGO  
194,943 IMAGES SERVED · 252,562 BUBBLES DRAWN · 24,234 POSSIBLE STAR CLUSTERS · 8,978 CANDIATE GALAXIES · 597,054 OTHER OBJECTS  
© COPYRIGHT 2010 ZOONIVERSE

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# UNIVERSE3D.org

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## What is Universe3D.org?

The intention of Universe3D.org is to host links to web content that enable the enhancement of our three-dimensional view of the Universe.

### Recently added Dataset

[SLOAN Digital Sky Survey](#) The Sloan Digital Sky Survey or SDSS is a major multi-filter imaging and spectroscopic redshift survey using a dedicated 2.5-m wide-angle optical telescope at Apache Point Observatory in New Mexico, United States. The main galaxy sample has a median redshift of  $z = 0.1$ ; there are redshifts for luminous red galaxies as far as  $z = 0.7$ , and for quasars as far as  $z = 5$ ; and the imaging survey has been involved in the detection of quasars beyond a redshift  $z = 6$ .

### Astronomy News

- *June 26, 2012:* Astronomers use supercomputer to explore role of dark matter in galaxy formation
- *June 25, 2012:* Moon to pass by Mars tonight
- *June 24, 2012:* Astronomers find planets so close they 'see' each other in night sky
- *June 14, 2012:* Huge Asteroid to fly by Earth
- *June 13, 2012:* Astronomers may have discovered the oldest galaxy in the Universe
- *June 5, 2012:* Last Transit of Venus for the 21st century

### Announcements

- *July 05, 2012:* Website moved to the URL [universe3d.org!](#)
  - *June 11, 2012:* Website moved to MediaWiki!
  - *December 5, 2011:* Site established!
- To make good on Alyssa Goodman's promise at the "Milky Way 2011" meeting held in Rome this past September, the site "universe3d.org" has been established. By 2012, it will be populated with links to existing data

### The Milky Way

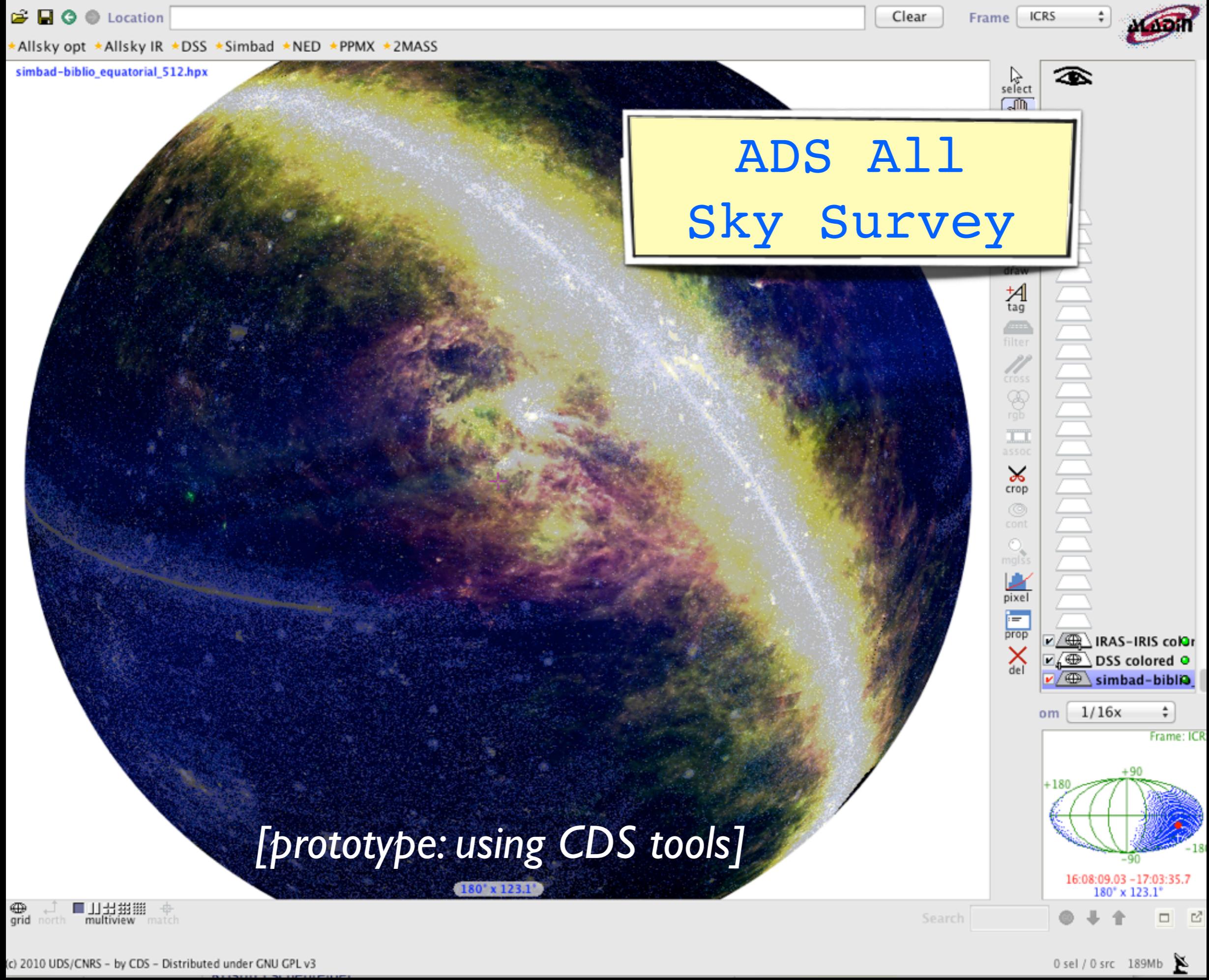


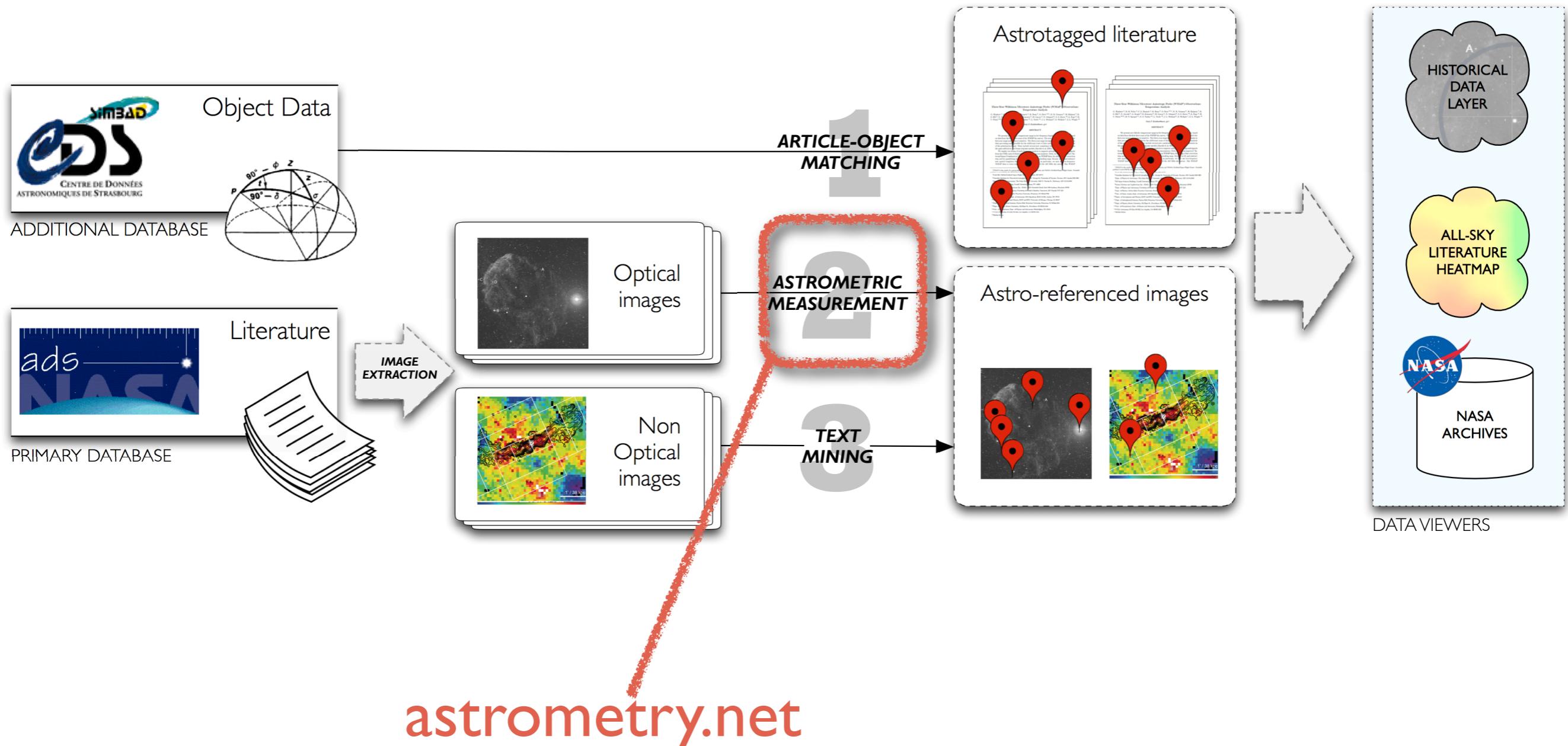
A Roadmap to the Milky Way

(artist's concept)

NASA / JPL-Caltech / R. Hurt (SSC-Caltech)

ssc2008-10a





# astrometry.net





## “The WorldWide Telescope”

A Presentation by Alyssa Goodman, Professor of Astronomy at  
Harvard University and a Research Associate of the Smithsonian Institution

**Thursday, January 31, 2013 at 6 p.m.**

**Harvard Allston Education Portal, 175 North Harvard Street, Allston, MA**

The free **WorldWide Telescope (WWT)** computer program from Microsoft Research is a stunningly beautiful tool offering immersive views of the sky and multimedia links to interactive descriptions and explanations of millions of celestial objects. WWT is used both in astrophysical research, and to educate the public about Astronomy and Science.

Harvard Astronomer Alyssa Goodman has collaborated with the creators of WorldWide Telescope at Microsoft Research since its creation in 2008. In her presentation, Goodman will take her audience on interactive tours of the Universe using the WorldWide Telescope, covering topics ranging from Galileo's understanding of our Solar System to our modern understanding of the structure of the distant Universe.

**Light refreshments will be served.**

**Free parking is available at 219 Western Avenue,  
adjacent to the Harvard Allston Education Portal.**

**Please RSVP by Wednesday, January 30, 2013 by phone at 617-496-5022  
or email [allston\\_edportal@harvard.edu](mailto:allston_edportal@harvard.edu).**

**Professor Goodman's** research and teaching interests span astronomy, data visualization, and online systems for research and education. Goodman received her undergraduate degree in physics from MIT in 1984, a Ph.D. in physics from Harvard in 1989, and became full professor at Harvard in 1999. Her personal research presently focuses primarily on new ways to visualize and analyze the tremendous data volumes created by large and/or diverse astronomical surveys. She is working closely with colleagues at Microsoft Research, helping to expand the use of the WorldWide Telescope program, in both research and in education. At Harvard, Goodman teaches courses on astrophysics and on the display of data, including one called *The Art of Numbers*.

**For more information, go to [www.edportal.harvard.edu](http://www.edportal.harvard.edu)**