

WorldWide Telescope

Microsoft
Research

WorldWide Telescope

Alyssa A. Goodman

*Harvard-Smithsonian Center for Astrophysics
Initiative in Innovative Computing @ Harvard*





Visual design:

Martin Kornmesser & Luis Calçada

Music and Sound Effects:

MoveTwo (Axel Kornmesser & Markus Löffler)

Footage and photos:

Gemini Observatory (Kirk Pu'uhou-Pummill/Peter Michaud), CFHT (Jean-Charles Cuillandre), TWAN (Babak Tafreshi, Laurent Laveder), Martin Kornmesser (ESA/Hubble), NASA, NASA/ESA Hubble Space Telescope, ESA/Mars Express, Kevin Govender, NASA/Spitzer Space Telescope, ESO/VLT/ALMA, & Akira Fujii

Project lead:

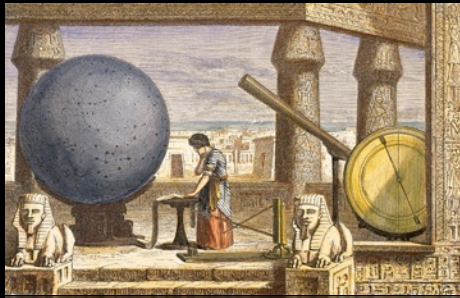
Lars Lindberg Christensen (ESA/Hubble)

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"

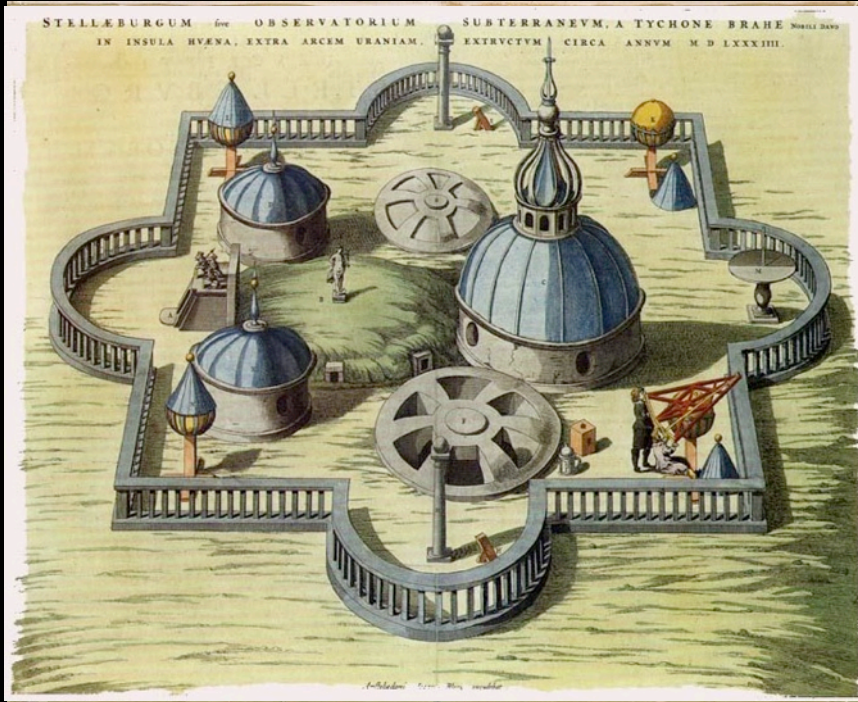


Long-distance
remote-control/
"robotic"
telescopes
1990s



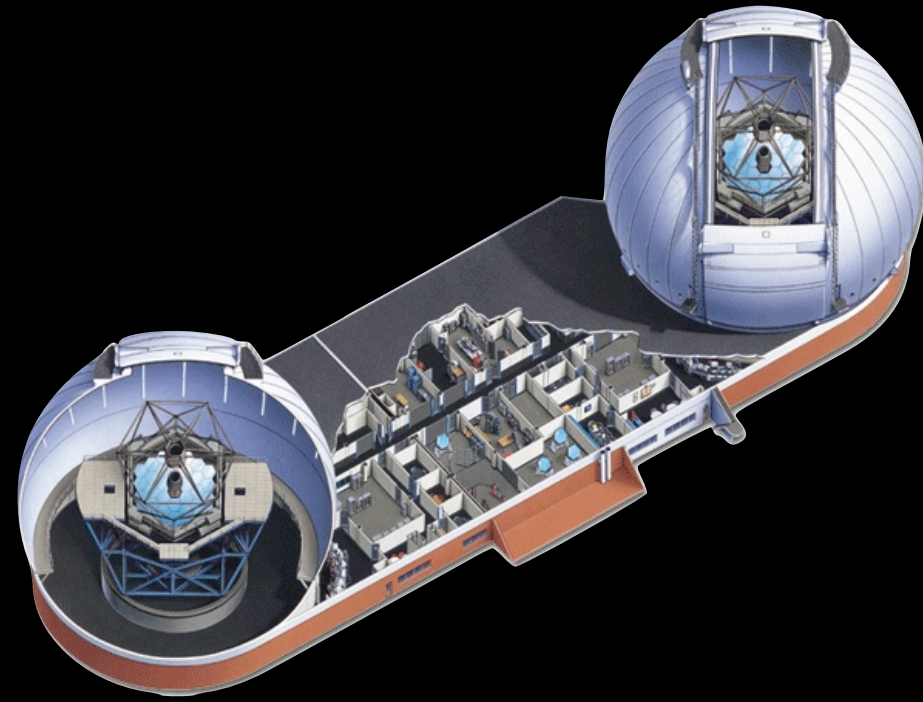
"Virtual
Observatories"
21st century

Stjerneborg (Tycho Brahe, 1586)



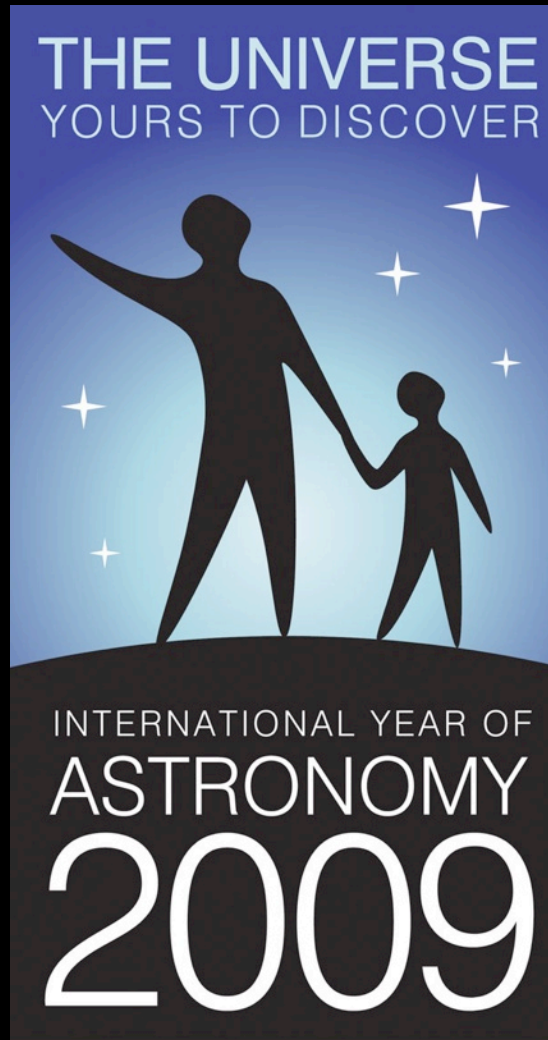
Galileo: c. 1609

W.H. Keck Observatory (1995+)



*Full-sky virtual astronomy:
c. 2023?*

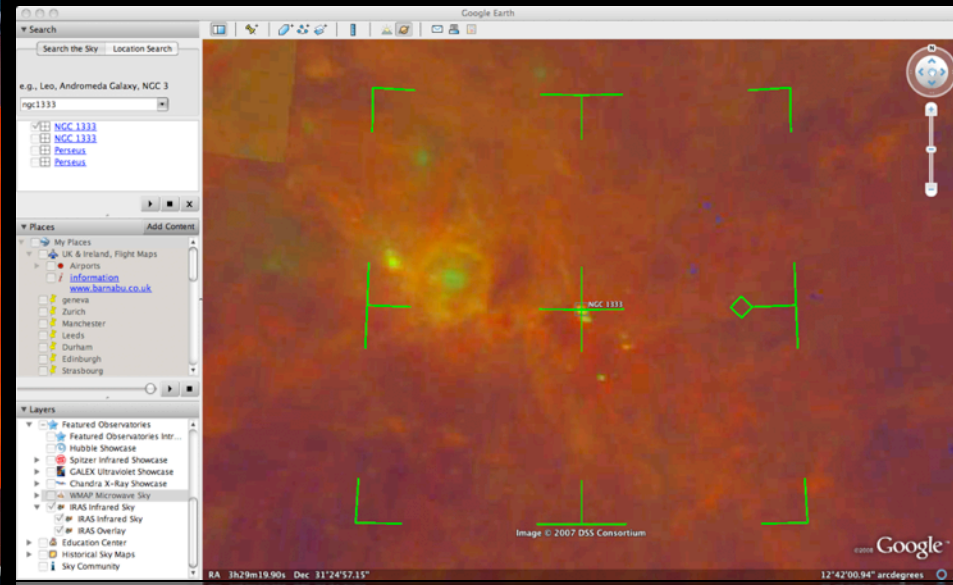
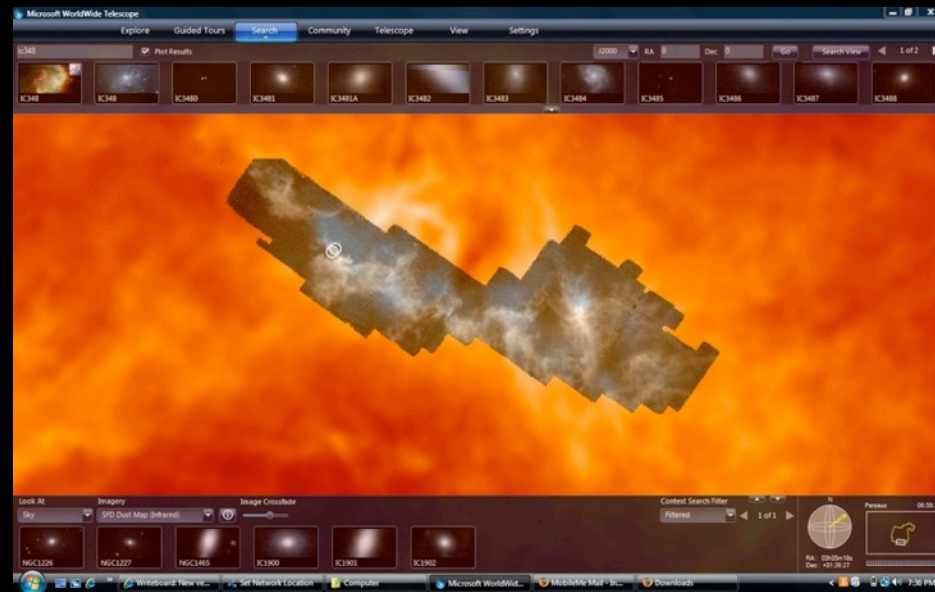
“One Earth, One Sky”



“One Earth, One Sky”

Microsoft

Google



gky, later...

COMPLETE Data Coverage Tool

http://www.cfa.harvard.edu/COMPLETE/data/CoverageTool/CoverageTool.htm

COMPLETE Data Coverage Tool 887

2 objects (2 shown):

[D14](#)

[BR7](#)

[Zoom in](#) to show these objects

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 checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
IRAS: Av/Temp Maps	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
FCRAO: 12 and 13CO	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
JCMT: 850 microns	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
Spitzer c2d: IRAC 1,3 (3.6,5.8 μ m)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
Spitzer c2d: IRAC 2,4 (4.5,8 μ m)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data
CSO/Bolocam: 1.2-mm	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
Spitzer MIPS: Derived Dust Map	<input checked="" 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 checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Data
IRAM 30-m: N2H+ and C18O	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
IRAM 30-m: 1.1-mm continuum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
Megacam/MMT: r,i,z images	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
Catalogs & Pointed Surveys					
NH3 Pointed Survey	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Data
YSO Candidate list (c2d)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Data

Done

Now: Clear, 30° F | Tue: 36° F | Wed: 36° F

WWT 2001

WWT 2008

VIEWPOINT

The World-Wide Telescope

Alexander Szalay,¹ Jim Gray²

September 17, 2007

All astronomy data and literature will soon be online and accessible via the Internet. The community is building the Virtual Observatory, an organization of this worldwide data into a coherent whole that can be accessed by anyone, in any form, from anywhere. The resulting system will dramatically improve our ability to do multi-spectral and temporal studies that integrate data from multiple instruments. The Virtual Observatory data also provide a wonderful base for teaching astronomy, scientific discovery, and computational science.

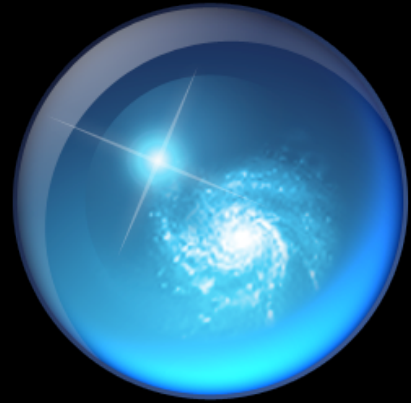
Digital Sky Survey (SDSS) (3), the Two Mi-

instrument. In addition, all the astronomy literature is online and is cross-indexed with the observations (6, 7).

Why is it necessary to study the sky in such detail? Celestial objects radiate energy over an

whereas telescope CCD pixels double every 2 years. This rate seems to be accelerating. It implies a yearly data doubling. Huge advances in storage, computing, and communications technologies have enabled the Internet and will enable the Virtual Observatory.

¹The Johns Hopkins University, Baltimore, MD 21218, USA. ²Microsoft Bay Area Research Center, San Francisco, CA, USA.



quick demo of WWT

“WWT as a Preview of 21st Century e-Research in Astronomy”
(or, “what I told colleagues at the American Astronomical Society Meeting in Long Beach last week”...)



The “Professional” NVO, c. 2006

what do
those zeros mean?

movie created by Harvard undergraduates Sara Watson, '06 & David Kosslyn '11, as part of IIC internship program

What do these (buzz) words really mean?

“e-Research” • “Semantic Web” • “Modular Apps”

“Ontology”

“GIS/Layering”

“Search”

What’s needed?

“Progressive Resolve”

“Registration”

“Selection”

**“Side-by-Side
Comparison”**

“Readable Labels”

“Highlighting”

“Zoom”

“Custom Site”

“Measurement”

“Off-the-Desktop”

“Inference”



Tuesday, June 2, 2009

From: Yan Xu
 Subject: RE: (non WWI) press conference attendance for AG on Tuesday AM
 Date: December 31, 2008 2:56:23 AM EST
 To: Yan Xu , Alyssa Goodman , Megan Watzke
 Cc: Becki Culbert (Swift Group) , Curtis G. G. Wong <curtisgwong@msn.com> , Jens Kauffmann , Rosalind Reid

Email with Room Numbers
 (result of search)

I just found Megan's earlier email, which mentioned that the press will be in room 204 of Convention Center. It is probably not too far from our room 308.

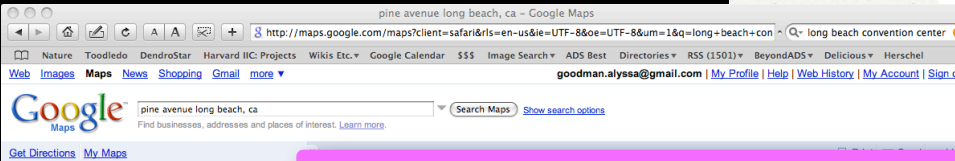
Our setup and presentation will be in the same room: #308 (Exhibition Hall C).

Thanks,
 Yan

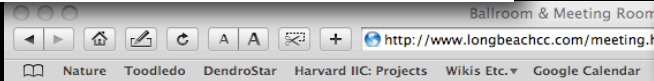
Requires "Ontology"

Interior Map on Long Beach CC Web Site

Requires "GIS/Layering"



Area Map, with Photos & Street Names from Google Maps

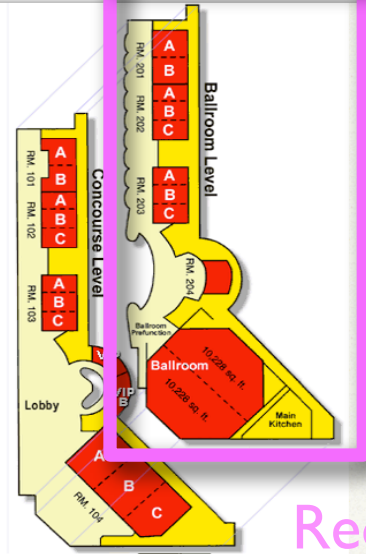


SPECIAL SERVICES INCLUDED:

- House lighting, ventilation, heat or air conditioning as required during open times. Energy conservation is of prime concern to the Convention Center and minimal light and comfort levels will be maintained during move-in and move-out periods. Rehearsals and similar pre-event activities will be maintained accordingly.
- Housekeeping services during open hours in aisles, corridors, lobby, open spaces and restrooms, plus one rough cleaning of these same areas during non-open hours. Meeting rooms will be cleaned between 12 AM and 8 AM nightly unless prior arrangements are made with the Event Manager.
- Water service will be supplied to head tables and urns only. All other water service needs must be ordered through your Catering Sales Manager.
- Basic set up is included with the daily rental. Additional set ups are charged based upon half of the daily rental.
- One-time basic room set per rented event day. Meeting rooms included with an Exhibit Hall rental include a one-basic room set for the run of the event.
- Equipped first-aid facilities. Does not include an Emergency Medical Technician will be included through your Event Manager.
- Use of the outdoor marquee, as available. The marquee is listed to information directly related to Licensee's activities within the Convention Center. All messages must be re-approved by Convention Center staff. (Please see Catering kit for all in-house Marketing and Public Relations details pertaining to your event).

SPECIAL SERVICES NOT INCLUDED:

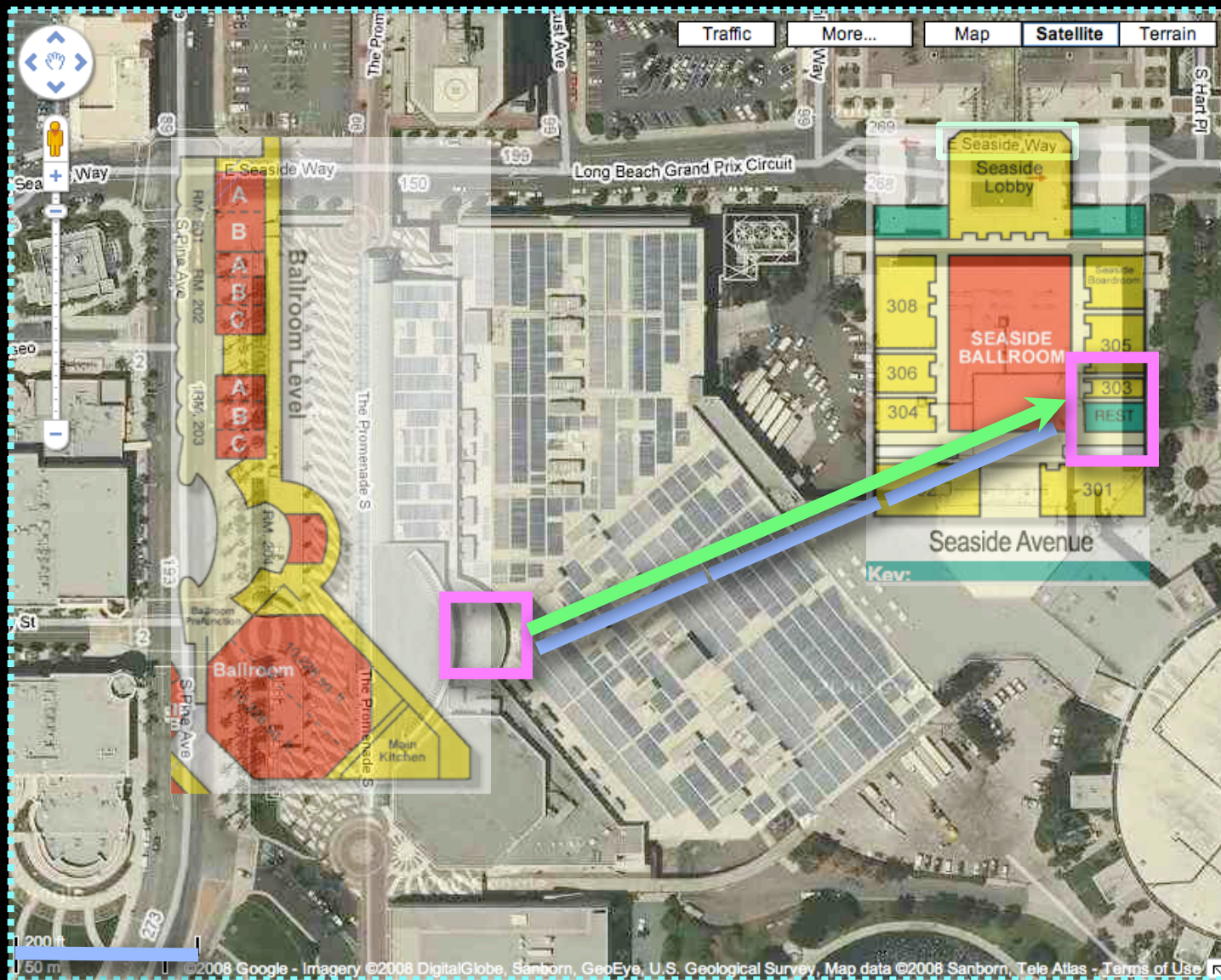
- First aid staffing with Emergency Medical Technician will be provided at current rates.
- Licensee is responsible for removal of bulk trash, crates, pallets, packing materials, lumber, etc. prior to show time and following move-out.
- Set sellers, ticket takers, ushers, security, stagehands, and event operations shall be provided by the Convention Center and billed to Licensee.
- Performance stages, exhibit tables and dance floors.



Requires "Search"



Seaside Meeting Room Key



...requires: **“Selection”** ; **“Registration”**;
“Readable Labels” ; **“Highlighting”**; & **“Measurement”**

in order to yield: **“Inference”**: ...Wow, that's about 600 feet, hope we can change the room!

And, what about that
“**custom Triplt site**” I made to
organize all this?
What about the
hotel?

Triplt | Organize your travel
http://www.tript.com/trip/show/id/994306

Triplt | Organize your travel
http://www.tript.com/trip/show/id/994306
(425) 649-2800 / (800) 699-2660
Booking Rate: 146.00

Triplt | Organize your travel
http://www.tript.com/trip/show/id/994306
(425) 649-2800 / (800) 699-2660
Booking Rate: 146.00

Map of HYATT
200 S PINE AVENUE

10:42 PM

Expedia®

Home Flights Hotels Cars Vacation Packages Cruises Activities DEALS & OFFERS Maps Business

Start search over
Back to search results

Hotel Information

Pictures & Virtual Tours

Location & Map
Address, Points of Interest

Hotel Details
Hotel description, Amenities & facilities

Traveler Opinions
Hotel Reviews and Ratings

Rooms & Rates
Room description, Room rates

Mon, Jan 5

Email this hotel to a friend

Hyatt Regency Long Beach
Hotel near Long Beach Harbor overlooking lagoon
★★★★½ Star Rating

Road Aerial Labels Reset

Bay St

Long Beach

S Pine Ave

Hyatt Regency Long

40 yds

Microsoft Virtual Earth™
© 2008 Microsoft Corporation © 2008 NAVTEQ © AHD
Image courtesy of USF&E

Nearby Points of Interest



Hyatt Regency Long Beach
Hotel near Long Beach Harbor overlooking lagoon
★★★★☆ Star Rating

“Side-by-Side Comparison”

Click

“Zoom”

“Progressive Resolve”

“Inference”: ...Oh, that building with the funky paths outside is the Hyatt... what if I...



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Hyatt Regency Long Beach Hotel

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Home → United States → California (CA) → Long Beach → Long Beach Hotels

Hyatt Regency Long Beach

- Search**
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 - Before You Go
 - Things to Do
 - Restaurants
 - Map
 - Traveler Photos
 - Forum
 - Long Beach Deals
 - Discount Hotels
 - Hotel & Air
 - All Travel Offers



Hotel class: ★★★★★

Rooms: 510

[COMPARE PRICES](#)

- [Hotel photos](#)
- [Map this hotel](#)
- [Hotel amenities](#)
- [Virtual tour](#)

200 South Pine Avenue, Long Beach, CA 90802

Property Type: Hotel

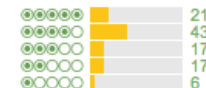
Full service hotel with water views from rooms. Walking distance to 100 shops and restaurants, Aquarium of the Pacific. Centrally located for easy...

[+ more »](#)



TripAdvisor Traveler Rating: ?

104 Reviews



[Write a review](#)

TripAdvisor Popularity Index: ?

#14 of 38 hotels in Long Beach

Call now to book: 1-800-45-HOTEL
from hotels.com

Check Rates and Availability: \$236 Avg. Price

Check-in: 10/2/2009
 Check-out: 10/9/2009
 Adults: 1

- | | |
|---|--|
| <input checked="" type="checkbox"/> Expedia.com | <input checked="" type="checkbox"/> Orbitz.com |
| <input checked="" type="checkbox"/> LongBeach.Hyatt.com | <input checked="" type="checkbox"/> hotels.com |
| <input checked="" type="checkbox"/> Travelocity | <input type="checkbox"/> HotelClub.com |
| <input checked="" type="checkbox"/> Priceline.com | <input type="checkbox"/> Gtahotels.com |

[CHECK RATES!](#) Opens one window for each offer. Please disable pop-up blockers.

Click here for best prices for Hyatt Regency Long Beach

- [Hyatt Regency Long Beach: Great rooms from \\$115 Smart Deal](#)
Expedia.com Photos, Reviews and the Guaranteed Lowest Prices
- [Hyatt Regency Long Beach: Save Up To 50% On Hotels Smart Deal](#)
Orbitz.com View Hotel Photos, Reviews & More Compare & Save on Hotels at Orbitz
- [Hyatt Regency Long Beach: Official Site Smart Deal](#)
LongBeach.Hyatt.com Best Rates Guaranteed. Book Direct.
- [Hyatt Regency Long Beach: Official Site Smart Deal](#)
Hyatt Regency Long Beach Best Rates

TripAdvisor Traveler Reviews

TripAdvisor Traveler Rating: ★★★★★

Free Newsletter

Interested in Hyatt Regency Long Beach and Long Beach?

We'll send you updates with the latest deals, reviews and articles for Hyatt

And now for “e-Research” with WWT..

“Progressive Resolve”

“Zoom”

“Search”

“Selection”

“GIS/Layering”

“Registration”

**“Side-by-Side
Comparison”**

“Readable Labels”

“Highlighting”

“Custom Site”

“Inference”

“Off-the-Desktop”

“Ontology”

“Measurement”

And now for “e-Research” with WWT..

“Progressive Resolve”

“Zoom”

“Search”

“Selection”

“GIS/Layering”

“Registration”

**“Side-by-Side
Comparison”**

“Readable Labels”

“Highlighting”

“Custom Site”

“Inference”

“Off-the-Desktop”

“Ontology”

“Measurement”

Going “Off-the-Desktop”



Microsoft
Surface

More information: See the IIC's
“Scientists Discovery Room” [project pages](#)

Slideshow: Tabletop Computers *Continued*

By Meredith Ringel Morris

First Published December 2008

[Email](#) [Print](#) [Comments \(1\)](#) [Reprints](#) [Newsletters](#)



UBITABLE: Users can interact with surface computers through auxiliary devices, such as laptops, phones, and PDAs. The display on the auxiliary device can convey private or sensitive content to a single user, while group-appropriate content can appear on the tabletop display. Chia Shen and her colleagues at Mitsubishi Electric Research Laboratories, in Cambridge, Mass., have explored auxiliary interactions with surface computers in their UbiTable project, in which two people with laptops collaborate over a tabletop display. Recently, Shen expanded the UbiTable into an interactive room called the WeSpace. People can share data on their laptops with other people in the room, using both a table and a large display wall. Here, three Harvard University astrophysicists discuss radio and IR spectrum images using the WeSpace.

What if the Viewer were WWT?

The screenshot shows the Aladin sky atlas interface. At the top, there is a navigation bar with logos for Simbad, VizieR, Aladin, Catalogs, Dictionary, Biblio, Tutorials, and Developers. The main window displays a sky map with various astronomical objects labeled, such as HH, PartofCloud, and RNeb. A toolbar on the right includes icons for select, pan, zoom, draw, filter, and other functions. A table at the bottom lists object data:

MAIN ID	OTYPE	RA	DEC	COO ...	COO ...	C...	PMRA	...
J1A1961.281	IR	03 29 17.03	+31 16 35.7					

Overlaid on the left is the IVOA logo, and on the right is the WWT logo. A 'Pixel mapping' dialog box is open on the right side, showing a histogram and various adjustment controls.

Pixel mapping
Adjust the colormap by modifying the transfert function and/or by moving the three triangles.
Help

Contrast: Log Sqrt Linear Pow2
Color map: BB

Orig. pixel range: [0.0 .. 250.0]
Autocut limits: [24.991 .. 168.99]
 Use Aladin autocut algorithm

(alpha) Web Version of WWT

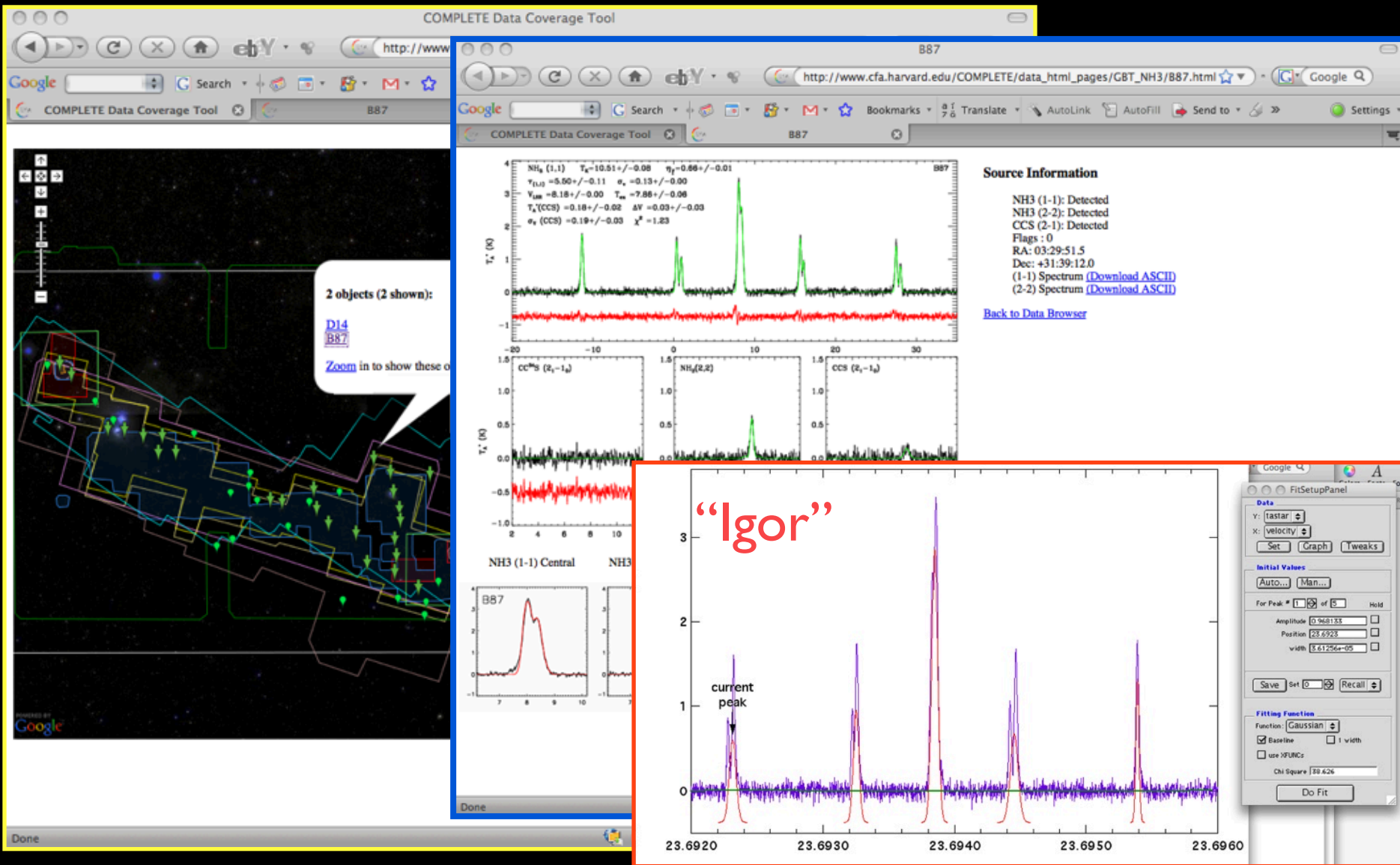
The screenshot displays the WWT web interface within a browser window. The browser's address bar shows 'WWTSL'. The interface includes a navigation menu with 'Explore', 'Guided Tours', 'Search', 'Community', 'View', and 'Settings'. Below the menu, there are search fields for 'RA' and 'Dec', and a 'Go' button. The main display area shows a large, detailed image of the M51 galaxy, rendered in a reddish-orange color scheme. The interface also features a 'Lock At' dropdown menu set to 'Sky', an 'Imagery' dropdown menu set to 'SDSS: Sloan Digital Sky Sur...', and an 'Image Crossfade' slider. At the bottom, there is a row of thumbnail images for various celestial objects, including 'Canes Venatici', 'Out of This Whirl!', 'Whirlpool Galaxy', 'Whirlpool Galaxy C', 'A Classic Beauty', 'M51', 'Whirlpool Galaxy a', 'M51', and 'NGC5194'. The bottom status bar shows the system clock and weather information: 'Now: Clear, 30° F', 'Tue: 36° F', and 'Wed: 36° F'.

Tuesday, June 2, 2009

“Modular (& Embeddable) Apps”

The screenshot shows a Facebook profile page for Nicholas Suntzeff. The browser address bar displays the URL: `http://www.facebook.com/profile.php?id=1438935116&ref=nf`. The page header includes navigation links for Home, Profile, Friends, and Inbox, along with user information for Alyssa Goodman and a search bar. The profile picture of Nicholas Suntzeff is visible on the left. The main content area shows a post from Nicholas: "Nicholas Suntzeff is in long beach, amazed at the number of smart, young astronomers. 12 hours ago". Below this, there are several activity updates, including profile picture changes and friend additions. A chat window for Julie Shubin is overlaid on the right side of the page, showing a conversation where she says "is doesn't want to get up at 6." and "what's the AAS". The chat window includes a "Clear Chat History" button and a timestamp of "11:40am". The bottom of the page shows a status bar with the text "Loading 'http://www.facebook.com/profile.php?id=1438935116&ref=nf', completed 78 of 79 items".

Embedded & Modular Tools



tools created by Jonathan Foster, CFA/COMPLETE

Seamless Astronomy

(now part of the WWT Academic Program!)

The screenshot displays the AstroNavigator web interface. At the top, the title "AstroNavigator" is shown in a blue header. Below the header are four buttons: "Project 1", "Project 2", "Project 3", and "Edit".

The main content area is divided into several panels:

- Panel A:** A text-based panel titled "QSO MgII absorption line observed". It lists authors (Drinkwater, Webster R.L., et al.) and a description: "The results of a large R-band".
- Panel B:** A panel titled "SAO/NASA ADS Astronomy Abstracts" containing search options: "Find Similar Abstracts (with default)", "Electronic Refereed Journal Article (PDF)", "Full Refereed Journal Article (PDF/P)", "FIND IT @ HARVARD", and "arXiv e-print (arXiv:astro-ph/0004386)".
- Panel C:** A diagrammatic panel showing a blue arrow pointing up and another blue arrow pointing right, with a large black letter "C" in the center. It includes labels like "STARS With Nebula ag" and "ST Grains".
- Panel D:** A panel featuring a satellite icon and a large black letter "D". It includes text: "IC 348", "Example Requires", "Inventory", "Images", "Footprint", "C 348 RA = 56.141667 De", and "results 1-20 of 907".

At the bottom of the interface is a Microsoft WorldWide Telescope (WWT) window. The title bar reads "Microsoft WorldWide Telescope". The interface includes a "Guided Tours" button, a search bar, and a "View" menu. Below the search bar is a row of thumbnail images for various astronomical objects. The main display area shows a large, detailed image of a nebula with a dark, irregularly shaped region overlaid on it. The bottom of the WWT window contains a "Layers" panel, an "Image Clouds" panel, a "Tracking" panel, and a "Context Search Filter" panel.

Mockup based on work of Eli Bressert, excerpted from Goodman et al. NASA AISRP proposal, 2008

astrobitz?

terabitz every bit on real estate

Getting Started | Sign 1

Street City, State or Zip

filter listings

Drag and Drop icon to workspace below

Navigation tabs: Listings, Local, Market, Education, Safety, Financing, Professional, Misc

Icons: Google Local Search, Local Photos, Airports, Banks, Cafes, Cinemas, Fast Food, Gas Stations, Grocery Stores, Health Care, Libr

Take Snapshot

Dashboard | Map

Mini Map

Map data ©2007 Tele Atlas - Terms of Use

For Sale Listings

2-Br 1-Ba	\$ 49,900
3116 Nw 17th St, Ocala, FL 34475	
3-Br 2-Ba	\$ 109,900
375 Nw 55th Ave, Ocala, FL 34482	
3-Br 2-Ba	\$ 124,900
280 Nw 53rd Ct, Ocala, FL 34482	
2-Br 2-Ba	\$ 150,000
3459 Sw 18th Pl, Ocala, FL 34474	

[filter listings](#) [Map](#) | 90 results

Banks

Regions Bank	352-291-2965
3101 Sw College Rd, Ocala, FL	
Regions Bank	352-861-2342
2811 Sw 27th Ave, Ocala, FL	
Wachovia Bank	352-873-5010
3201 Sw College Rd, Ocala, FL	
Community Bank & Trust of ...	352-369-1000
1603 Sw 19th Ave, Ocala, FL	










[Map](#) | 20 results

Some (PLASTIC/SAMP) are on the right track...

SIMBAD: Query by criteria

http://simbad.u-strasbg.fr/simbad/sim-fsam

aladin

SIMBAD: Query by criteria

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

Enter a search expression:

submit query clear

Criteria queries may require some time, especially if they are complex or involve a large number of objects. Please, wait for their completion if it is the case.

Example:
`ra > 15 & ra < 30 & dec > 70 & (cat = 'PPM' | cat = 'HIP') & mes = 'ROT' & ubv.v <= 10.0`

Return :

- object count
- display objects
- get references from the selected objects

Enter the name of an ASCII file containing a search expression:

Choose File no file selected

submit file clear

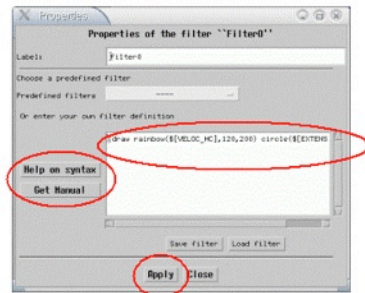
Description of the queriable fields (231) :

Criteria on basic data

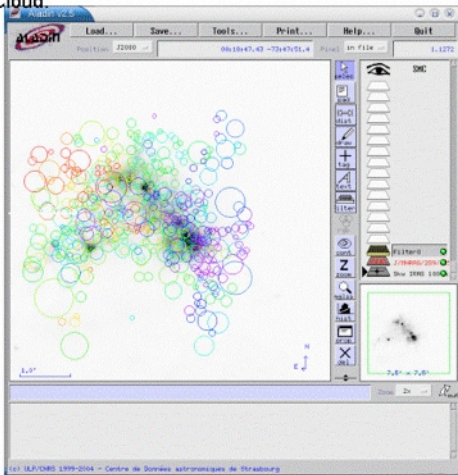
pm	proper motion (mas)	< / <= / > / >=	splum	criterion using only a luminosity class ('III', 'IV/V', ...) More info	= / != / > / >= / < / <= / in
pmqual	proper motions quality (A:best, E:worst)	= / != / in	sppec	criterion using only spectral type peculiarities ('ap', 'cn', ...) More info	= / != / in
plx	parallaxes (decimal value expressed in milliarcsec)	= / != / < / <= / > / >=	spqual	spectral type quality (A:best, E:worst)	= / != / > / >= / < / <= / in
plxqual	parallax quality (A:best, E:worst)	= / != / in	mttype	morphological type	= / != / ~ / !~ / in
rvtype	radial velocity type as the value was entered in the	= / !=	mtqual	morphological type	= / != / in

What we get

- Write the following expression in the **filter definition** box:
`{draw rainbow[${VELOC_HC},120,200] circle[${EXTENSION_RAD]}}`
- This filters draws a circle which radius is proportional to the extension radius of the shell (EXTENSION_RAD) and which colour scales with the heliocentric velocity of the bubble (VELOC_HC) (between 120 and 200 km/s) with a rainbow palette.
- For more informations on the filters syntax, please press the **Help on Syntax** button or **get the manual**.
- Press **Apply**.

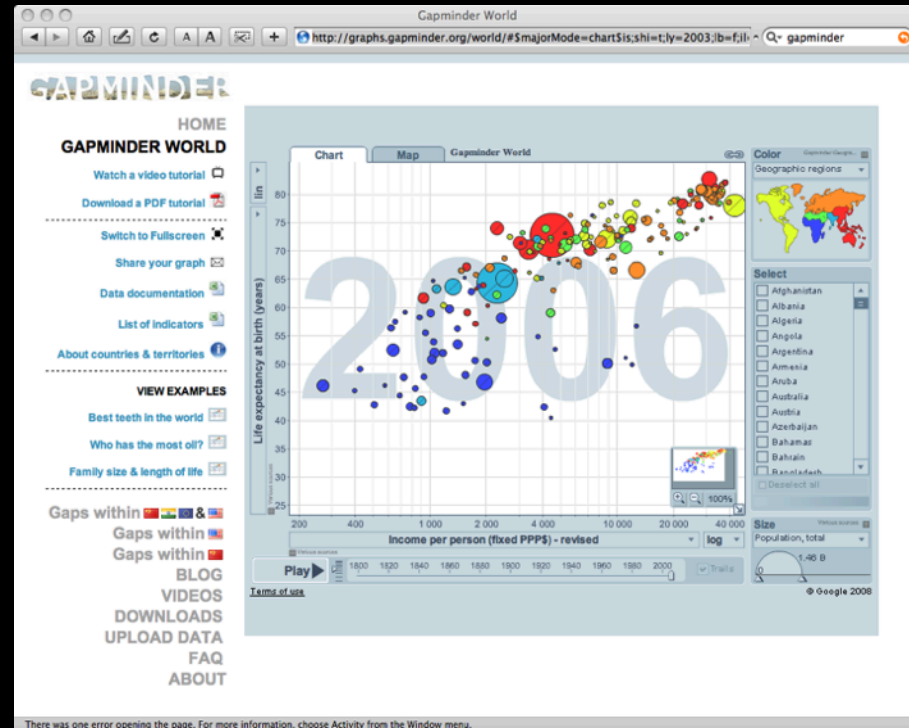


We can now observe the distribution of the HI shells with their position, size and velocities. Note the colour view of the velocity gradient of the Small Magellanic Cloud.



vs.

What the "public" gets



Seamless Astronomy

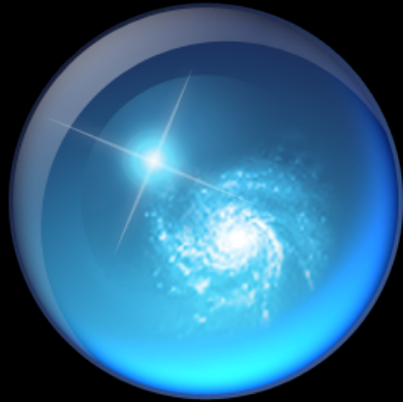
(now part of the WWT Academic Program!)

The screenshot displays the AstroNavigator web interface. At the top, the title "AstroNavigator" is visible. Below it, there are navigation buttons for "Project 1", "Project 2", "Project 3", and "Edit". The main content area is divided into several sections:

- Section A:** "QSO MgII absorption line observed". It lists authors "Drinkwater, Webster R.L., et al." and a description: "The results of a large R-band".
- Section B:** "SAO/NASA ADS Astronomy Abstracts". It includes links for "Find Similar Abstracts (with default)", "Electronic Refereed Journal Article (PDF)", "Full Refereed Journal Article (PDF)", "FIND IT @ HARVARD", and "arXiv e-print (arXiv:astro-ph/0004386)".
- Section C:** A diagram showing a satellite in orbit around Earth, with a blue arrow pointing towards a yellow circle labeled "STARS WITH NEBULA AG" and another blue arrow pointing towards a yellow circle labeled "ST GRAINS".
- Section D:** A satellite inventory table. It shows a satellite icon, the name "IC 348", and the text "Example Requires". Below the table, there are tabs for "Inventory", "Images", and "Footprint". The table lists "IC 348 RA = 56.141667 De" and "results 1-20 of 907".

In the center of the interface, there is a Microsoft Windows Telescope window showing a large, detailed image of a nebula or galaxy. The window has a toolbar at the top with options like "Explore", "Guided Tours", "Search", "Community", "Telescope", "View", and "Settings". The bottom of the window shows a "Tracking" section with "W3 Star Formation..." and a "Calculate" button.

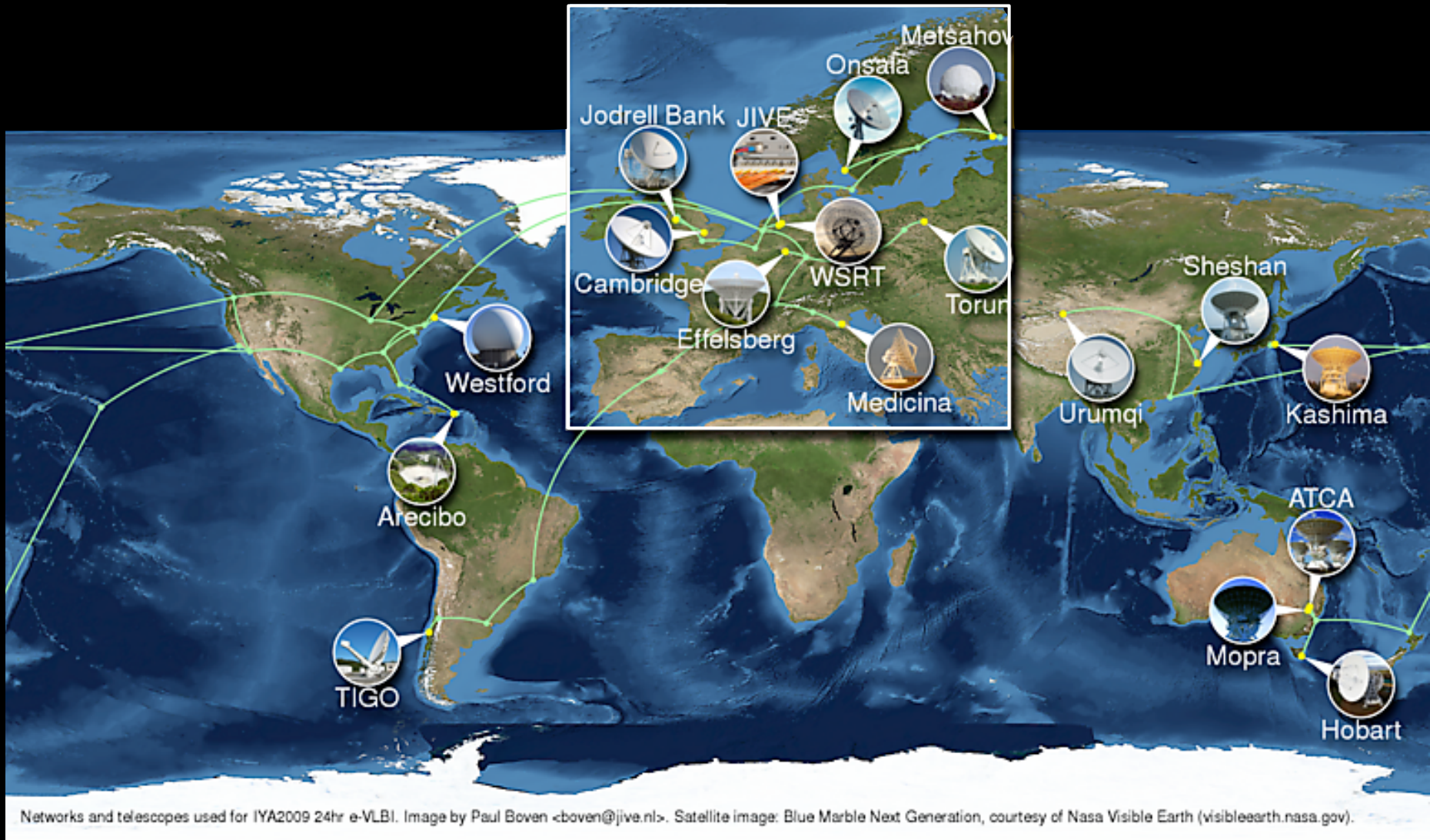
Mockup based on work of Eli Bressert, excerpted from NASA AISRP proposal by Goodman, Muench, Christian, Conti, Kurtz, Burke, Accomazzi, McGuinness, Hendler & Wong, 2008



30-second demo of WWT to ADS+

“e-Research” • “Semantic Web” • “Modular Apps”

+other kinds of e-Science, e.g. “e-VLBI”



“Semantic” Science (& “Social” or Group Science)

Loading "SWAN Hypothesis Browser"

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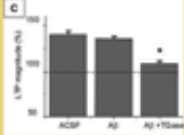
» Featured Contributions



H [Aβ Plaques Lead to Aberrant Regulation of Calcium Homeostasis In Vivo Resulting in Structural and Functional Disruption of Neuronal Networks.](#)
Kuchibhotla Kishore V et Al.



H [Amyloid-β protein dimers isolated directly from Alzheimer's brains impair synaptic plasticity and memory](#)
Shankar Ganesh M et Al.



C

Group	LTP Magnitude (%)
ACP	~100
AD	~100
AD + YG256	~80*

H [Transglutaminase induces prototypic amyloid β-protein assemblies that are resistant and inhibit long-term potentiation](#)
Hartley Dean M et Al.

click on the title to browse the full content and use the arrows to scroll the list

» Hot Topics (browse all hypotheses)

- Aβ accumulation in the brain is the primary event in Alzheimer Disease pathogenesis
- Soluble oligomeric aggregates of Aβ are toxic to neurons and cause AD pathology
- Insoluble fibrillar Aβ leads to AD
- Defective mechanisms of Aβ clearance contribute to AD
- Tau dysfunction mediates neurodegeneration
- ApoE contributes to AD through multiple mechanisms
- Changes in calcium homeostasis may provide a common pathway for the neuropathological changes in AD
- Changes in presenilin function lead to dementia and neurodegeneration in Alzheimer Disease
- Misfolded proteins accumulated into protein aggregates characterizes the pathologic lesions of AD
- The molecular mechanisms of neuronal cell death are involved in the dysfunction and death of neurons in AD
- Synaptic loss appears to be the most powerful and ubiquitous proximate factor leading to the dementia of AD
- Failure of axonal transport might be the underlying basis for neurodegeneration in AD
- Cell membrane properties play a key role in AD Pathophysiology

» Mechanisms

- Energetics
- Functional Changes of Proteins
- Structural Changes of Proteins

» How to Contribute

- **Build a hypothesis**
- **Critique a hypothesis**
- **Nominate a key paper**
- **Help find connections**
- **Propose new features**
- **Add supporting evidence**

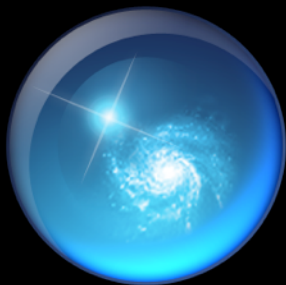
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Loading "http://hypothesis.alzforum.org/swan/do/getHome.action", completed 86 of 89 items



WWT communities

Microsoft® Research
WorldWide Telescope

[Install WorldWide Telescope](#) 
[System Requirements](#) (Windows® only)

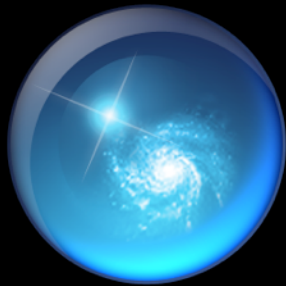
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	Astronomy magazine Type: Public Astronomy magazine's WWT community web site
	Sky & Telescope Type: Public Sky & Telescope magazine's WWT community web site

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WWVT Tours
Educational & Collaborative
Paths through the Sky

(examples...)

Astronomy Research's Future

“e-Research” • “Semantic Web” • “Modular Apps”



SPACE TIME MACHINE



DASCH: Digital Access to a Sky Century at Harvard

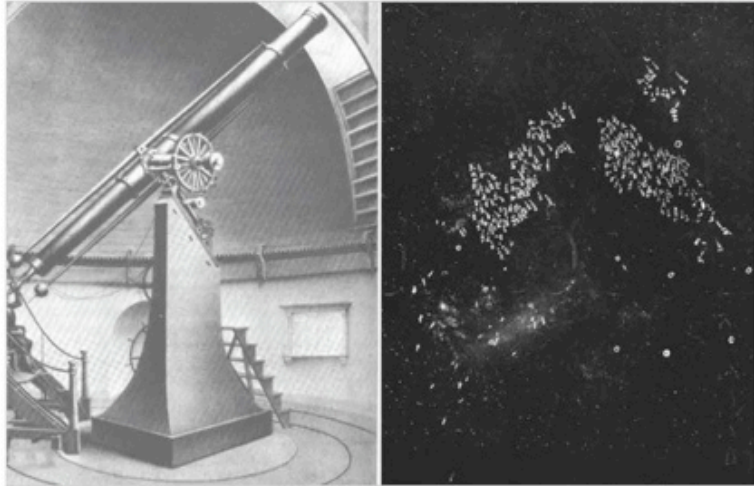
DASCH PI is Josh Grindlay, CfA

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A Trip Back in Time and Space



Harvard College Observatory

The Great Refractor, left, which captured the first picture of a star in 1850, and an image of the Large Magellanic Cloud taken in 1900. [More Photos >](#)

By GEORGE JOHNSON
Published July 10, 2007

In the summer of 1889, when this was still an analog world, a young astronomer named Solon I. Bailey carefully packed two crates of glass photographic plates taken at his outpost in the Peruvian Andes for shipment to [Harvard](#) College Observatory. Carried down the mountain on muleback and across a suspension bridge to the village of Chosica, the fragile load was put on a train bound for Lima and the long voyage to Boston Harbor.

For nearly 18 months the data stream continued — more than 2,500 plates from what Mr. Bailey had quaintly named Mount Harvard — followed in the coming years by tens of thousands more from a second Peruvian station in Arequipa. Over the decades more streams came from Chile, South Africa and New Zealand, joining the growing piles produced by telescopes in Massachusetts.

The accumulated result weighs heavily on its keepers on Observatory Hill, just up Garden Street from Harvard Square: more than half a million images constituting humanity's only record of a century's worth of sky.

*Besides being 25 percent of the world's total of

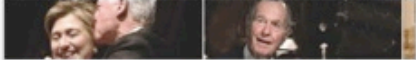
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SPACE TIME MACHINE



Principal Contacts:

WWT Pro: *Alyssa Goodman* (STM Consortium Chair)
& *Gus Muench* (Project Manager)

WWT: *Curtis Wong* & *Jonathan Fay*

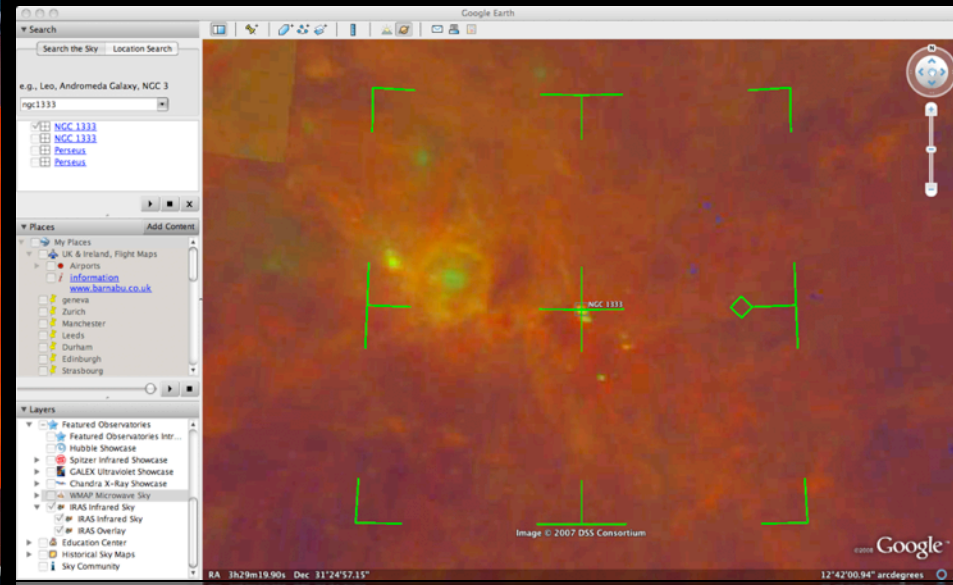
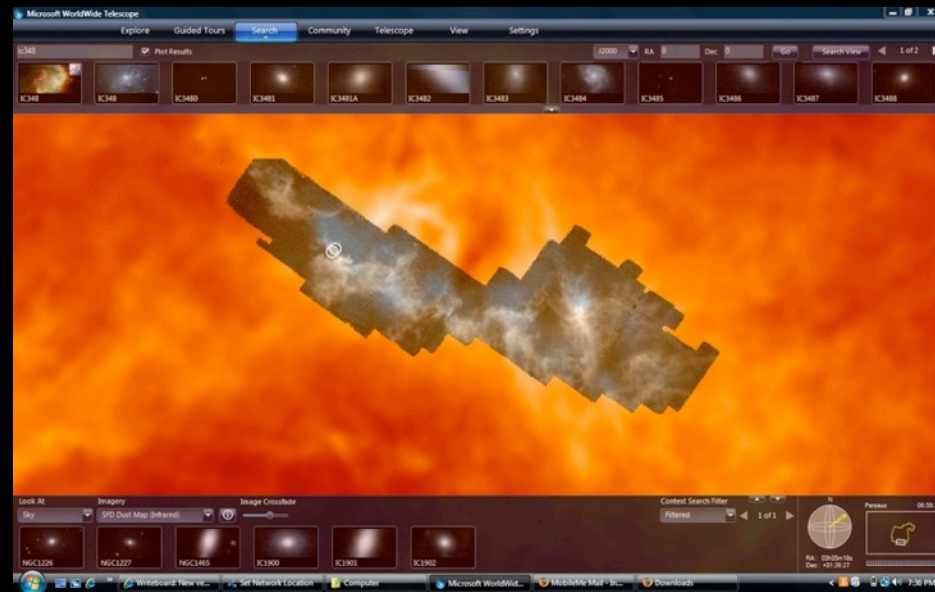
TSC: *Pavlos Protopapas* (PI)

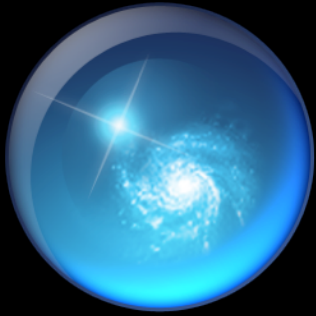
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“Unsolicited Advice” for 2009 from www.microsoft-watch.com

“3. Make incubation projects the top development priority.

Simply some of your best work in 2008 came from incubation projects. Keep them coming and better reward employees for their innovation. Give your customers more products like Live Mesh, Photosynth and [WorldWide Telescope](#).

Incubation projects:

- Engage enthusiasts
- Create positive buzz
- Show how Microsoft can truly innovate.

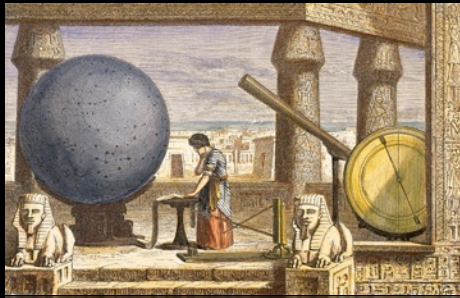
...Then there's Google. Yes, Google. Gmail is now a modularized product. Gmail users choose which features they want to add on, stuff coming out of Google incubation development. Outstanding.”

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