Astronomy as I "See" It

Alyssa A. Goodman

Professor of Astronomy
& Founding Director of the
Initiative in Innovative Computing,
Harvard University

Scholar-in-Residence,
WGBH Boston

What the IIC has done for me... / ~~What the IIC has done for research...~~

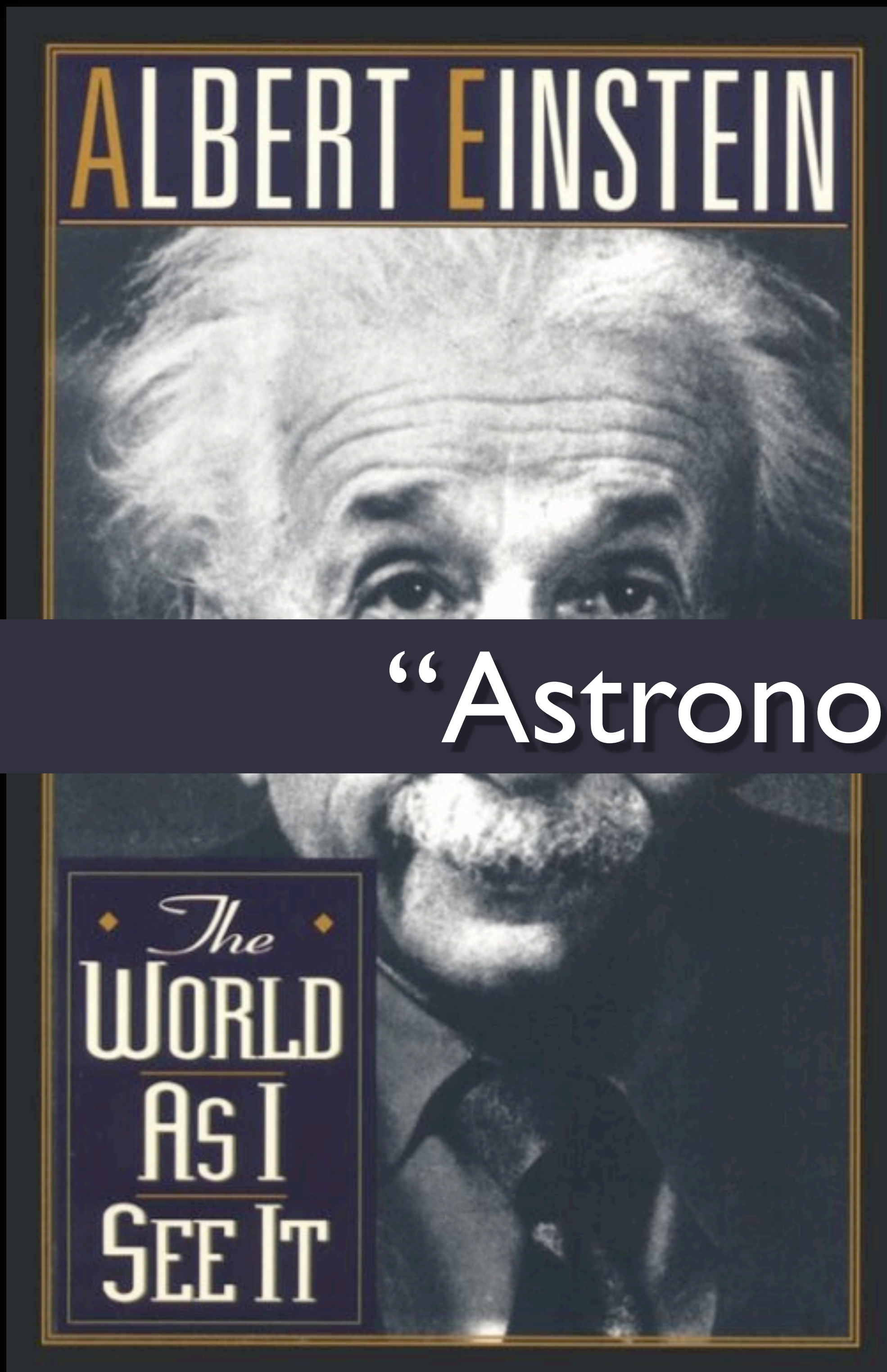
Astronomical Medicine

3D PDF (& Touch & Taste)
(a.k.a. "coming to our senses")

WorldWide Telescope

"Seamless Astronomy"

and someday...Generalized Interoperable Viz Tools

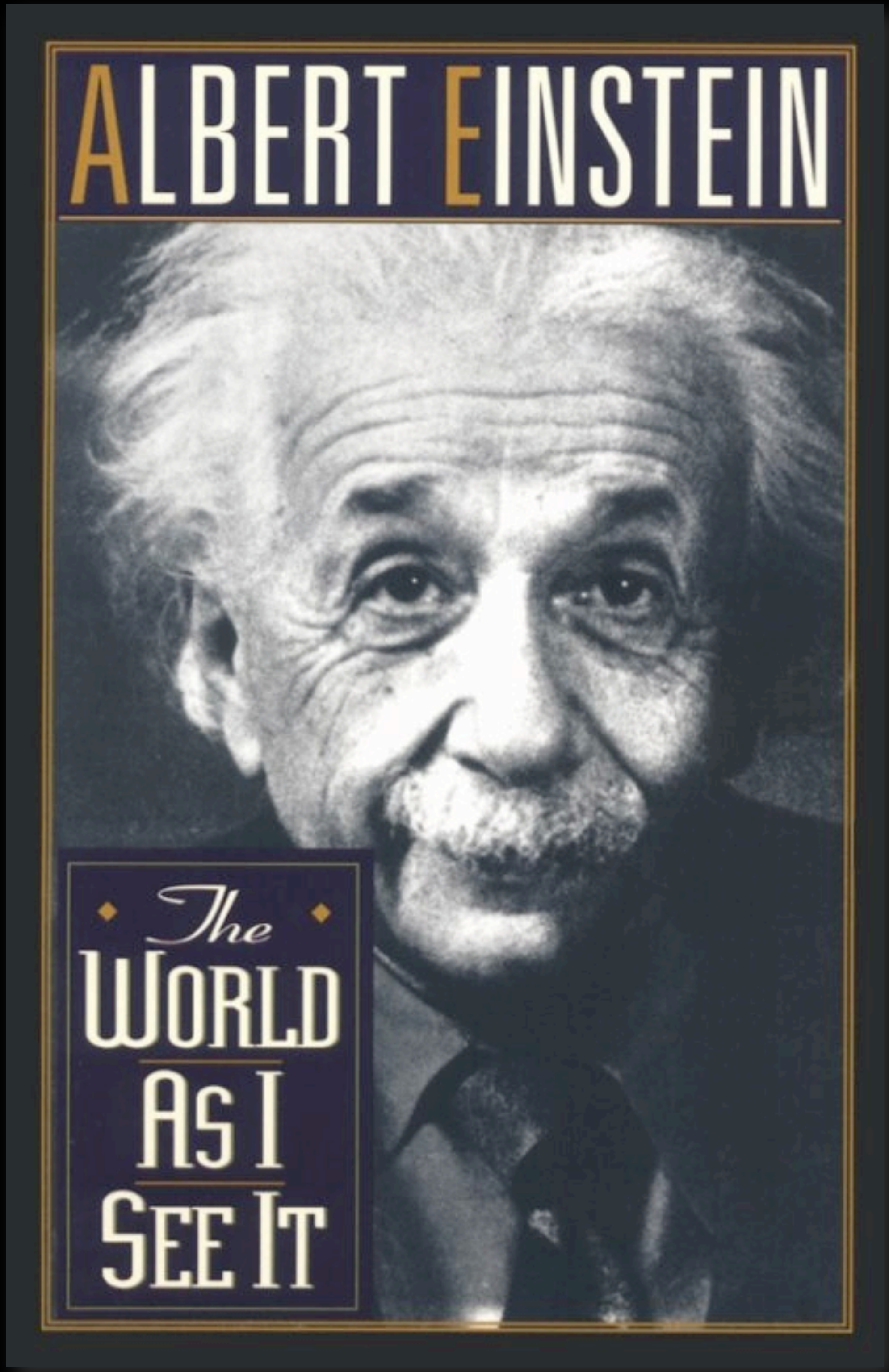


The most incomprehensible

“Astronomy as I See It”

- Albert Einstein

“Astronomy as IIC It”



The most incomprehensible thing about the universe is that it is comprehensible.

\- Albert Einstein

Relative Strengths

Pattern Recognition
Creativity

Calculations


"Interocularity"
(see work of John Tukey)
"Image and Meaning"
(see work of Felice Frankel,
and imageandmeaning.org)

Data • Dimensions • Display
(DDD)

What about DDD...

...is easier now than before?

fast computation, animation, 3D

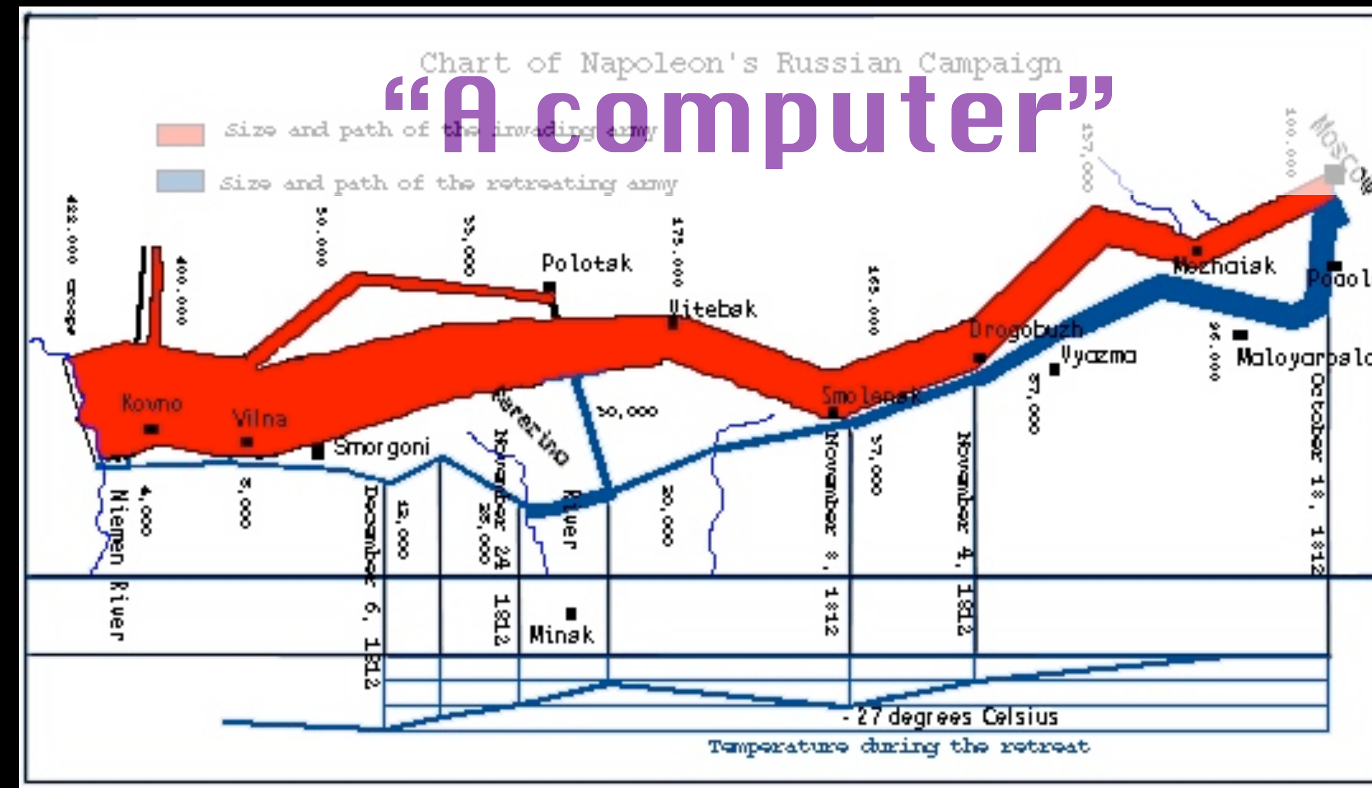
...was easier before than now?

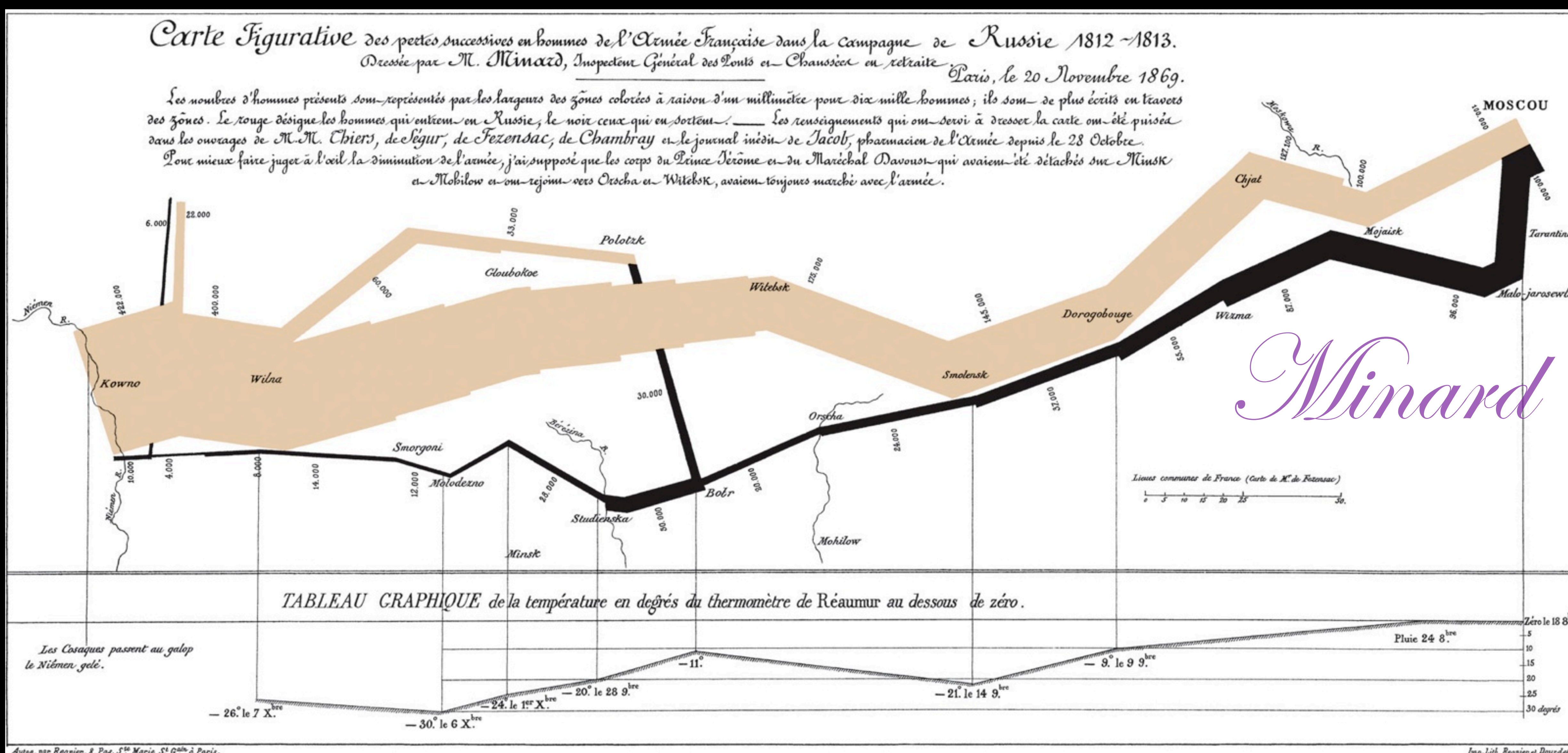
craftsmanship

...should be easier in the future?

modular craftsmanship

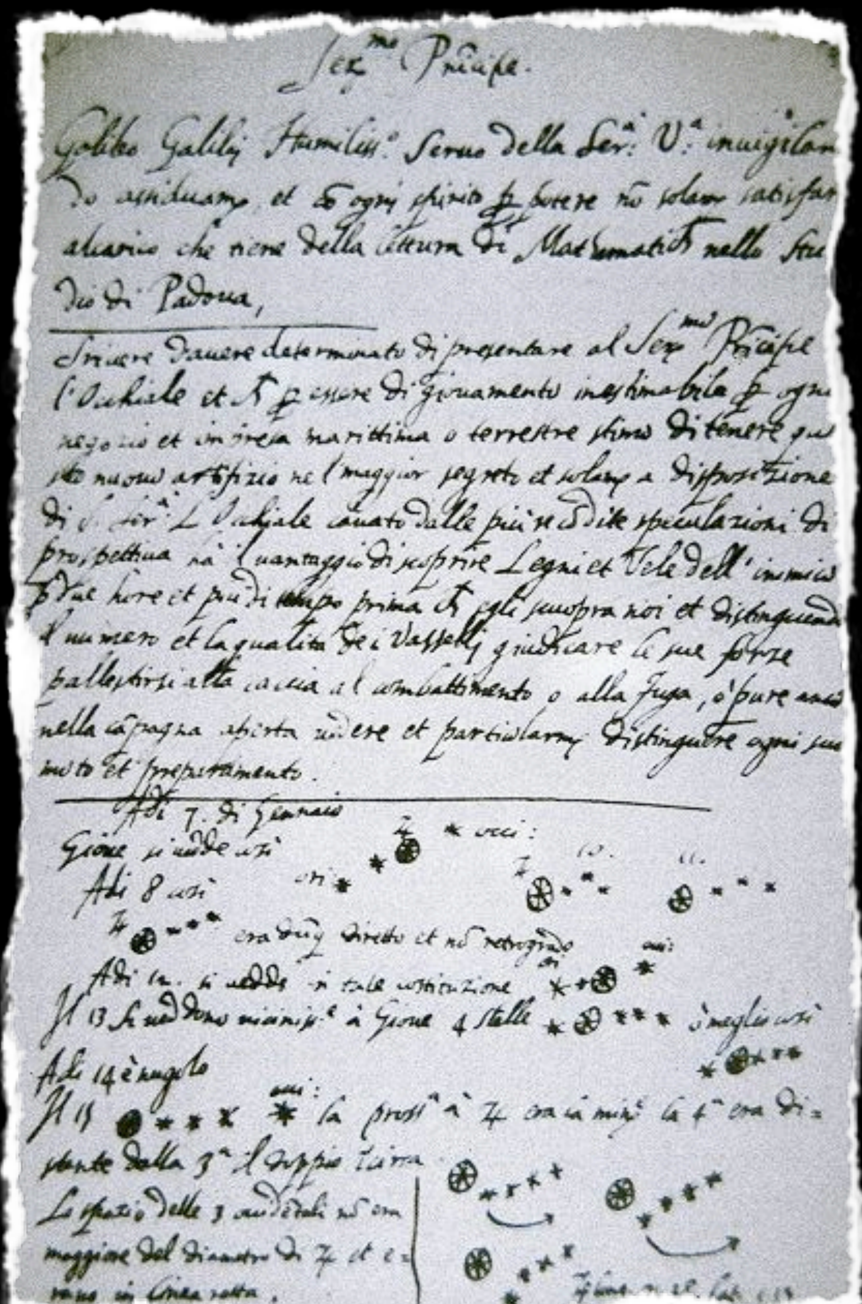
Are we held back by confining tools?

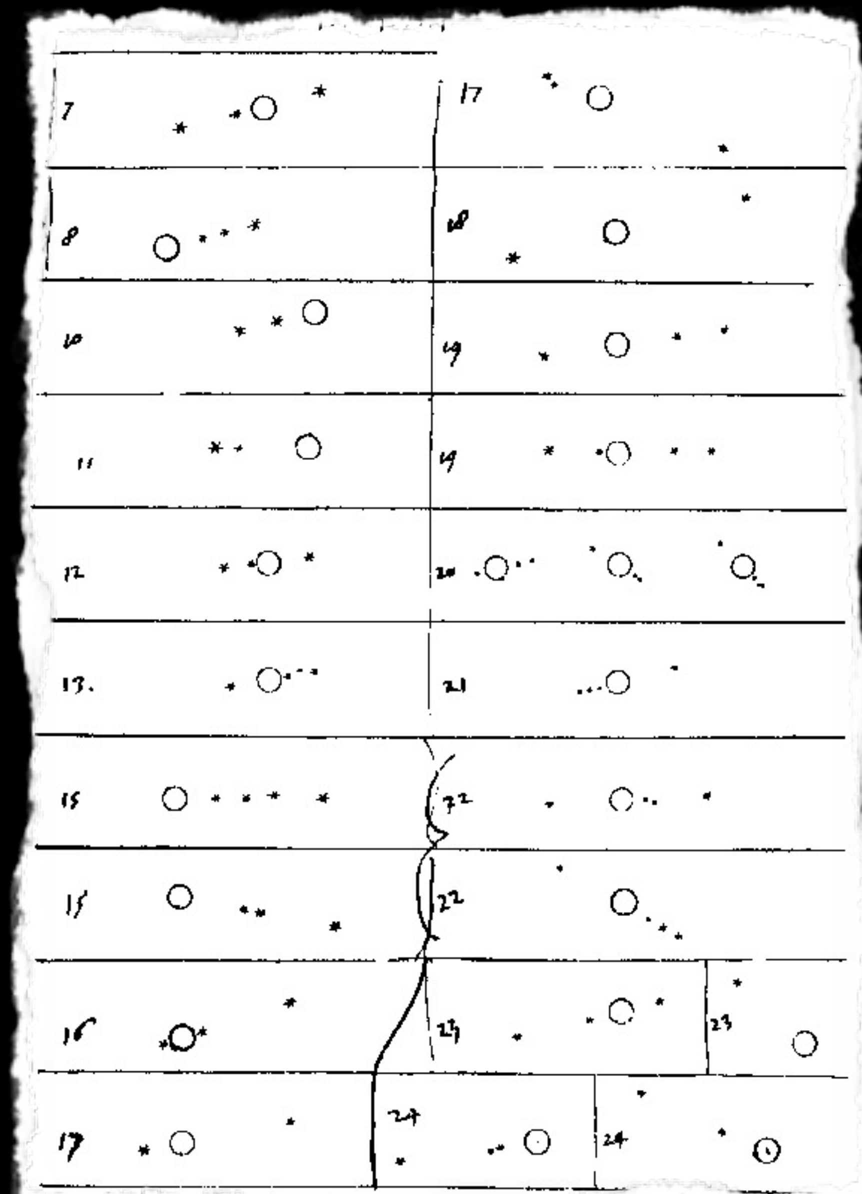


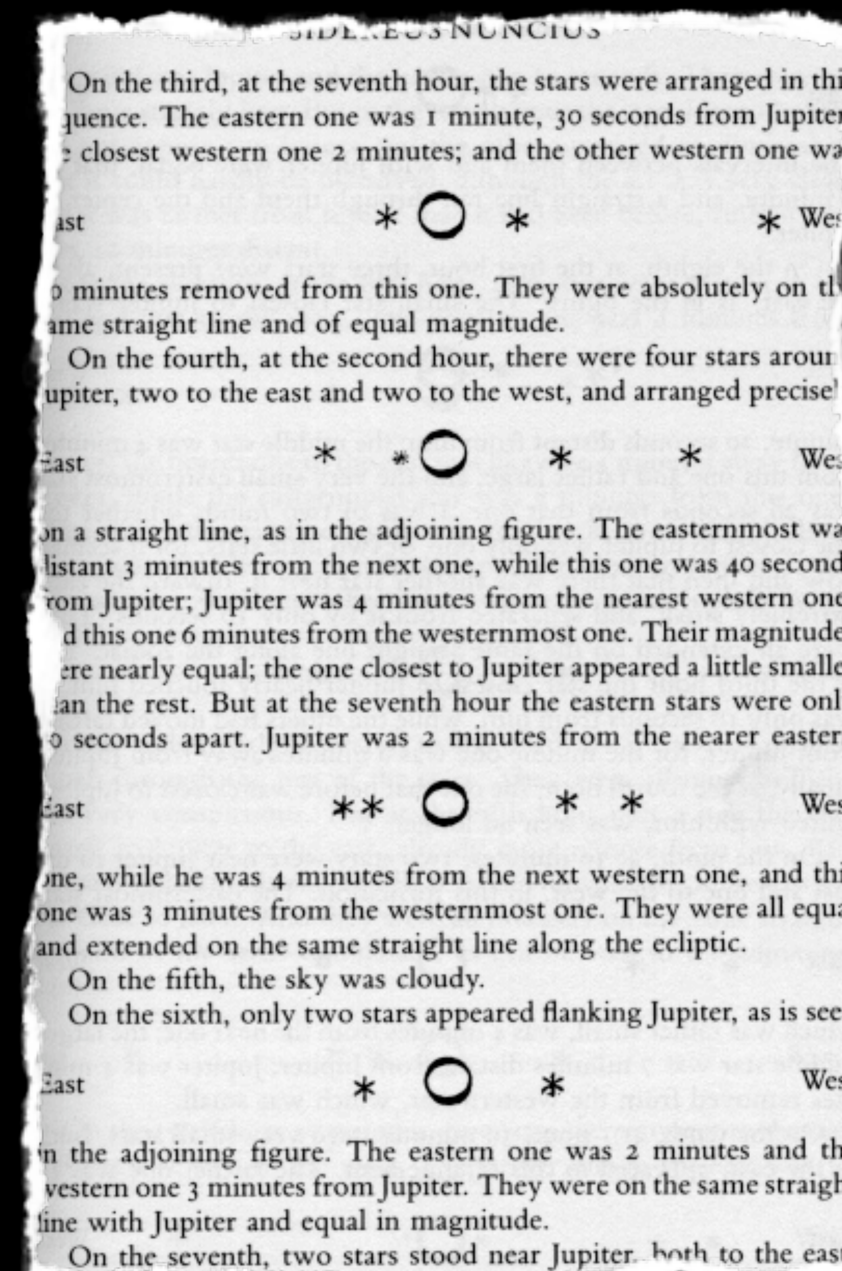


Galileo

(1564-1642)







SIDE...EUS NUNCIUS

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

ast * O * * Wes

minutes removed from this one. They were absolutely on th
ame straight line and of equal magnitude.

On the fourth, at the second hour, there were four stars arour
upiter, two to the east and two to the west, and arranged precise

East * *O * * Wes

on a straight line, as in the adjoining figure. The easternmost wa
distant 3 minutes from the next one, while this one was 40 second
rom Jupiter; Jupiter was 4 minutes from the nearest western one
d this one 6 minutes from the westernmost one. Their magnitude
ere nearly equal; the one closest to Jupiter appeared a little smalle
an the rest. But at the seventh hour the eastern stars were only
o seconds apart. Jupiter was 2 minutes from the nearer easter

East ** O * * West

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

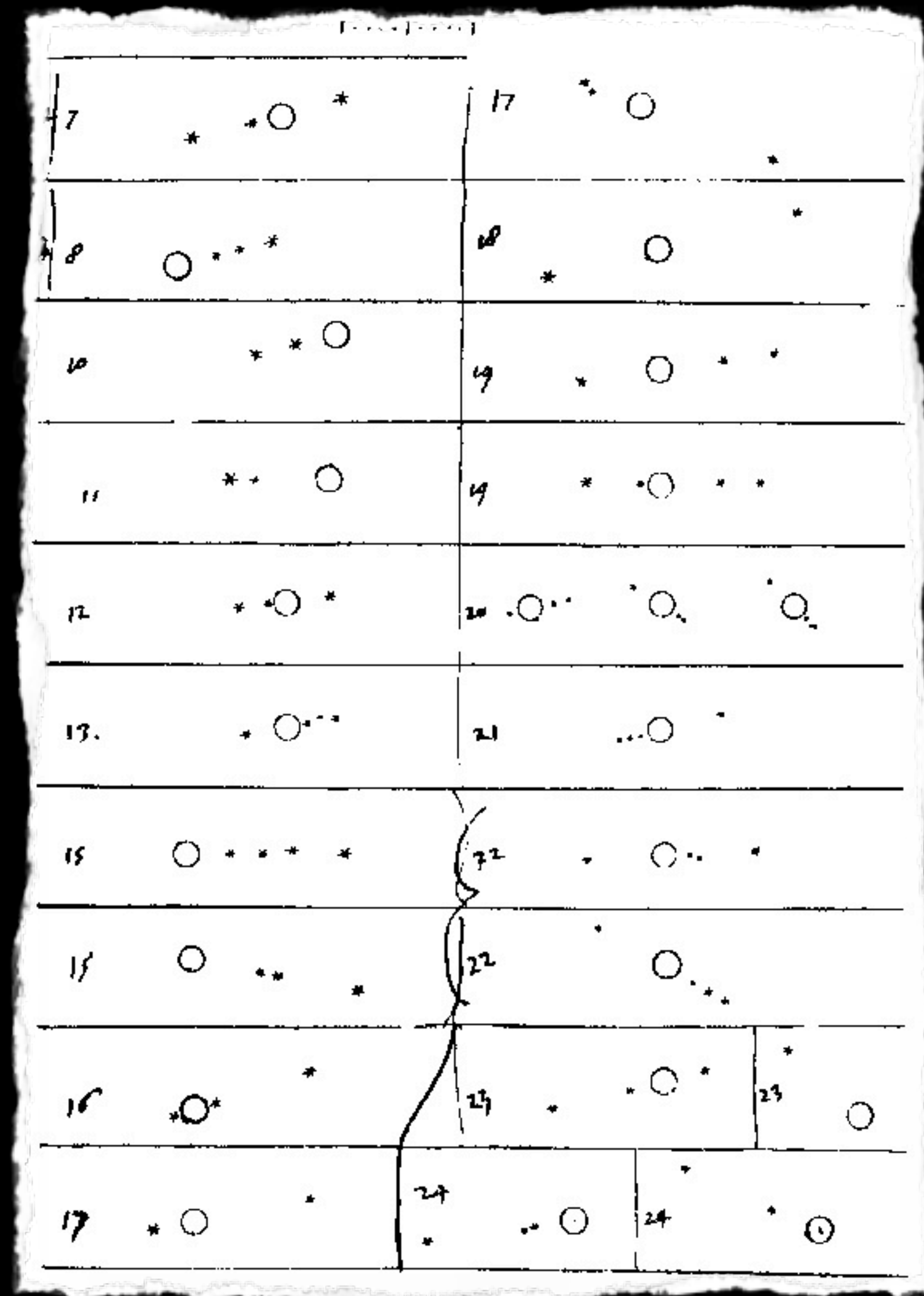
East * O * West

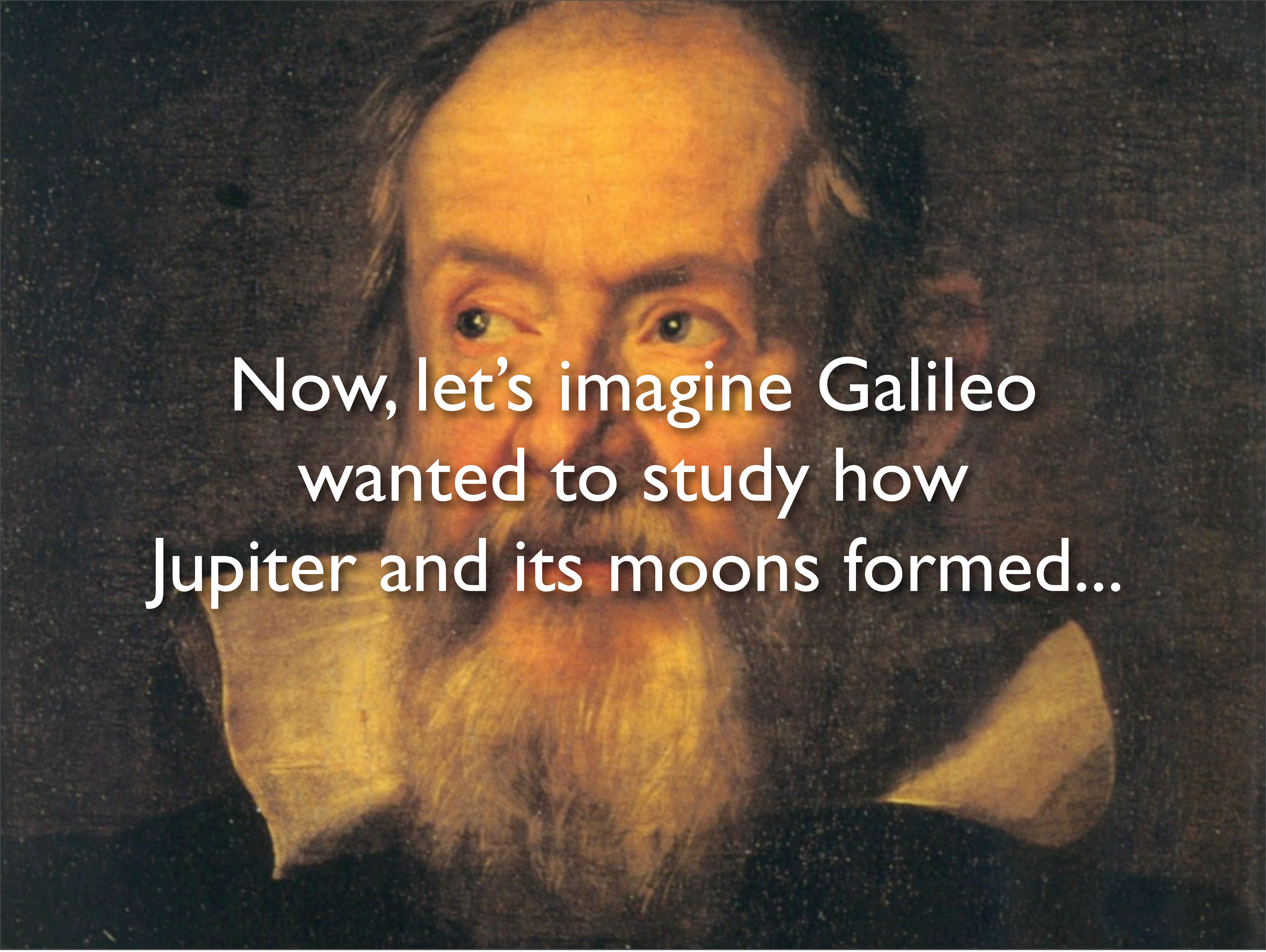
in the adjoining figure. The eastern one was 2 minutes and the
western one 3 minutes from Jupiter. They were on the same straight
line with Jupiter and equal in magnitude.

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

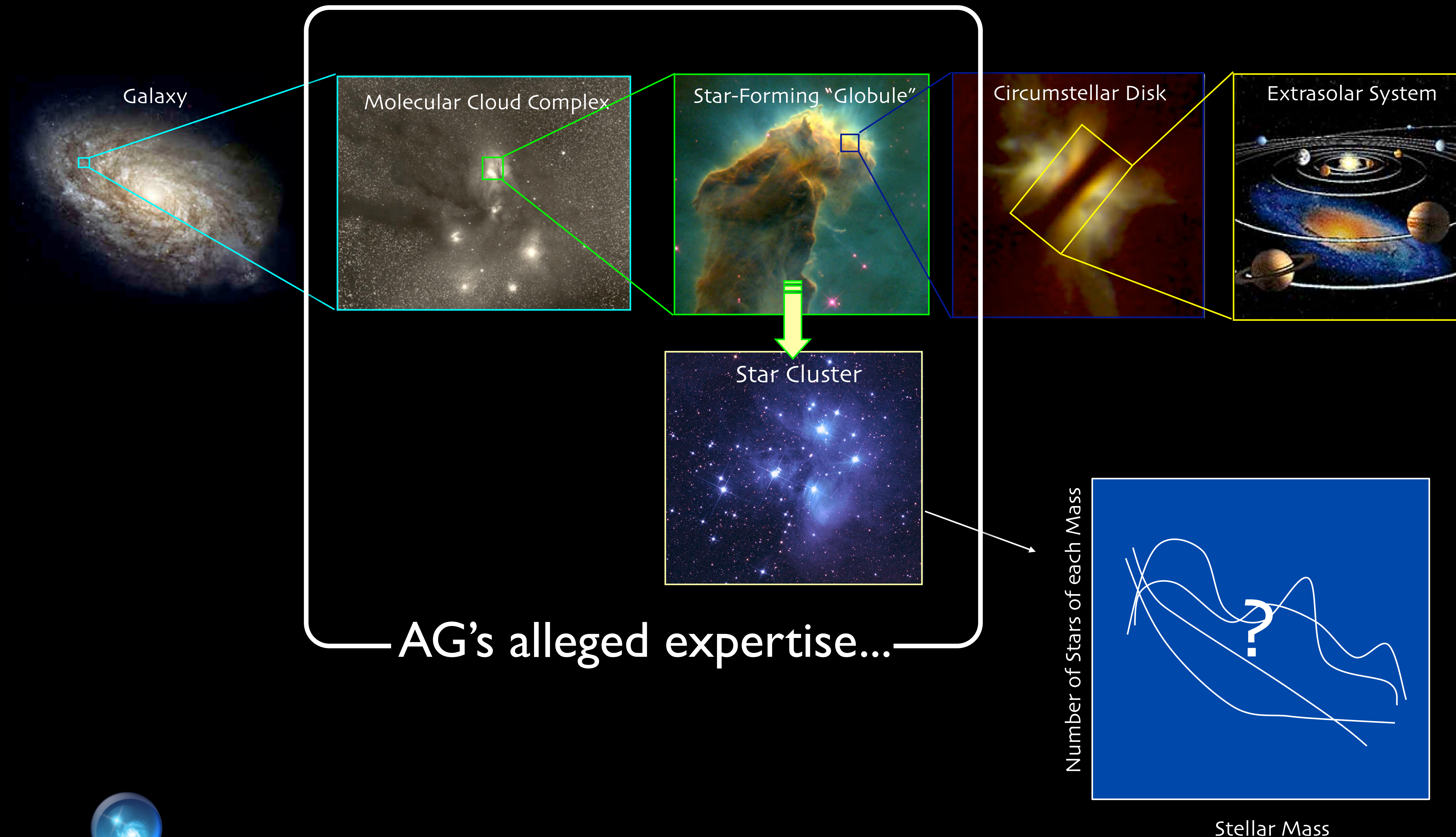
Notes for & re-productions of Siderius Nuncius

How could Galileo study Jupiter and its moons *now*?

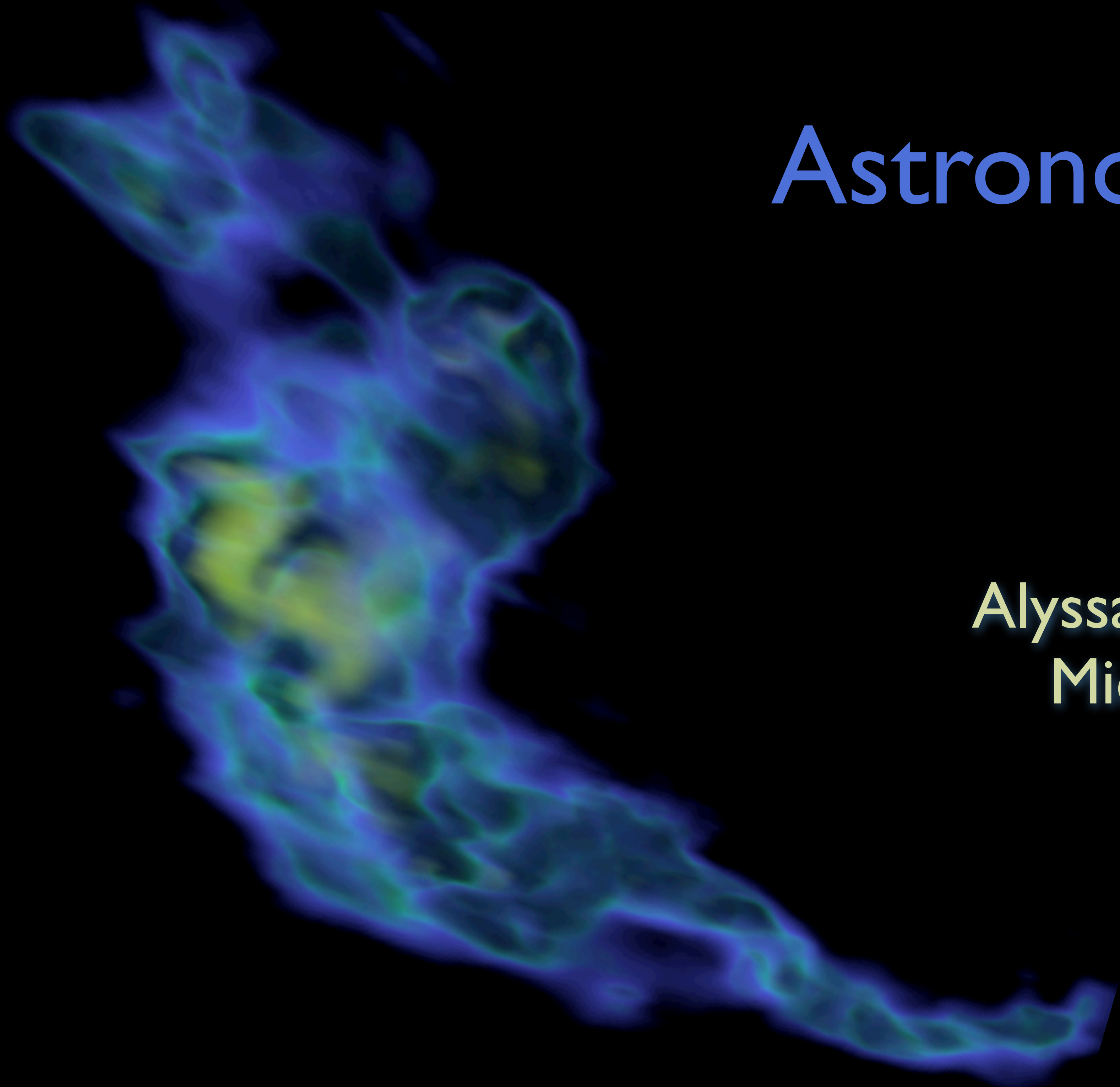



Now, let’s imagine Galileo
wanted to study how
Jupiter and its moons formed...

Star (and Planet, and Moon) Formation 101



Astronomical Medicine

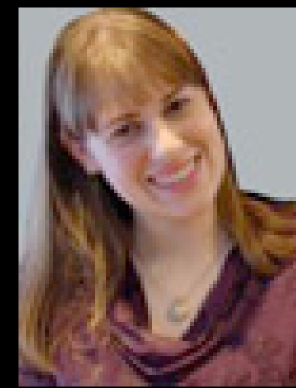


Alyssa Goodman (IIC/CfA/FAS)
Michael Halle (IIC/SPL/HMS)
Ron Kikinis (SPL/HMS)
Douglas Alan (IIC)
Michelle Borkin (FAS/IIC)
Jens Kauffmann (CfA/IIC)
Erik Rosolowsky (CfA/UBC Okanagan)
Nick Holliman (U. Durham)

The Astronomical Medicine Story

Computer Scientist

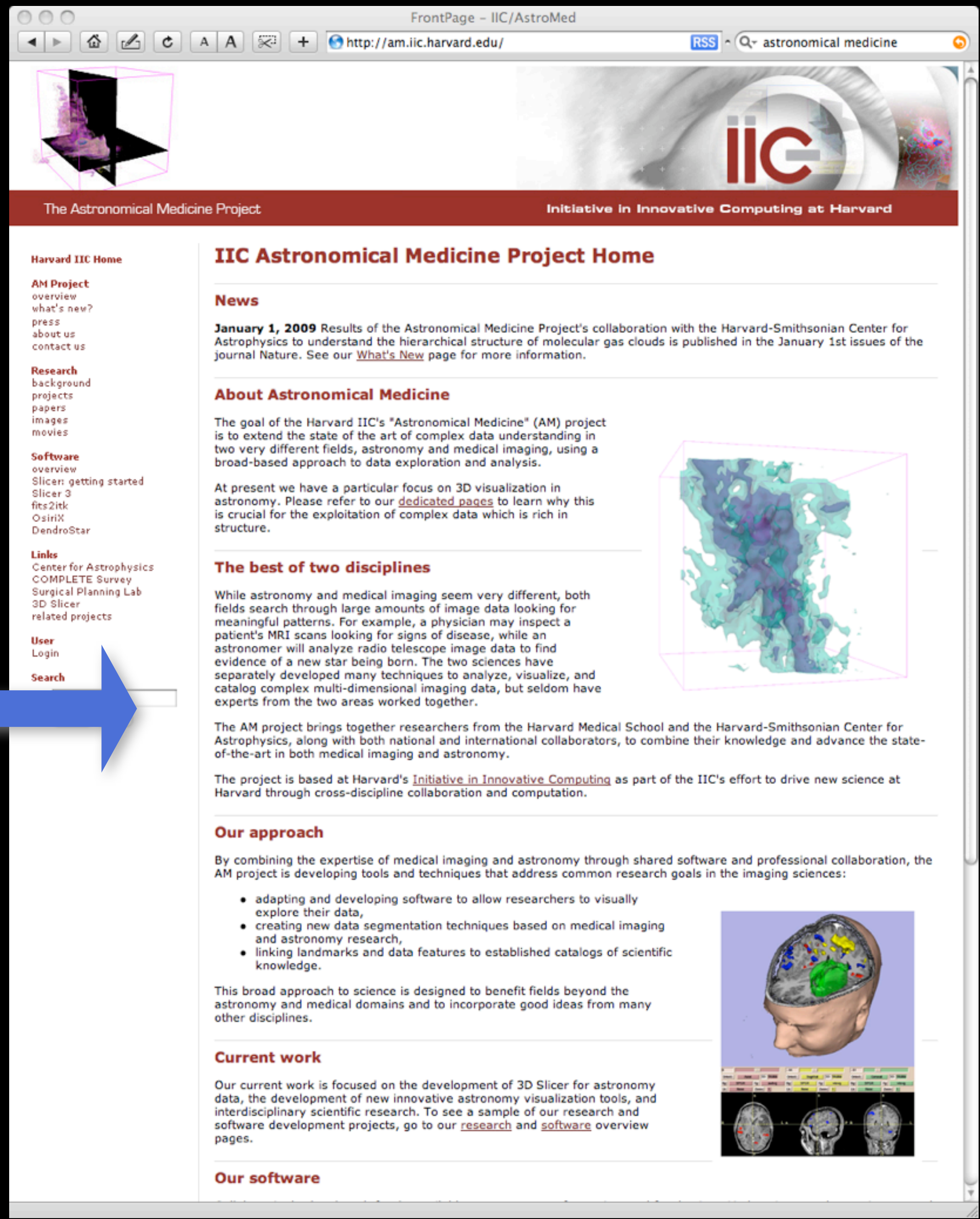
Computer Scientist



Unsuspecting Undergrad

Astronomer

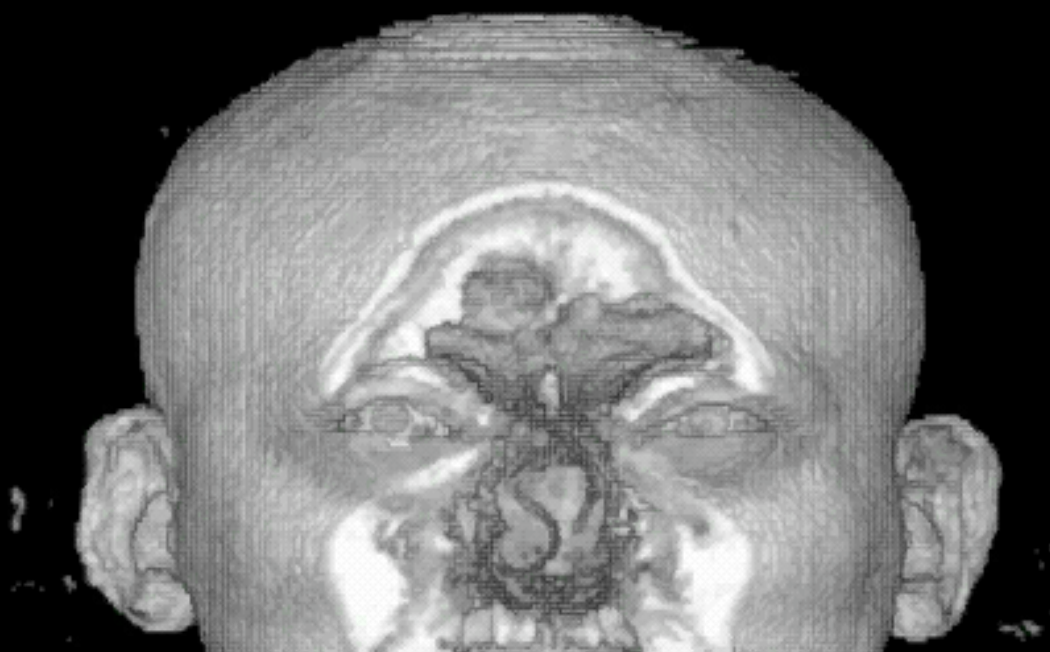
"Viz has failed the scientific community…"



+Nick Holliman (CS, 3D expert)
+Doug Alan (S/W Engineer)
+Jens Kauffmann (postdoc)
+Erik Rosolowsky (postdoc) + ...

The "DDD" issue Mike saw in his mind...
"Astronomical Medicine"

"KEITH"



"z" is depth into head

"PERSEUS"

"z" is line-of-sight velocity

(This kind of "series of 2D slices view" is known in the Viz as "the grand tour")

Data • Dimensions • Display

What can we observe?

$$I(E, s, \vec{x}, t)$$

Intensity

Energy
(wavelength)

"State"
(e.g. polarization)

Spatial Position
(x, y, z)

Time

...and the science is in the interpretation of these measurements into physical quantities & processes.

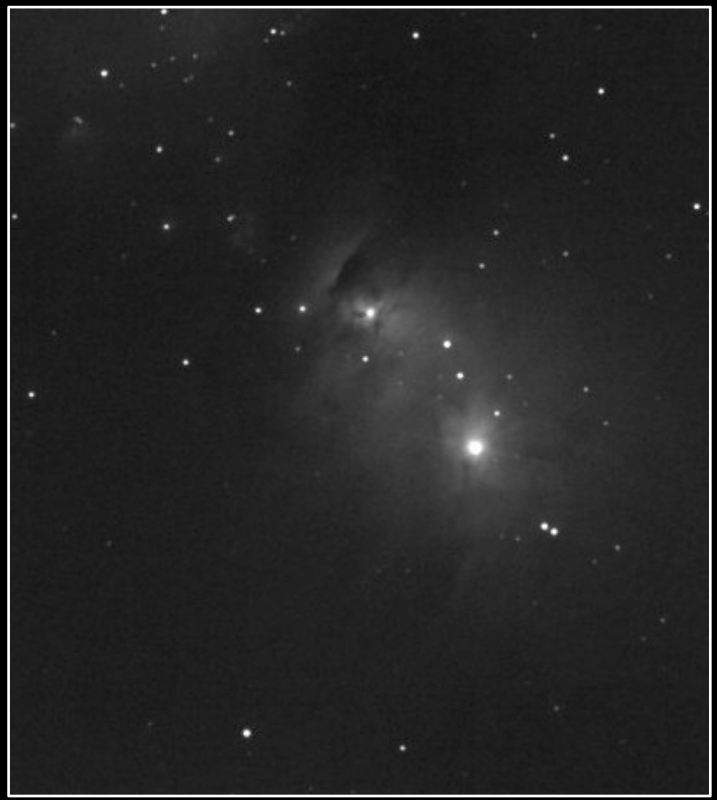
What can we observe?

$$I(\qquad \vec{x} \quad)$$

Intensity

Spatial Position

$(x, y \quad)$



Optical Single-Band
Image of NGC1333

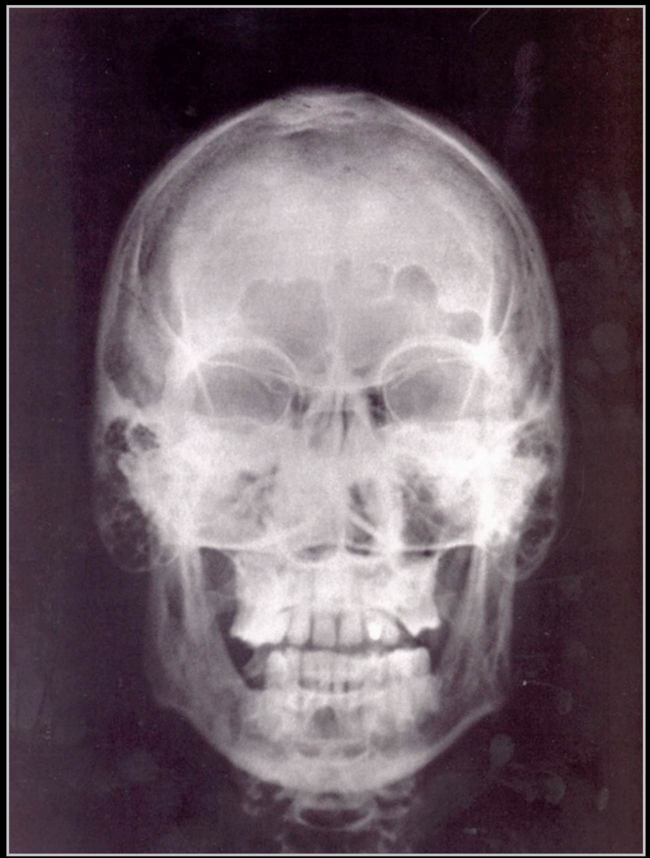
What can we observe?

$$I(\quad\vec{x}\quad)$$

Intensity

Spatial Position

$(x, y \quad)$



X-Ray of Human Skull, c. 1920

What can we observe?

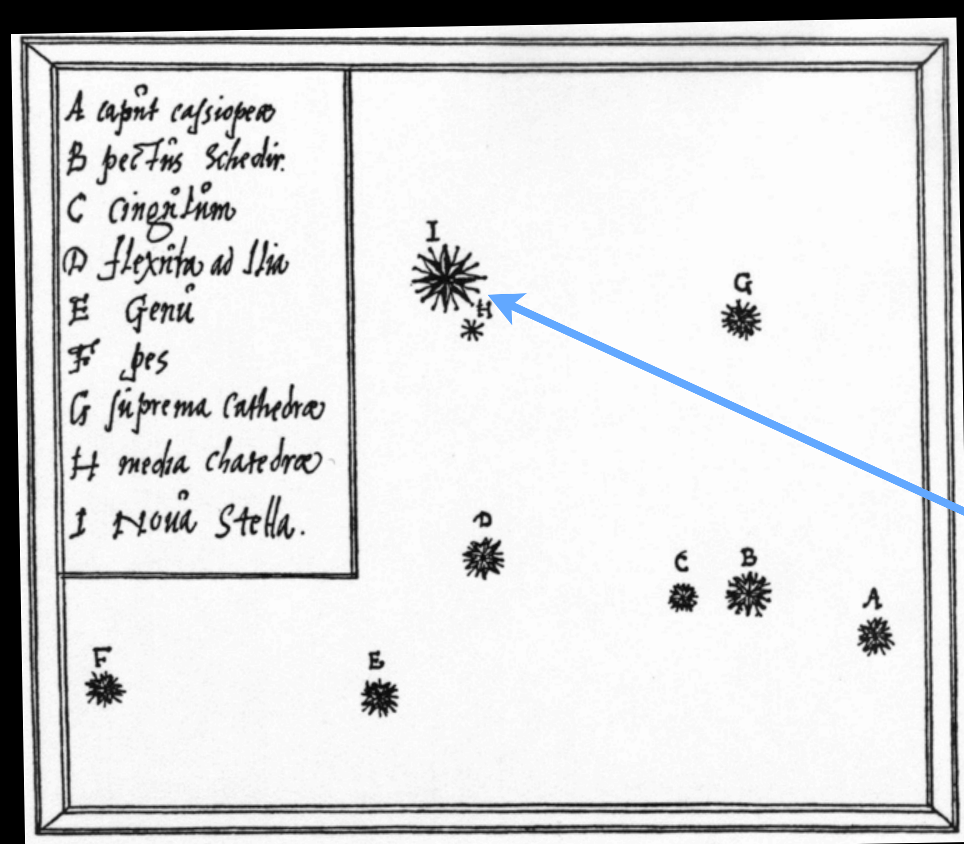
$$I(\quad\quad \vec{x}, t)$$

Intensity

Spatial Position

(x, y, z)

Time



"Nova Stella"
of Tycho, 1572

What can we observe?

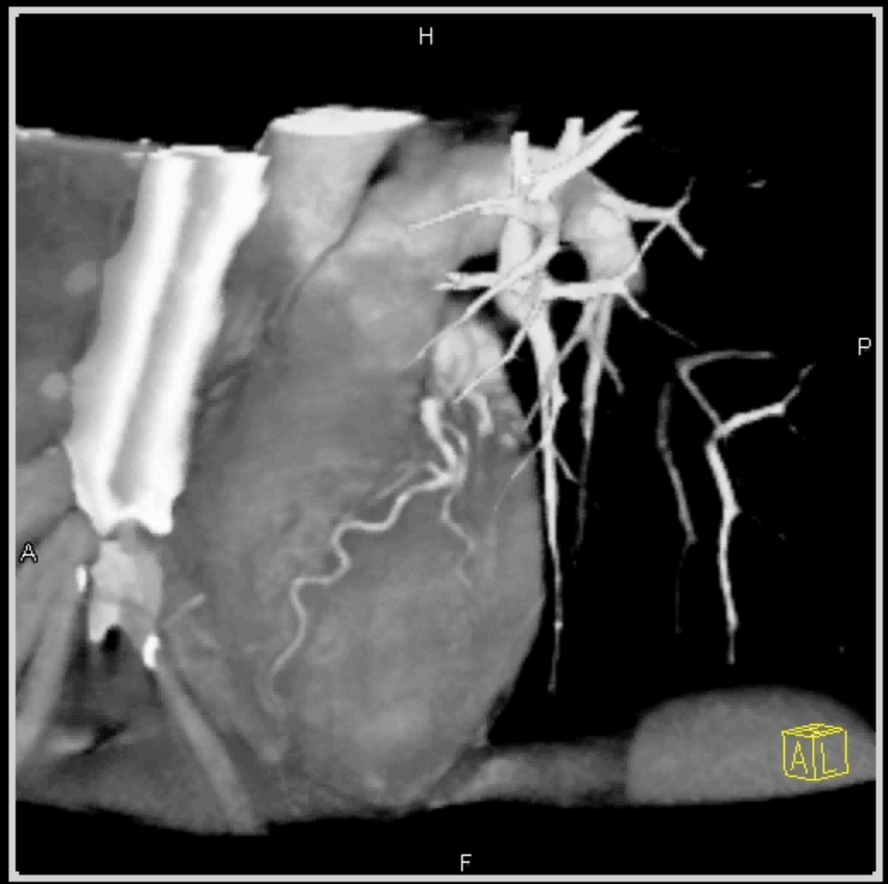
$$I(\vec{x}, t)$$

Intensity

Spatial Position

(x, y, z)

Time



Cardiac Motion

What can we observe?

$$I(E, \quad \vec{x} \quad)$$

Intensity

Energy
(wavelength)

Spatial Position
$(x, y \quad)$

Optical (B,V,R) image
of NGC1333

What can we observe?

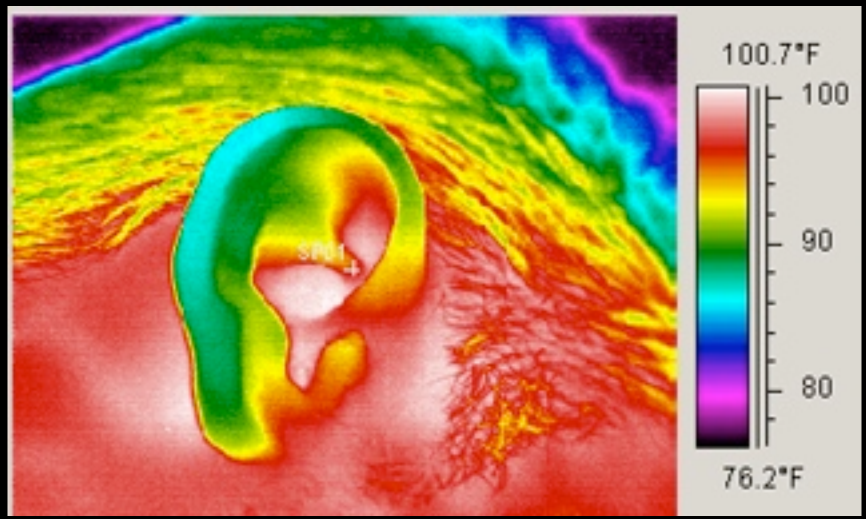
$$I(E, \quad \vec{x} \quad)$$

Intensity

Energy
(wavelength)

Spatial Position
$(x, y \quad)$

Human Ear,
Thermal Infrared



What can we observe?

$$I(\quad s, \vec{x} \quad)$$

Intensity

"State"
(e.g. polarization)

Spatial Position
$(x, y \quad)$

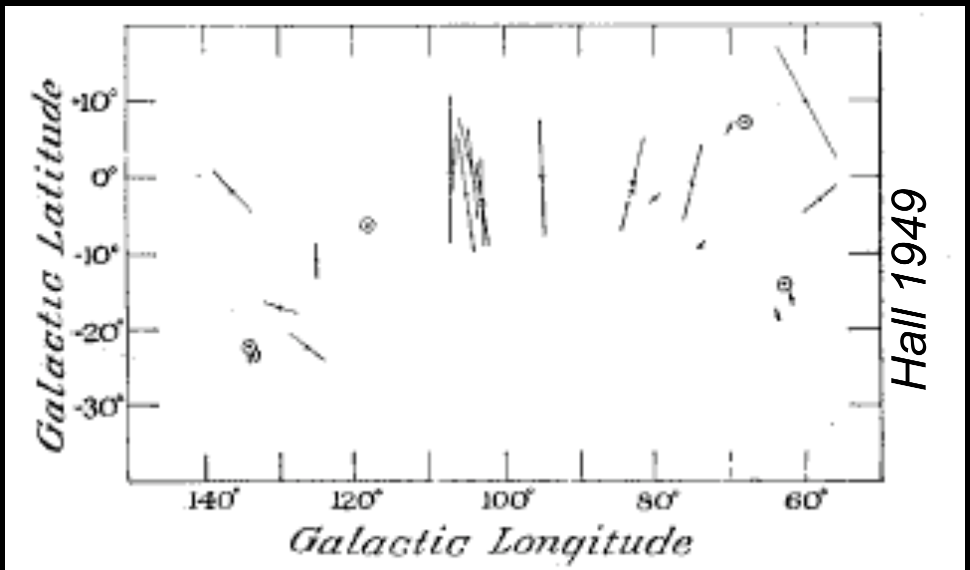


FIG. 4. Observational evidence that there is no one preferential orientation of the plane of polarization. Stars showing no polarization are represented by circles.

Hall 1949

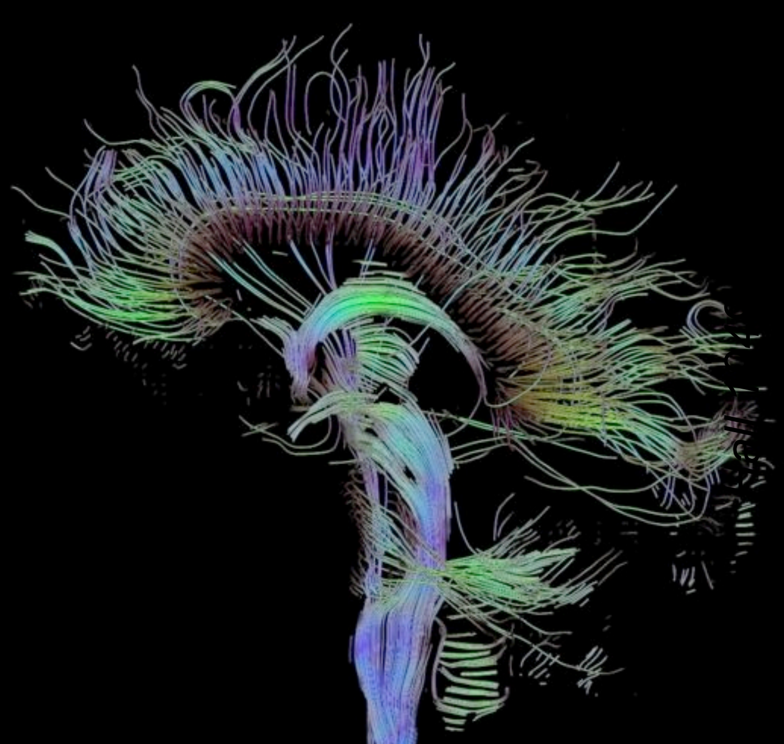
What can we observe?

$$I(\quad s, \vec{x} \quad)$$

Intensity

"State"
(~diffusivity)

Spatial Position
(x, y, z)



Our current interest in

$$I(E, s, \vec{x}, t)$$

COMPLETE Home Page

http://www.cfa.harvard.edu/COMPLETE/

COMPLETE

The COordinated Molecular Probe Line Extinction Thermal Emission Survey of Star Forming Regions

- Data
- Results
- Projects
- People
- Learn
- Restricted

Project Description

The COordinated Molecular Probe Line Extinction Thermal Emission Survey of Star Forming Regions (COMPLETE) provides a range of data complementary to the Spitzer Legacy Program "From Molecular Cores to Planet Forming Disks" (c2d) for the Perseus, Ophiuchus and Serpens regions. In combination with the Spitzer observations, COMPLETE will allow for detailed analysis and understanding of the physics of star formation on scales from 500 A.U. to 10 pc.

Phase I, which is now complete, provides fully sampled, arcminute resolution observations of the density and velocity structure of the three regions, comprising: extinction maps derived from the Two Micron All Sky Survey (2MASS) near-infrared data using the NICER algorithm; extinction and temperature maps derived from IRAS 60 and 100um emission; HI maps of atomic gas; 12CO and 13CO maps of molecular gas; and submillimeter continuum images of emission from dust in dense cores.

Click on the "Data" button to the left to access this data.

Phase II (which is still ongoing) uses targeted source lists based on the Phase I data, as it is (still) not feasible to cover every dense star-forming peak at high resolution. Phase II includes high-sensitivity near-IR imaging (for high resolution extinction mapping), mm-continuum imaging with MAMBO on IRAM and high-resolution observations of dense gas tracers such as N2H+. These data are being released as they are validated.

COMPLETE Movies: Check-out our movies page for animations of the COMPLETE data cubes in 3D.

Referencing Data from the COMPLETE Survey

COMPLETE data are non-proprietary. Please reference **Ridge, N.A. et al., *"The COMPLETE Survey of Star Forming Regions: Phase 1 Data"*, 2006, AJ, 131, 2921** as the data source. However, we would like to keep a record of work that is using COMPLETE data, so please send us an email (with a reference if possible) if you make use of any data provided here.

Recent COMPLETE Publications

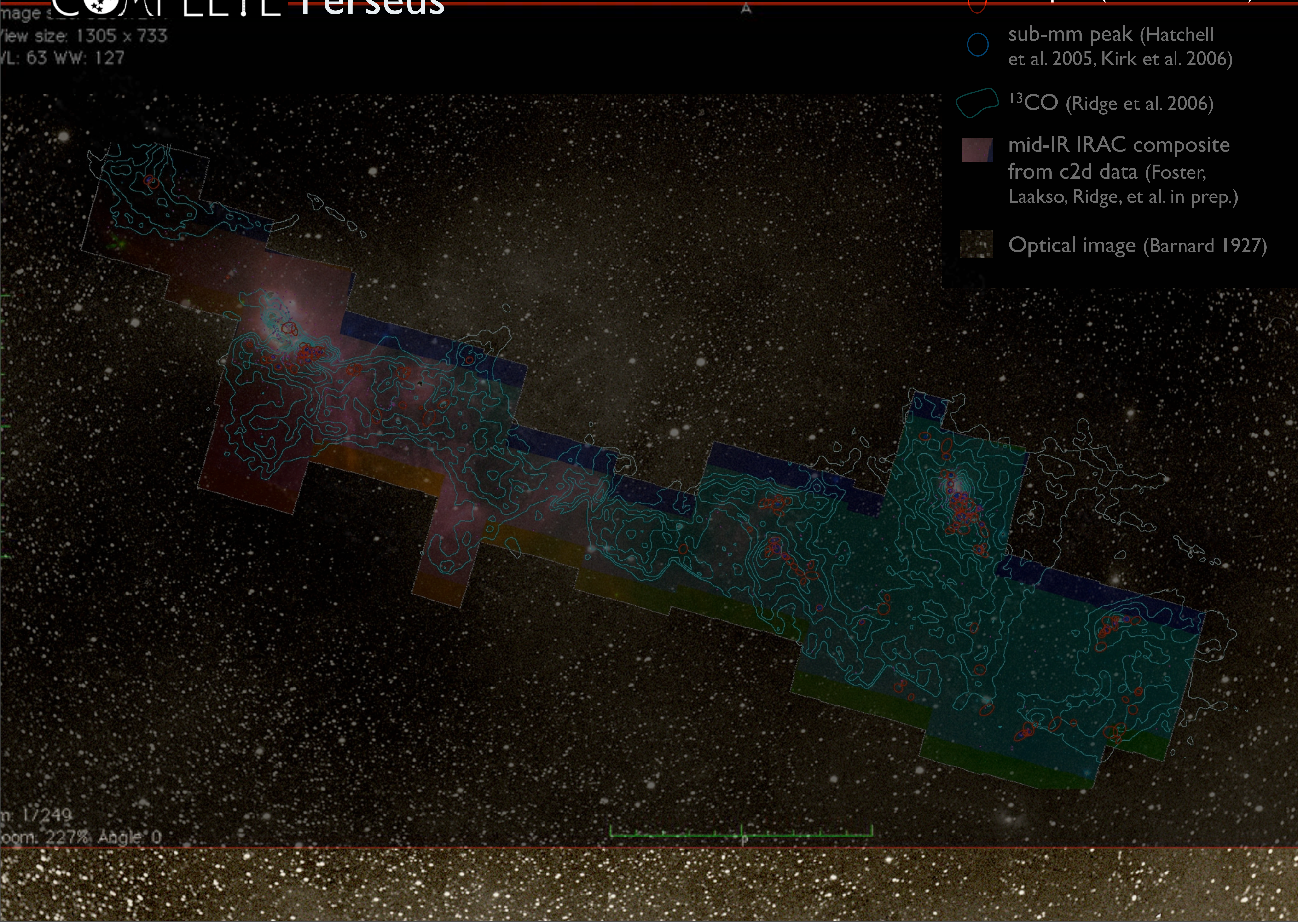
NEW Rahul Shetty, Jens Kauffmann, Scott Schnee, Alyssa A. Goodman, Barbara Ercolano *The Effect of Line of Sight Temperature Variation and Noise on Dust Continuum Observations*, Accepted to ApJ. (Local | astro-ph)

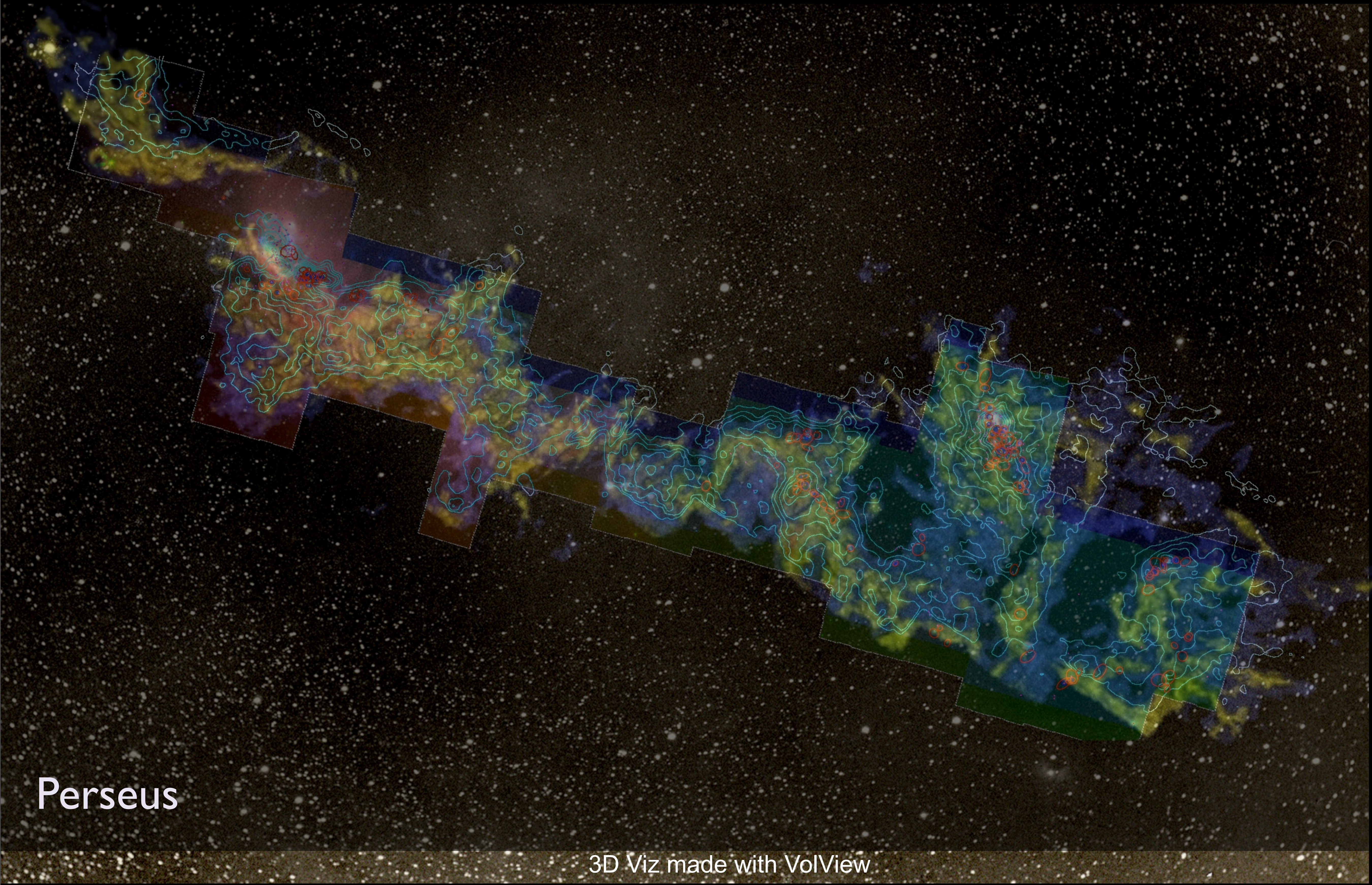
NEW Rahul Shetty, Jens Kauffmann, Scott Schnee, Alyssa A. Goodman, *The Effect of Noise on the Dust Temperature - Spectral Index Correlation*, Accepted to ApJ. (Local | astro-ph)

NEW Jonathan B. Foster, E.R. Rosolowsky, J. Kauffman, J.E. Pineda, M.A. Borkin, P. Caselli, P.C. Myers, A.A. Goodman, *Dense Cores in Perseus: The Influence of Stellar Content and Cluster Environment*, Accepted to ApJ. (Local | astro-ph)

NEW A.A. Goodman, E.W. Rosolowsky, M.A. Borkin, J.B. Foster, M. Halle, J. Kauffmann & J.E. Pineda, 2009, *A role for self-gravity at multiple length scales in the process of star formation*, Nature, 2009, 457, 63-66 (doi:10.1038/nature07609) (Nature | ADS)

COMPLETE Perseus

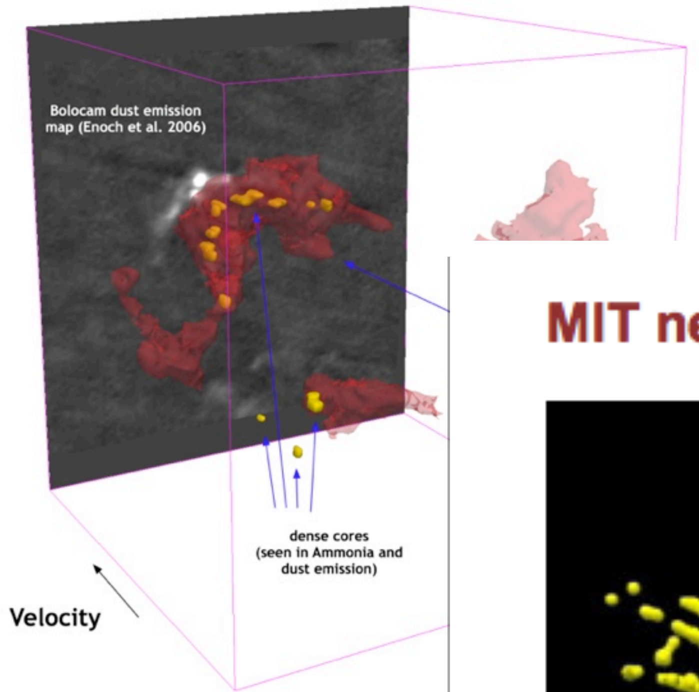




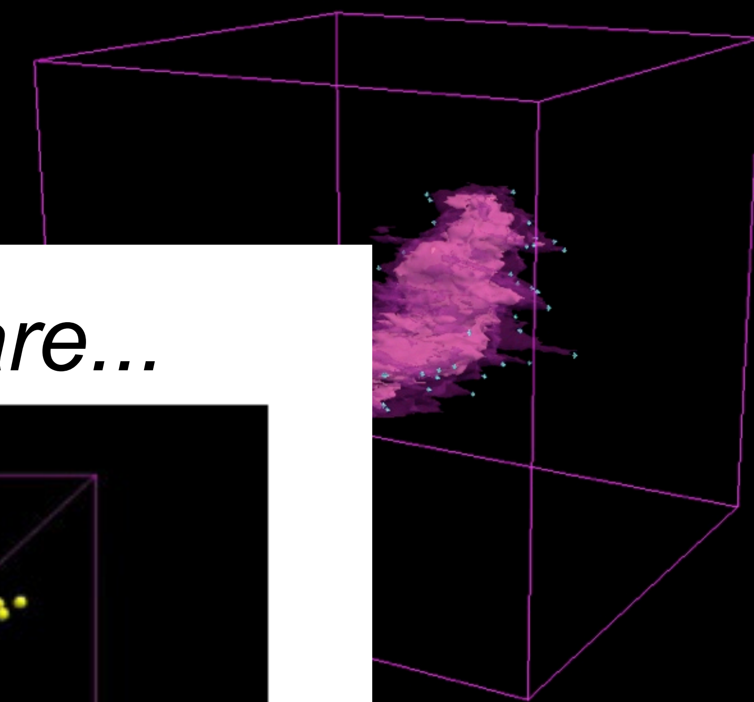
AstronomicalMedicine@IIC

COMPLETE

Some of What We've Learned...



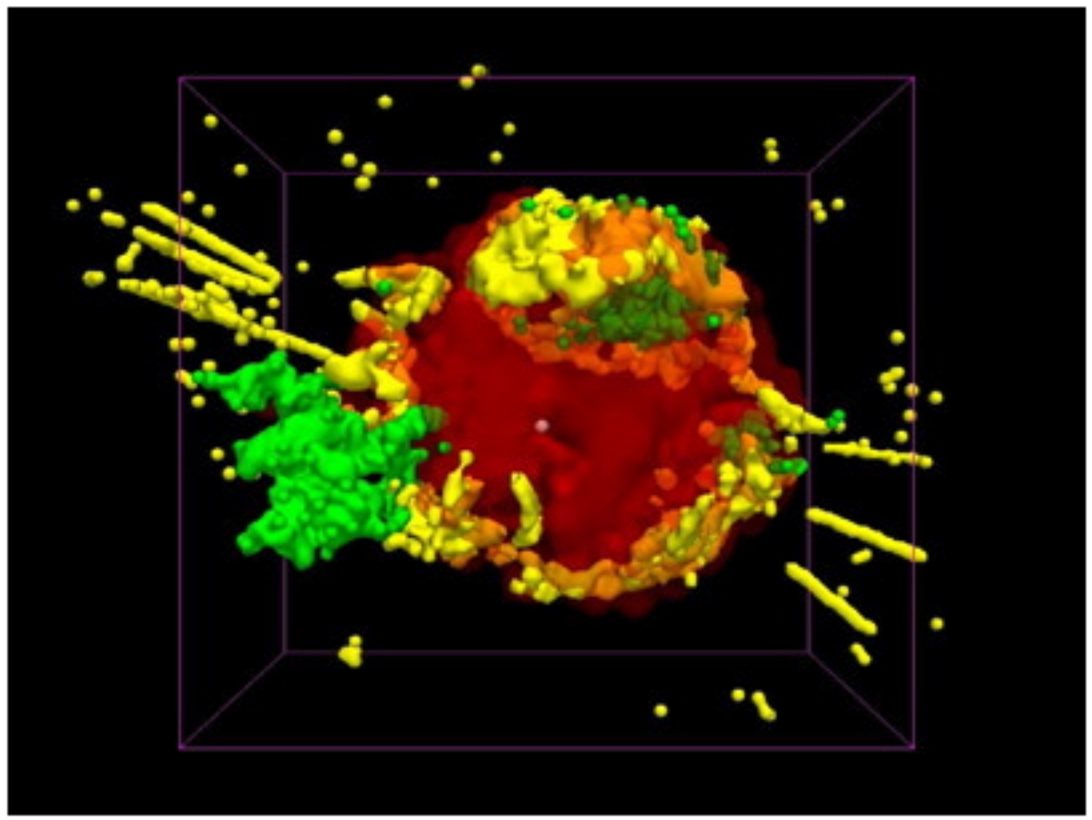
Cores nest in co
(Kauffmann et a



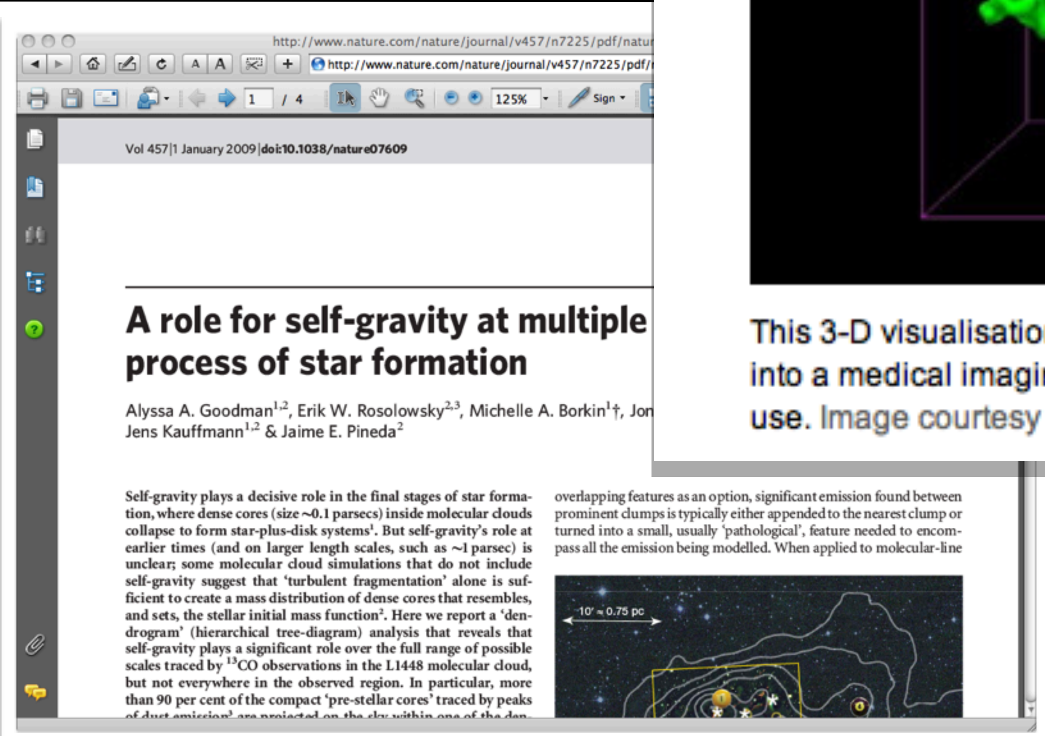
l Outflows
t al. 2008,9)

MIT news

and we share...



This 3-D visualisation of Cas A was made possible by importing the data into a medical imaging program that has been adapted for astronomical use. Image courtesy / NASA/CXC/MIT/T.Delaney et al.



Vol 457|1 January 2009|doi:10.1038/nature07609

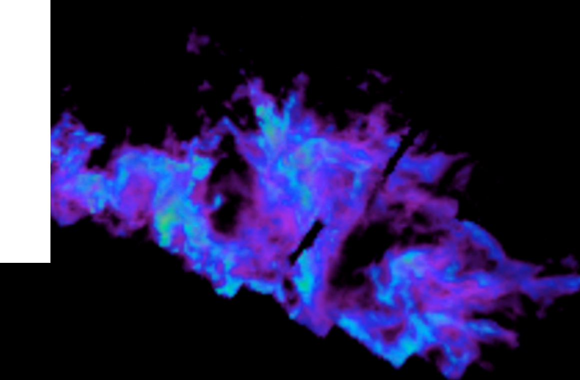
A role for self-gravity at multiple process of star formation

Alyssa A. Goodman[1,2], Erik W. Rosolowsky[2,3], Michelle A. Borkin[1]†, Jon
Jens Kauffmann[1,2] & Jaime E. Pineda[2]

Self-gravity plays a decisive role in the final stages of star formation, where dense cores (size ~0.1 parsecs) inside molecular clouds collapse to form star-plus-disk systems[1]. But self-gravity's role at earlier times (and on larger length scales, such as ~1 parsec) is unclear; some molecular cloud simulations that do not include self-gravity suggest that 'turbulent fragmentation' alone is sufficient to create a mass distribution of dense cores that resembles, and sets, the stellar initial mass function[2]. Here we report a 'dendrogram' (hierarchical tree-diagram) analysis that reveals that self-gravity plays a significant role over the full range of possible scales traced by ^{13}CO observations in the L1448 molecular cloud, but not everywhere in the observed region. In particular, more than 90 per cent of the compact 'pre-stellar cores' traced by peaks

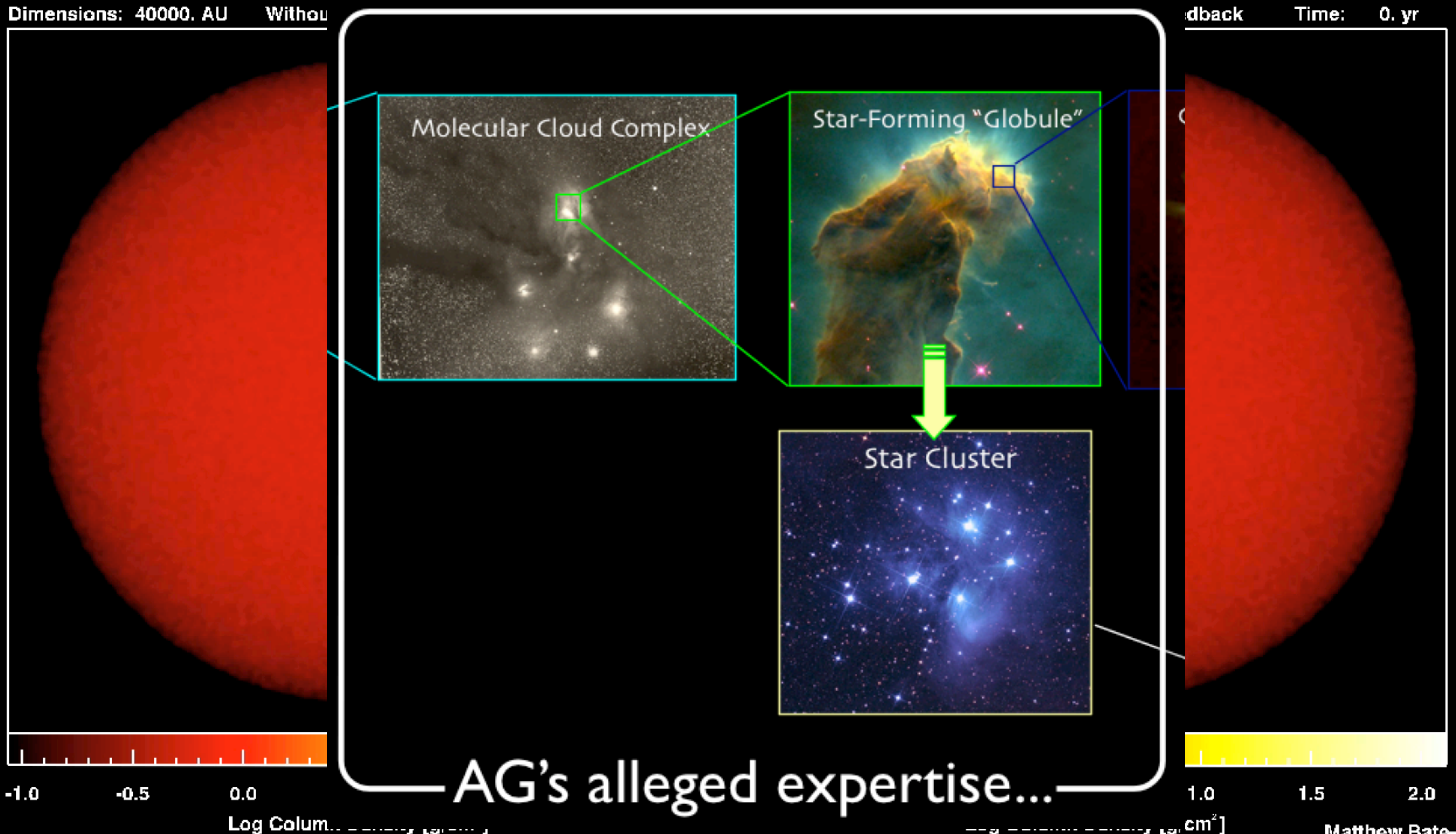
overlapping features as an option, significant emission found between prominent clumps is typically either appended to the nearest clump or turned into a small, usually 'pathological', feature needed to encompass all the emission being modelled. When applied to molecular-line

Gravity Matters
(Goodman et al. 2009)



Shells Rule
(Arce et al. 2009)

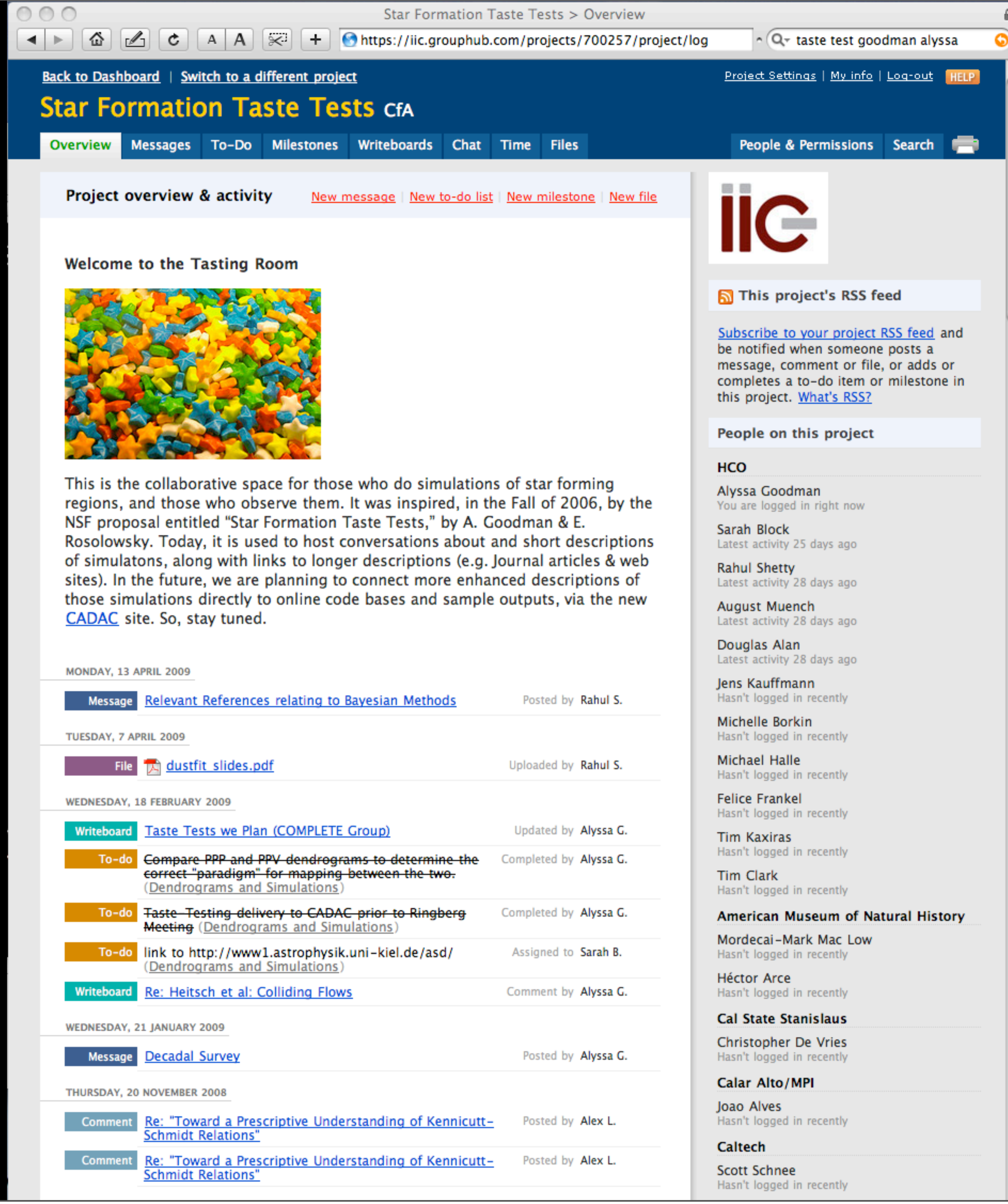
Physics: "Taste-Testing" Data & Simulations



Simulations of Bate 2009

Social Tasting of

$$I(E, s, \vec{x}, t)$$



A sample of what we've learned, and shared (3D PDF)

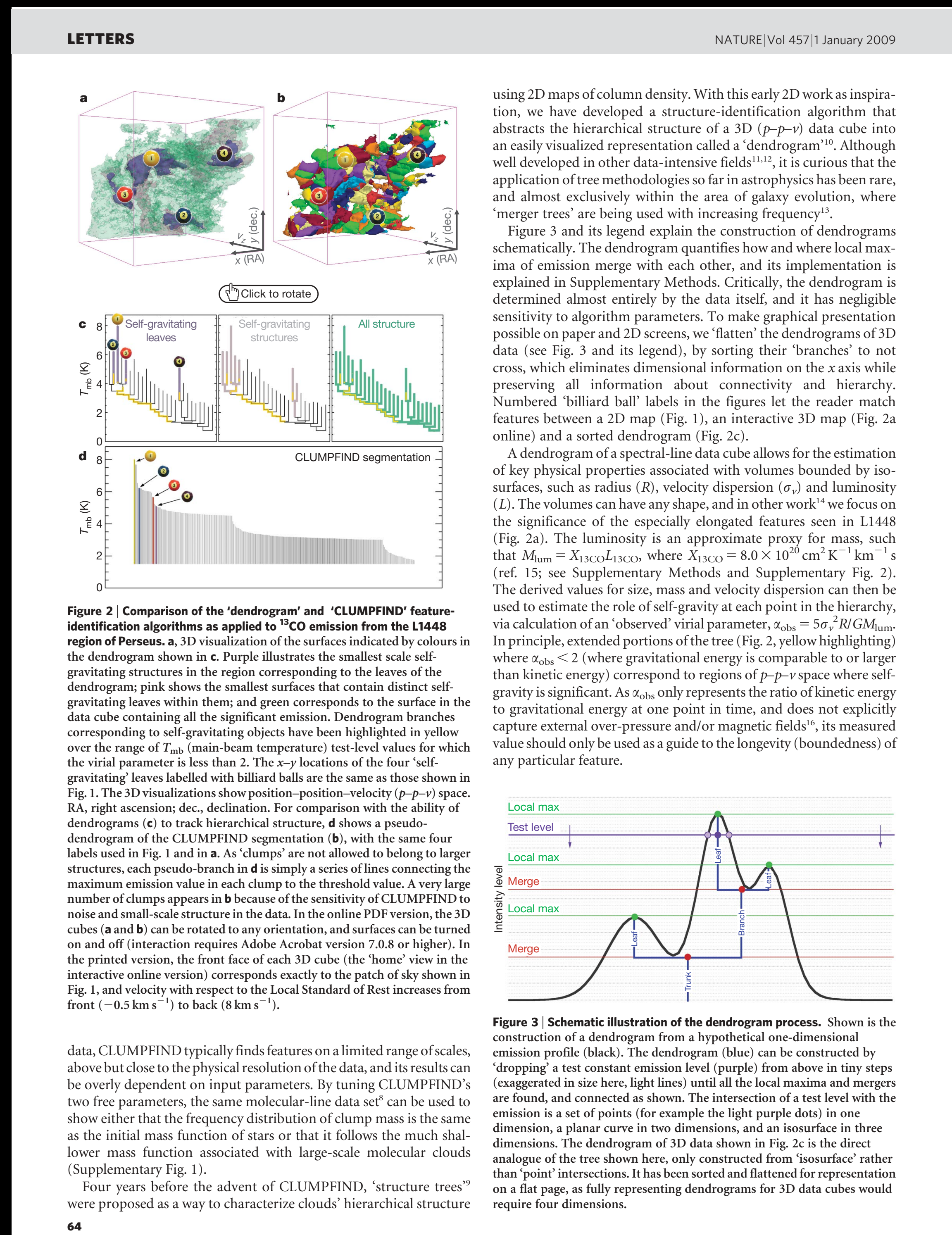


Figure 2 | Comparison of the 'dendrogram' and 'CLUMPFIND' feature-identification algorithms as applied to ^{13}CO emission from the L1448 region of Perseus. a, 3D visualization of the surfaces indicated by colours in the dendrogram shown in **c**. Purple illustrates the smallest scale self-gravitating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

data, CLUMPFIND typically finds features on a limited range of scales, above but close to the physical resolution of the data, and its results can be overly dependent on input parameters. By tuning CLUMPFIND's two free parameters, the same molecular-line data set[8] can be used to show either that the frequency distribution of clump mass is the same as the initial mass function of stars or that it follows the much shallower mass function associated with large-scale molecular clouds (Supplementary Fig. 1).

Four years before the advent of CLUMPFIND, 'structure trees'[9] were proposed as a way to characterize clouds' hierarchical structure using 2D maps of column density. With this early 2D work as inspiration, we have developed a structure-identification algorithm that abstracts the hierarchical structure of a 3D (p–p–v) data cube into an easily visualized representation called a 'dendrogram'[10]. Although well developed in other data-intensive fields[11,12], it is curious that the application of tree methodologies so far in astrophysics has been rare, and almost exclusively within the area of galaxy evolution, where 'merger trees' are being used with increasing frequency[13].

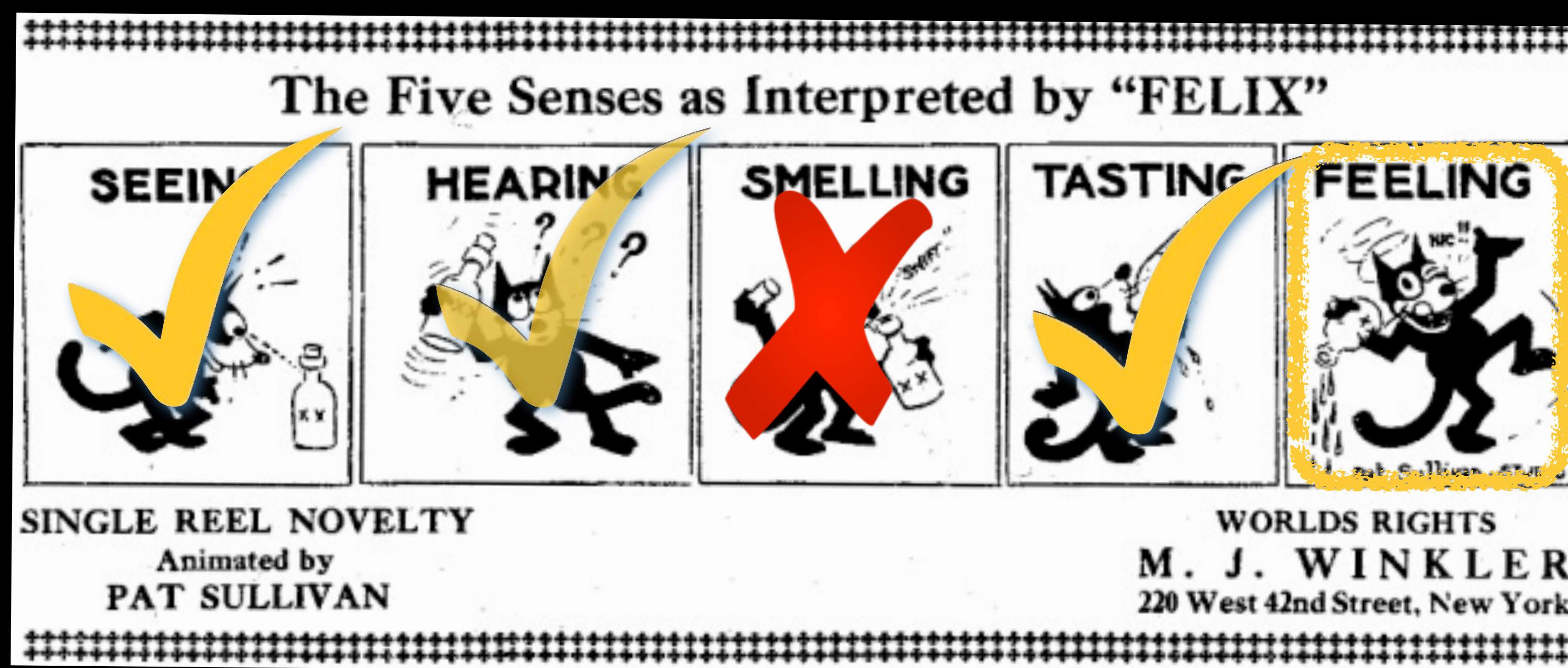
Figure 3 and its legend explain the construction of dendrograms schematically. The dendrogram quantifies how and where local maxima of emission merge with each other, and its implementation is explained in Supplementary Methods. Critically, the dendrogram is determined almost entirely by the data itself,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

A dendrogram of a spectral-line data cube allows for the estimation of key physical properties associated with volumes bounded by isosurfaces, such as radius (R), velocity dispersion (σ_v) and luminosity (L). The volumes can have any shape, and in other work[14] 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 $M_{lum} = X_{13CO}L_{13CO}$, where $X_{13CO} = 8.0 \times 10^{20}\,cm^2\,K^{-1}\,km^{-1}\,s$ (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, $\alpha_{obs} = 5\sigma_v^2 R/GM_{lum}$. In principle, extended portions of the tree (Fig. 2, yellow highlighting) where $\alpha_{obs} < 2$ (where gravitational energy is comparable to or larger than kinetic energy) correspond to regions of p–p–v space where self-gravity is significant. As α_{obs} only represents the ratio of kinetic energy to gravitational energy at one point in time, and does not explicitly capture external over-pressure and/or magnetic fields[16], 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.

Goodman et al. *Nature*, 2009

Data • Dimensions • Display



Astronomy as I *Touch* it?

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- people
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- reaching the iic

Initiative in Innovative Computing at Harvard

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scientists' discovery room lab (sdr lab)

Lead investigators
Chia Shen (IIC) and Hanspeter Pfister (SEAS/IIC)

Project staff
Michael Horn, Meekal Bajaj, Matthew Tobiasz and Matthias Lee

Description

The Scientists' Discovery Room (SDR) is a next-generation visual digital laboratory for science discovery, collaborative learning and education. Our research focuses on experimenting with new modalities of human-computer interaction and visualization, to create a new genre of navigation, exploration and detailed analyses in multi-dimensional information spaces. All projects in SDR are in close collaboration with domain scientists and educators.

INVOLV is a generalizable multi-user interactive visualization framework for large hierarchical data sets. In this project, we address the visual layout of both the primary data representation and the overlay of alternate structures of the same data. Our first case study is the visualization of life on earth based on the Encyclopedia of Life (www.eol.org) and Tree of Life (www.tolweb.org). The user interface provides free-form exploration of more than 1.2 million named species while communicating issues of biodiversity and phylogeny. The current visualization combines a Voronoi Treemap tessellation with innovative human-computer interaction designs to support collaborative exploration and learning. Please visit www.involvweb.org for more information on this project.

CThru, a collaborative endeavor with Molecular and Cellular Biology faculty, aims to develop a self-guided learning environment. In CThru, we examine methods for constructing interactive video-based educational modules. Using the animation "The Inner Life of the Cell" as a testbed, CThru addresses research issues of embedding interactive visible objects, extensive multimedia information and manipulatable 3D models within a video flow, replacing sequential video viewing with the experience of exploring and manipulating in a multi-dimentional information space.

WeSpace is a collaborative work space that integrates a large data wall with a multi-user multi-touch table. WeSpace has been developed for a population of scientists who frequently meet in small groups for data exploration and visualization. It provides a low overhead walk-up and share environment for users with their own personal applications and laptops.

LivOlay is an interactive image overlay tool that enables the rapid visual overlay of live data rendered in different applications. Our tool addresses datasets in which visual registration of the information is necessary in order to allow for thorough understanding and visual analysis.

Slideshow: Tabletop Computers *Continued*

By Meredith Ringel Morris

First Published December 2008

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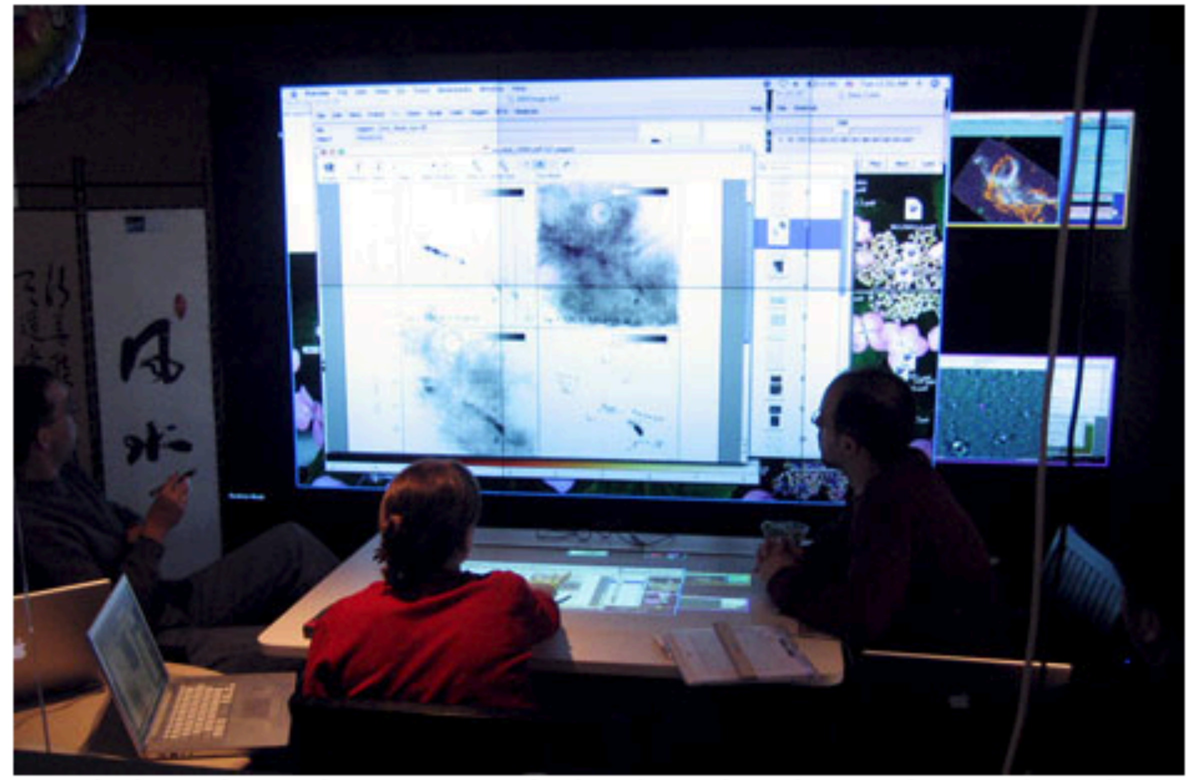


PHOTO: HAO JIANG, DANIEL WIGDOR, CLIFTON FORLINES, AND CHIA SHEN

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.

http://iic.harvard.edu/research/scientists-discovery-room-lab-sdr-lab

http://spectrum.ieee.org/dec08/6999/9

The Scientists' Discovery Room
(Shen & Pfister)

movie courtesy Daniel Wigdor, equipment now in Chia Shen's SDR lab at SEAS

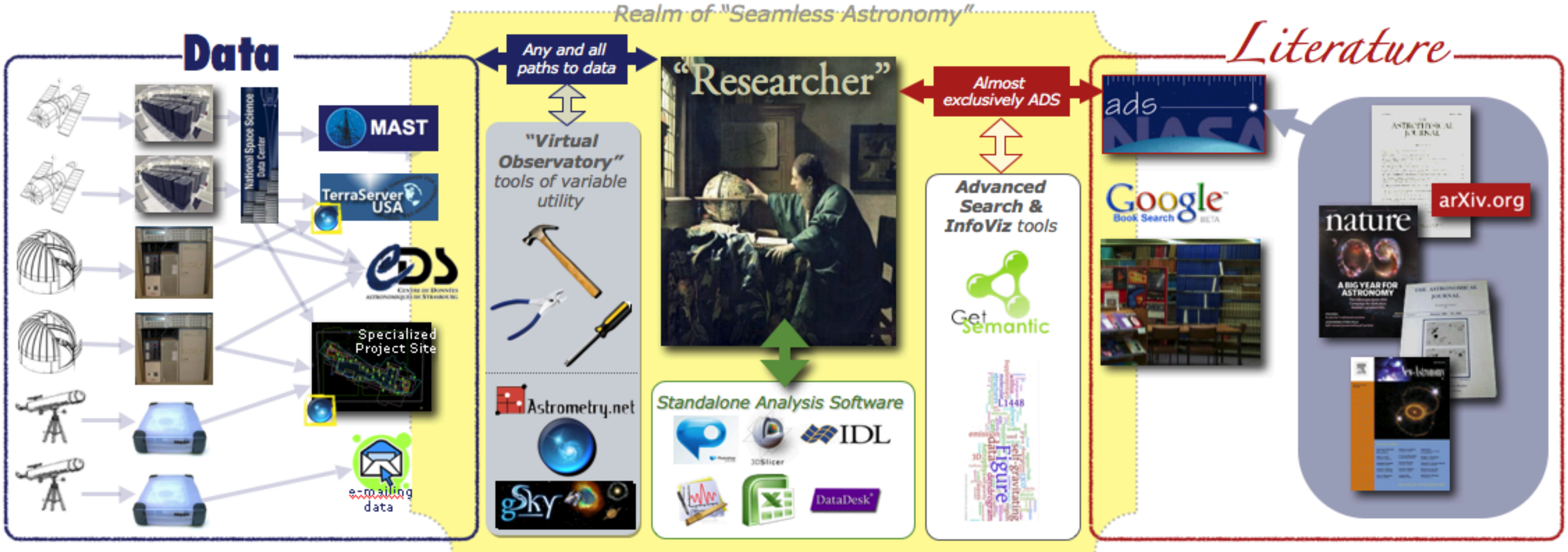
The Big Picture:

Seamless Astronomy

...and the future of DDD

Seamless Astronomy

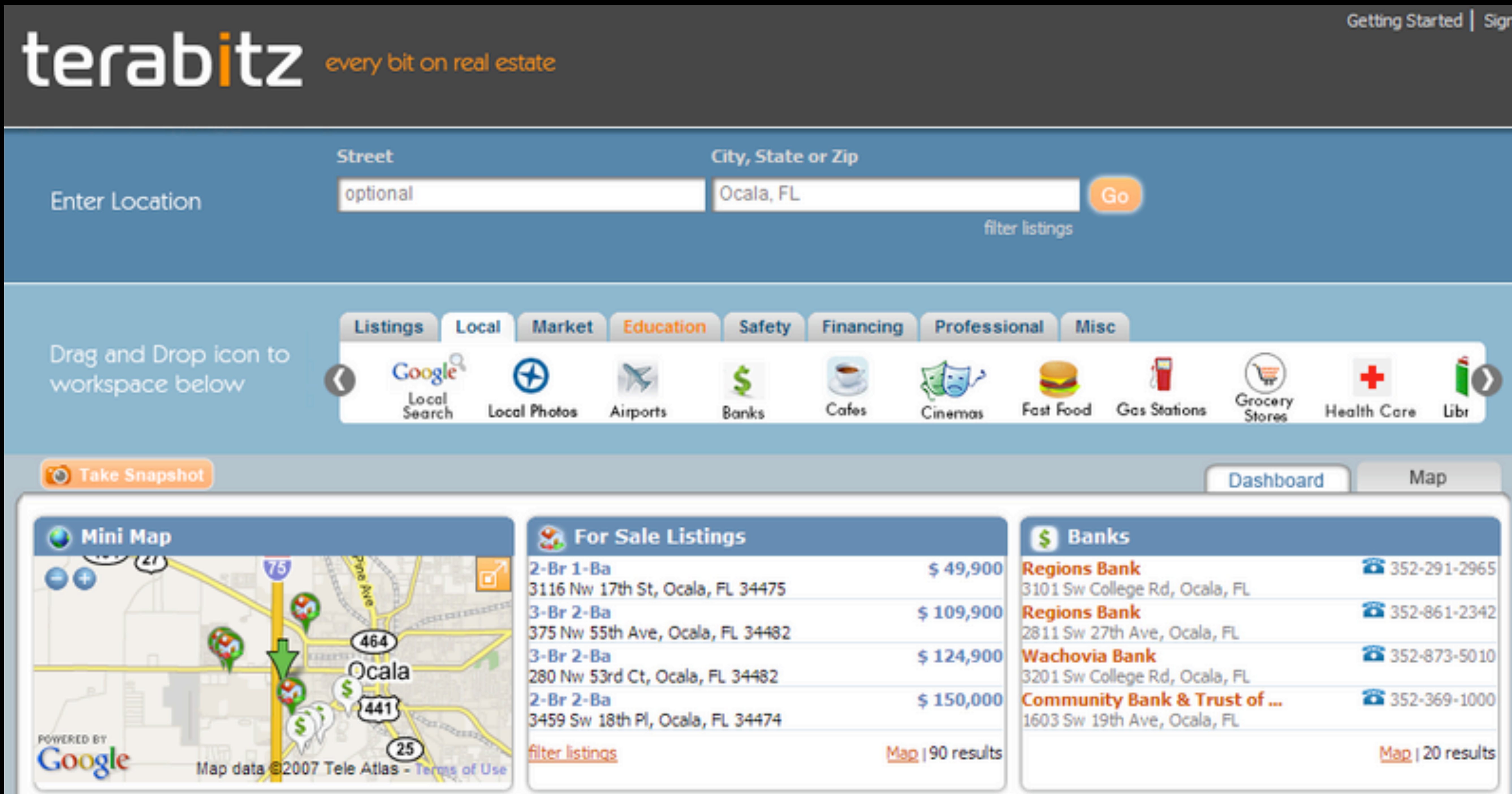
www.cfa.harvard.edu/~agoodman and worldwidetelescope.org



Today, "Virtual Observatory" should really just mean "Facilitated Online Astronomy Research"

Seamless Astronomy includes a collaboration amongst researchers from CfA/WWT (Goodman, Muench) MSR/WWT (Wong), RPI (Hendler, McGuinness), STScI (Conti, Christian), ADS (Accomazzi, Kurtz), Chandra (Bressert, Rots, Burke) and UCLA (Borgman)

astrobitz?

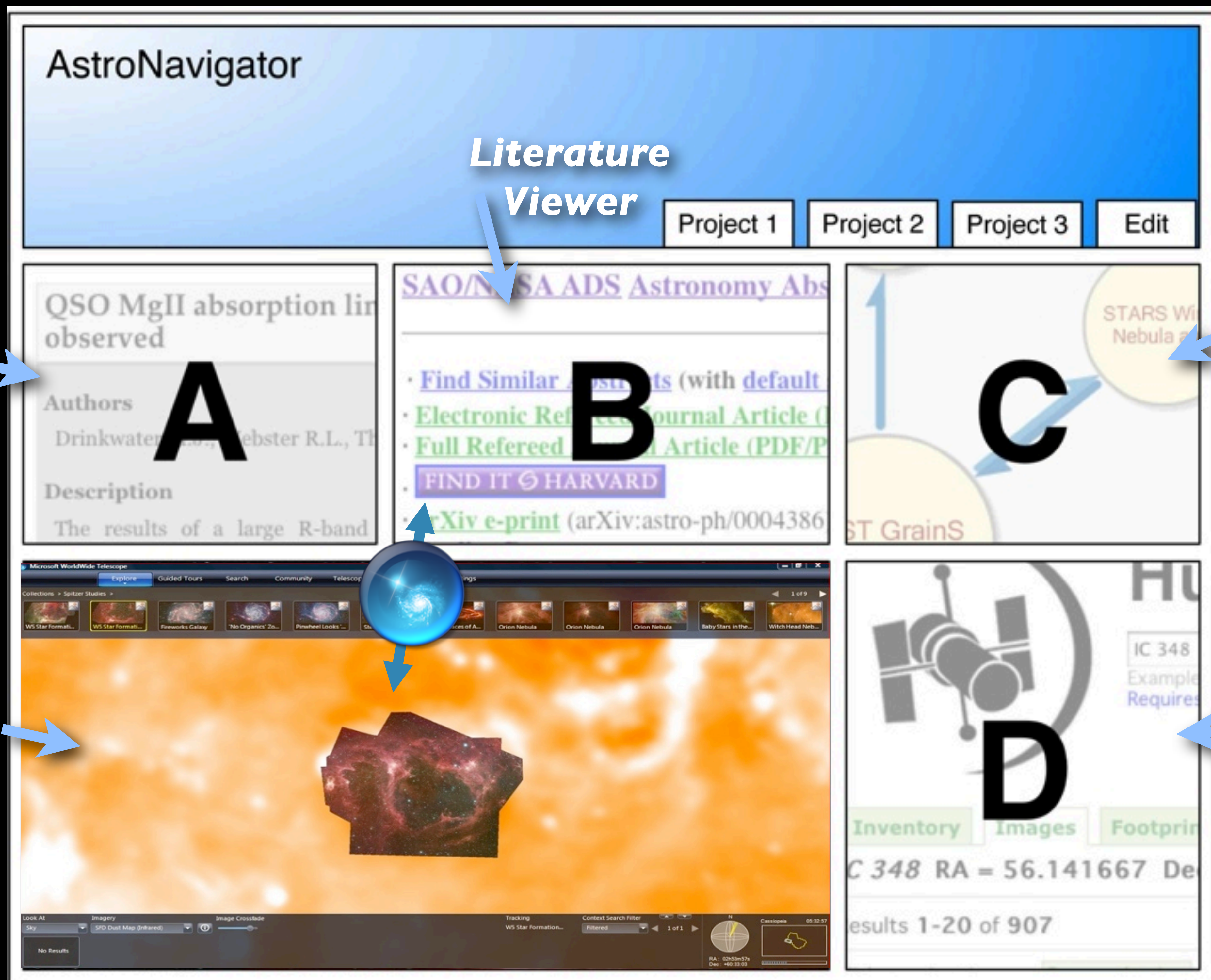

Getting Started | Sign I
terabitz
every bit on real estate
Enter Location
Street
optional
City, State or Zip
Ocala, FL
Go
filter listings
Drag and Drop icon to workspace below
Listings
Local
Market
Education
Safety
Financing
Professional
Misc
Local Search
Local Photos
Airports
Banks
Cafes
Cinemas
Fast Food
Gas Stations
Grocery Stores
Health Care
Take Snapshot
Dashboard
Map
Mini Map
Ocala
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

Seamless Astronomy

astrobitz?

Semantic Search

Data Viewer (e.g. WWT)



Info Viz for Search Results

Archive 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

“Ontology”

“GIS/Layering”

“Search”

What’s needed?

“Progressive Resolve”

“Registration”

“Side-by-Side Comparison”

“Selection”

“Readable Labels”

“Highlighting”

“Zoom”

“Custom Site”

“Measurement”

“Inference”

“Off-the-Desktop”


LONG BEACH CONVENTIO CENTER

From: Yan Xu
Subject: RE: (non WWT) press conference attendance for AG or 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

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.

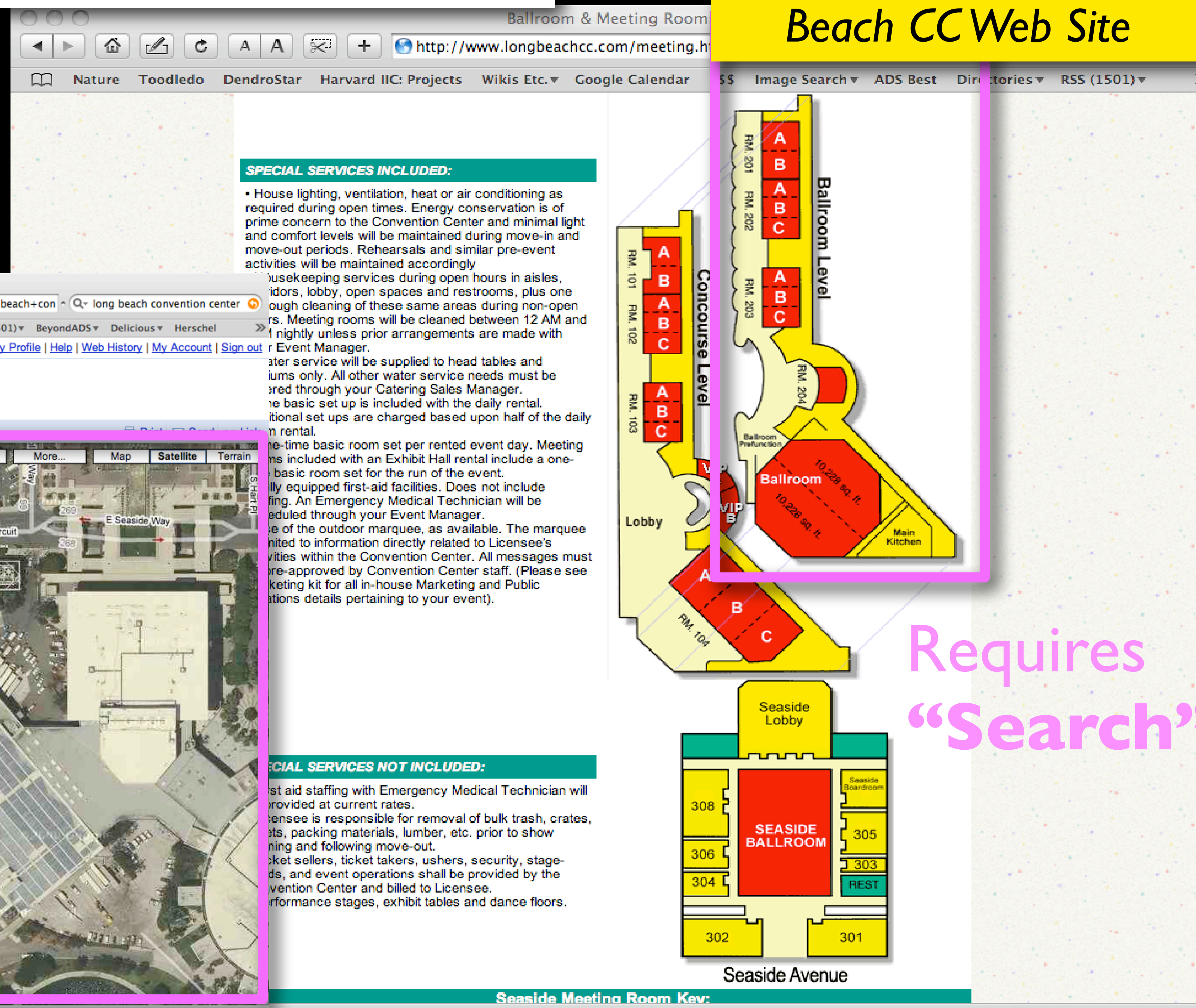
Our setup and presentation will be in the same room: #308 (Exhibition Hall C).

Thanks,
Yan

Email with Room Numbers (result of search)

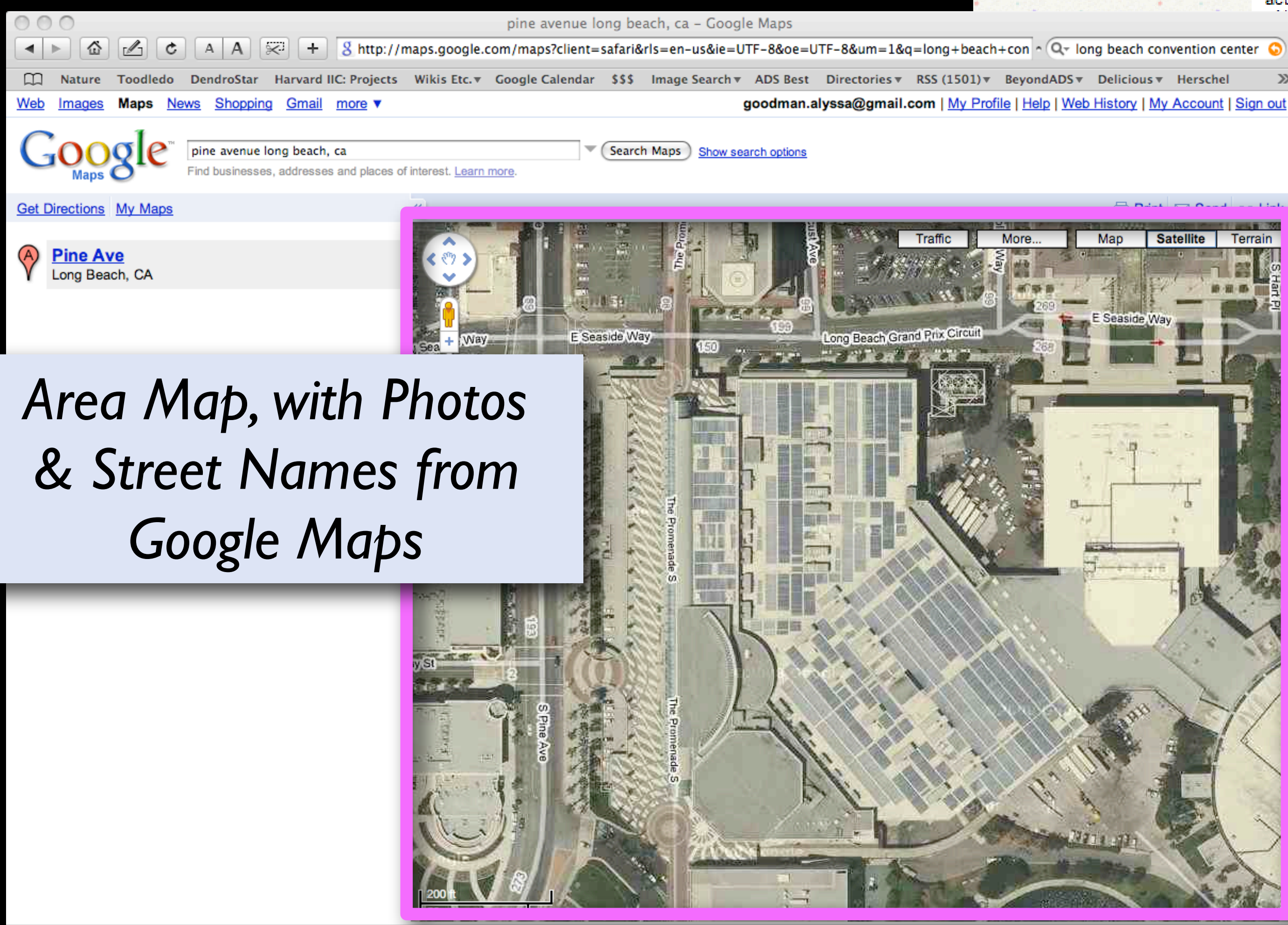
Requires "**Ontology**"

Interior Map on Long Beach CC Web Site

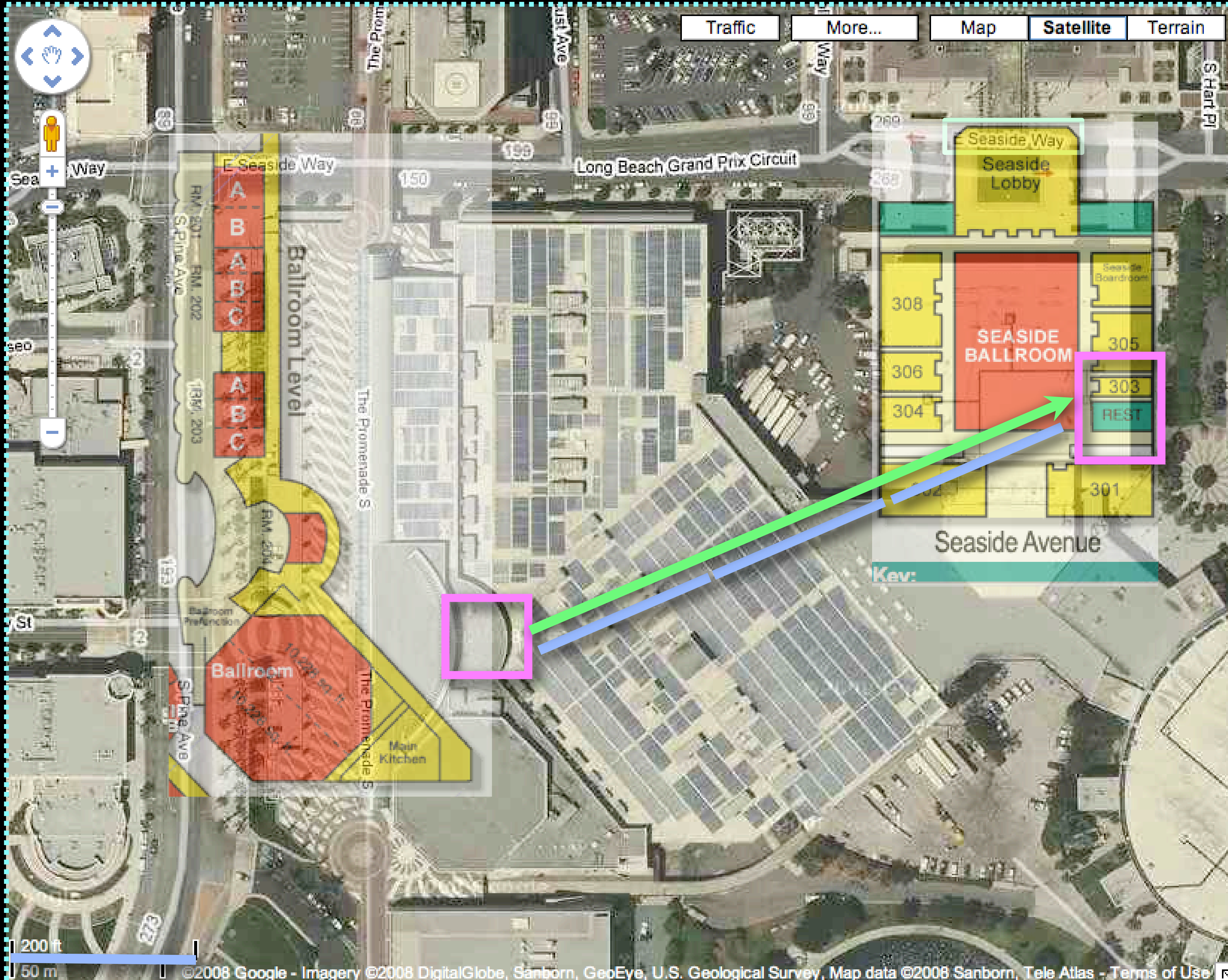


Requires "**Search**"

Requires "**GIS/Layering**"



Area Map, with Photos & Street Names from Google Maps

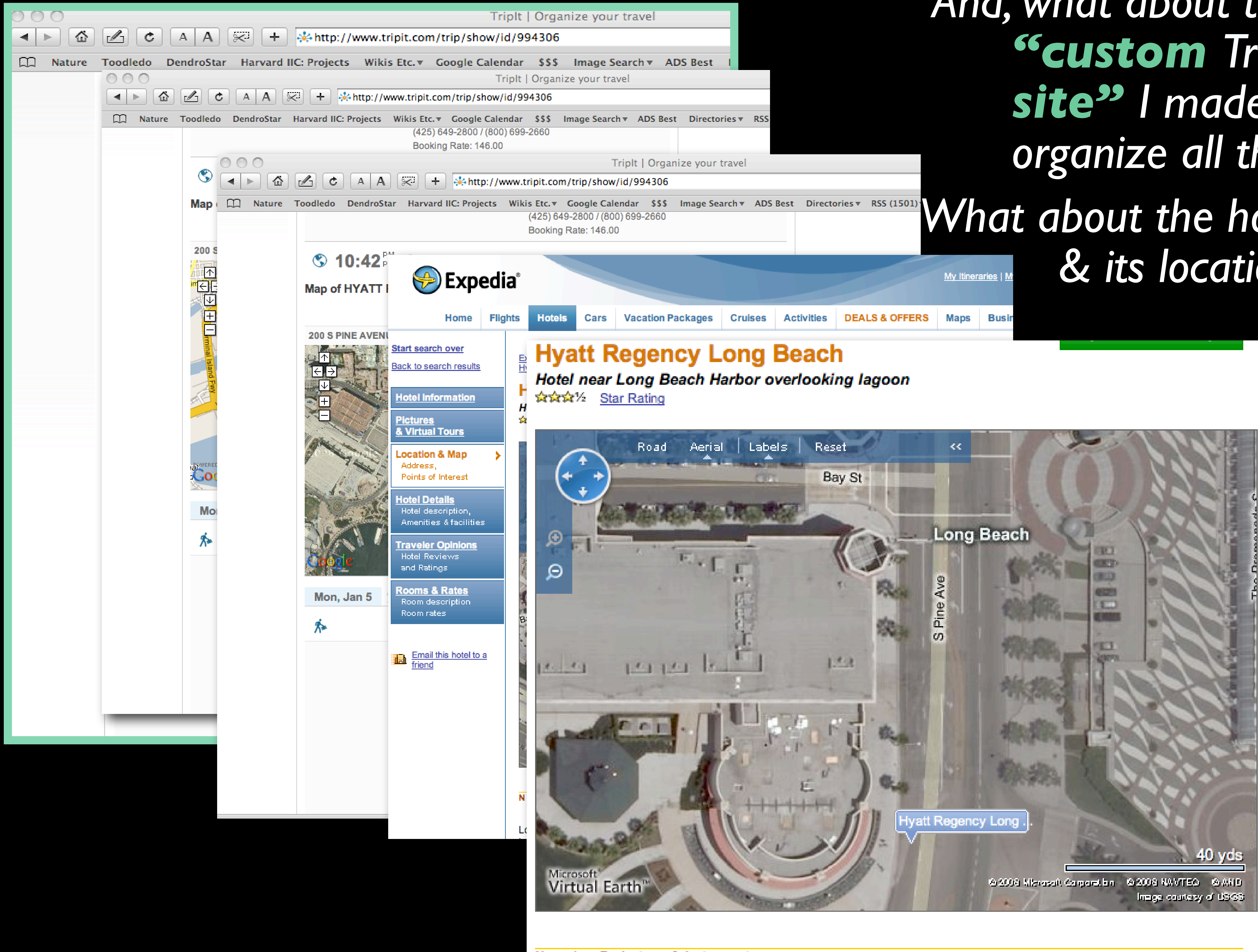


...requires: **"Selection"** ; **"Registration"**; **"Readable Labels"** ; **"Highlighting"** ; & **"Measurement"**

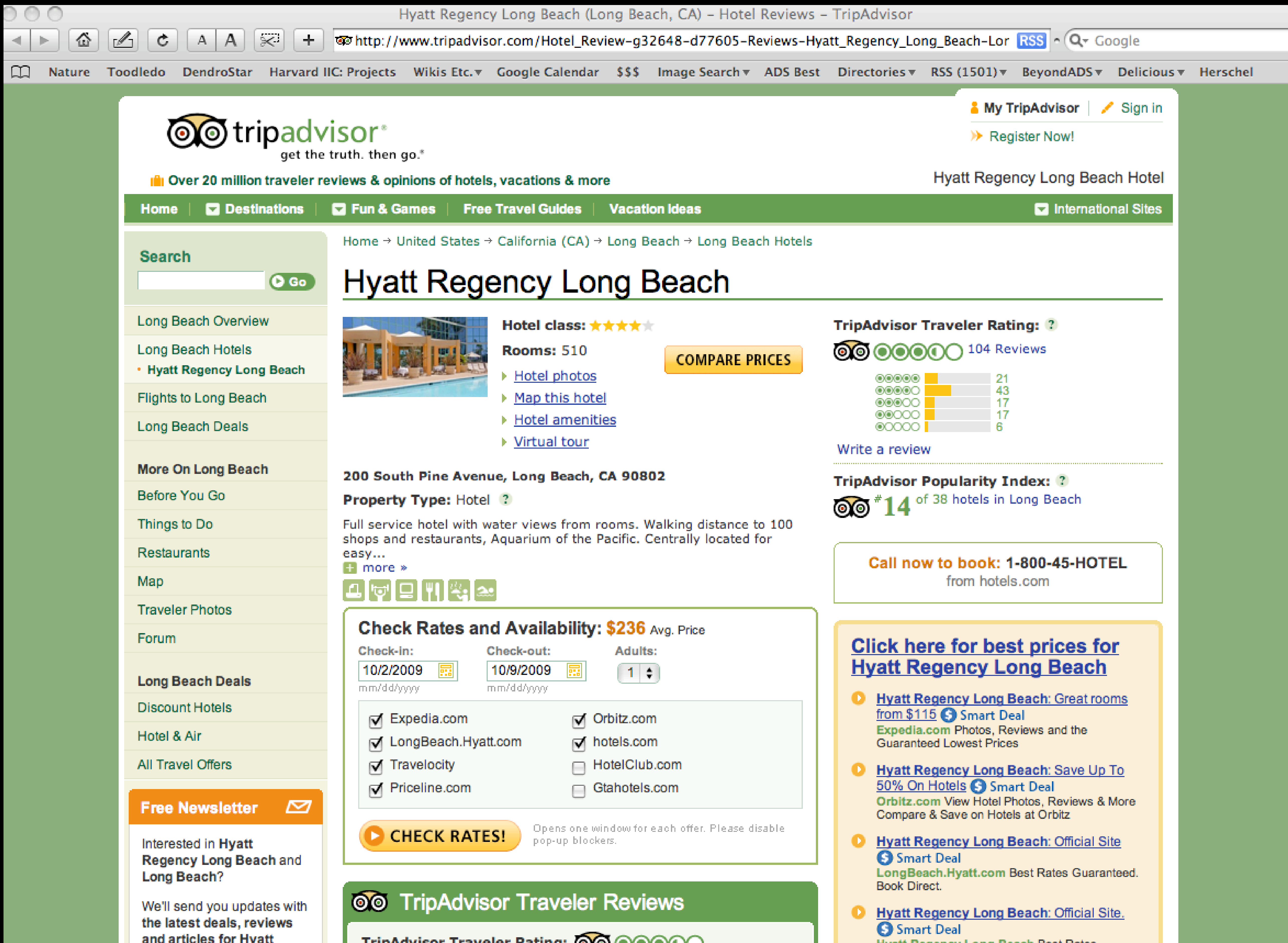
in order to yield: **"Inference"**: *...Wow, that's about 600 feet, hope we can change the room!*

And, what about that ***"custom*** *TripIt* ***site"*** *I made to organize all this?*

What about the hotel & its location?



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



Monday, May 18, 2009

What's possible now?

"Progressive Resolve"

"Zoom"

"Search"

"Selection"

"GIS/Layering"

"Registration"

"Side-by-Side Comparison"

"Readable Labels"

"Highlighting"

"Custom Site"

"Inference"

"Off-the-Desktop"

"Ontology" **"Measurement"**

WWT Silverlight “Alpha”

“Side-by-Side Comparison”

“Readable Labels”

“Highlighting”

“Custom Site”

“Inference”

“Off-the-Desktop”

“Progressive Resolve”

“Zoom”

“Search”

“Selection”

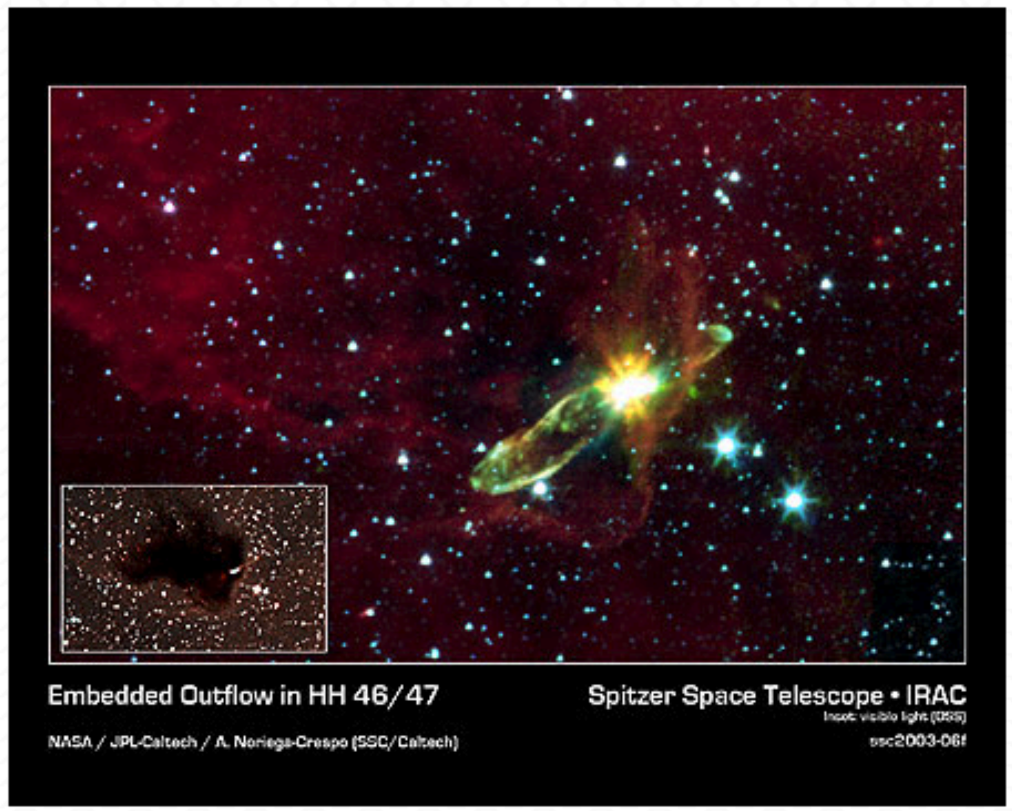
“GIS/Layering”

“Registration”

Image ssc2003-06f

http://www.spitzer.caltech.edu/Media/releases/ssc2003-06/ssc200

NEWSROOM



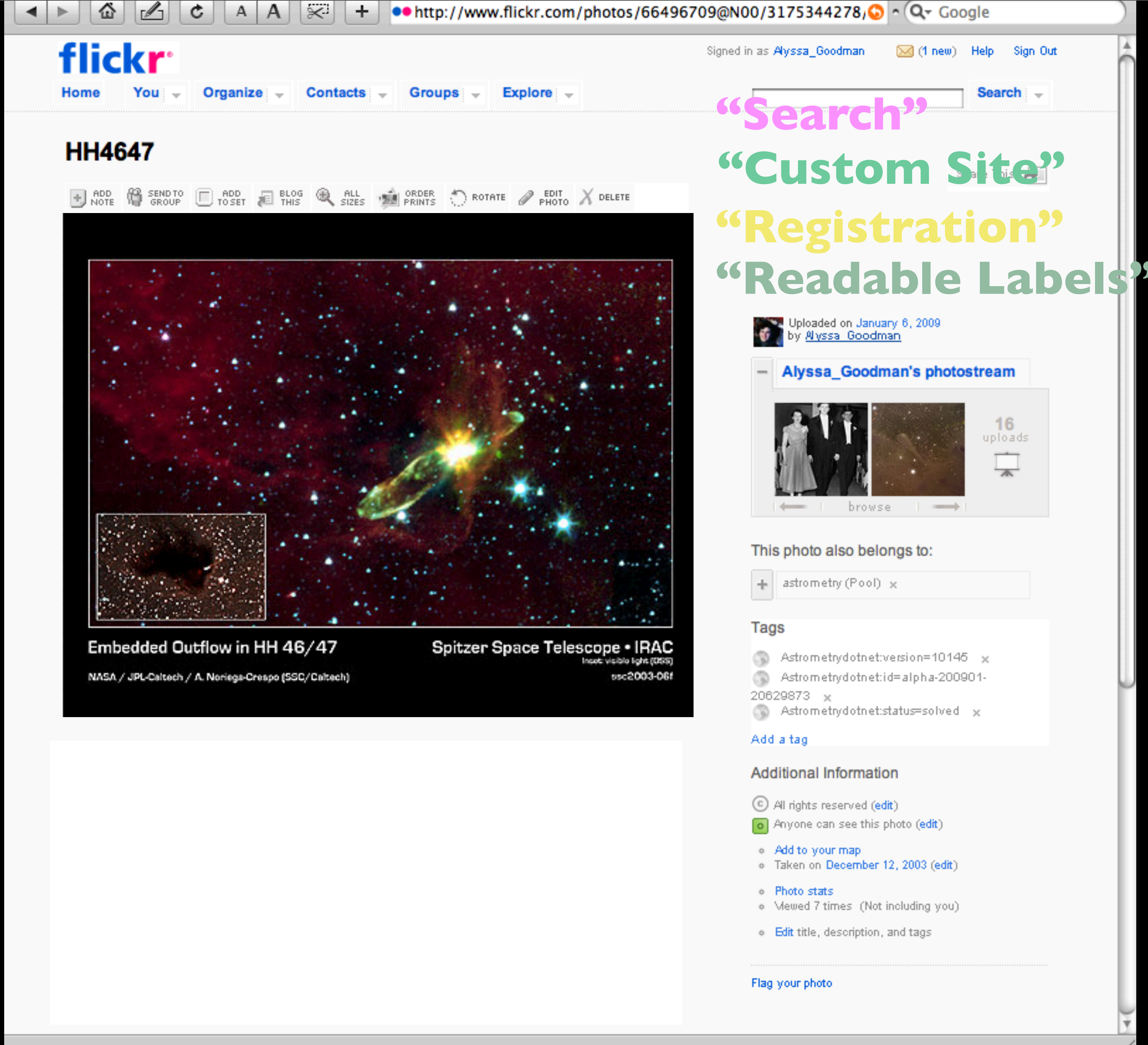
Credit: NASA/JPL-Caltech/A. Noriega-Crespo (SSC/Caltech), Digital Sky Survey

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



Monday, May 18, 2009

To go really "seamless"...

"Progressive Resolve"

"Zoom"

"Search"

"Selection"

"GIS/Layering"

"Registration"

"Side-by-Side Comparison"

"Readable Labels"

"Highlighting"

"Custom Site"

"Inference"

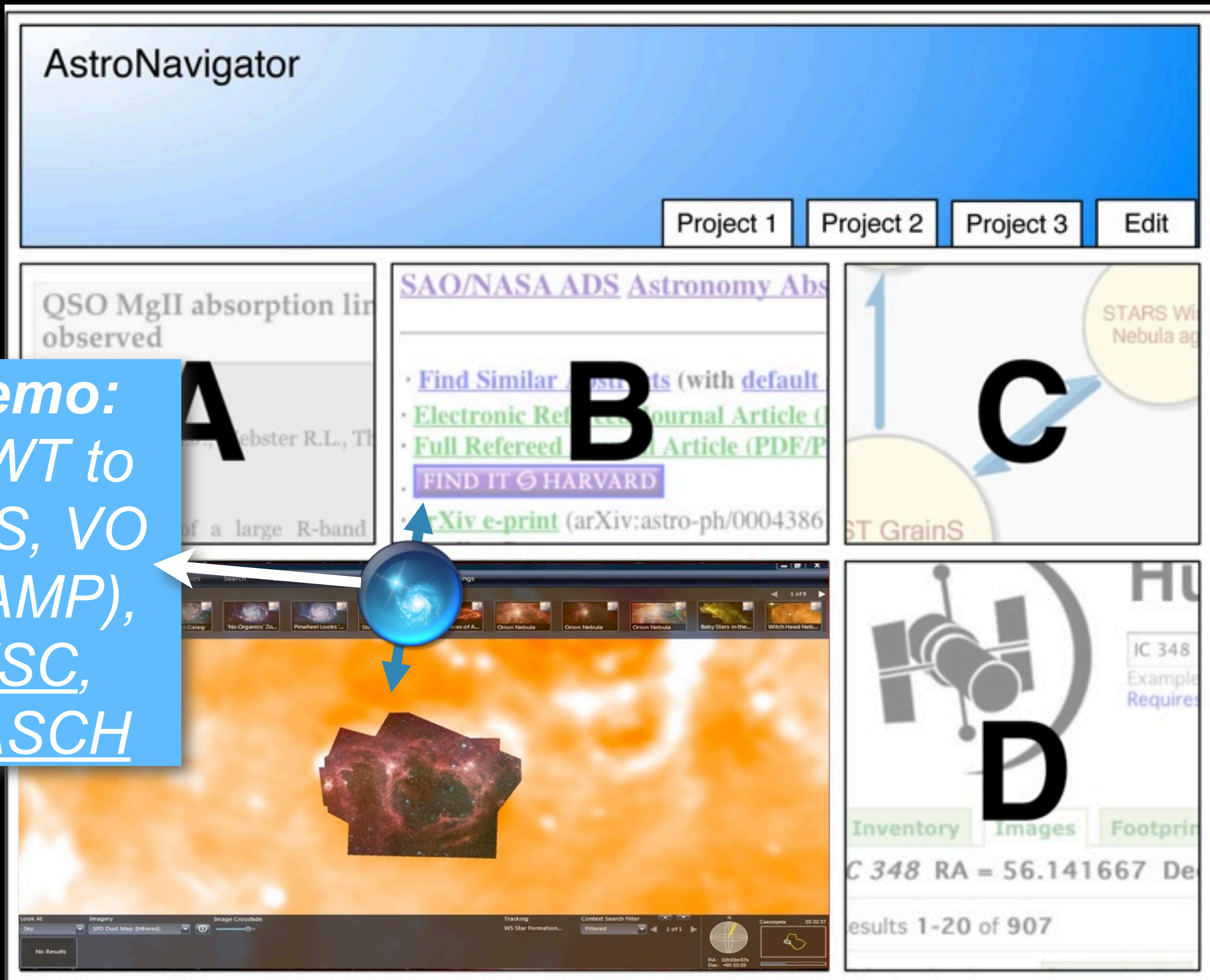
"Off-the-Desktop"

"Ontology"

"Measurement"

“Ontology” **“Measurement”**

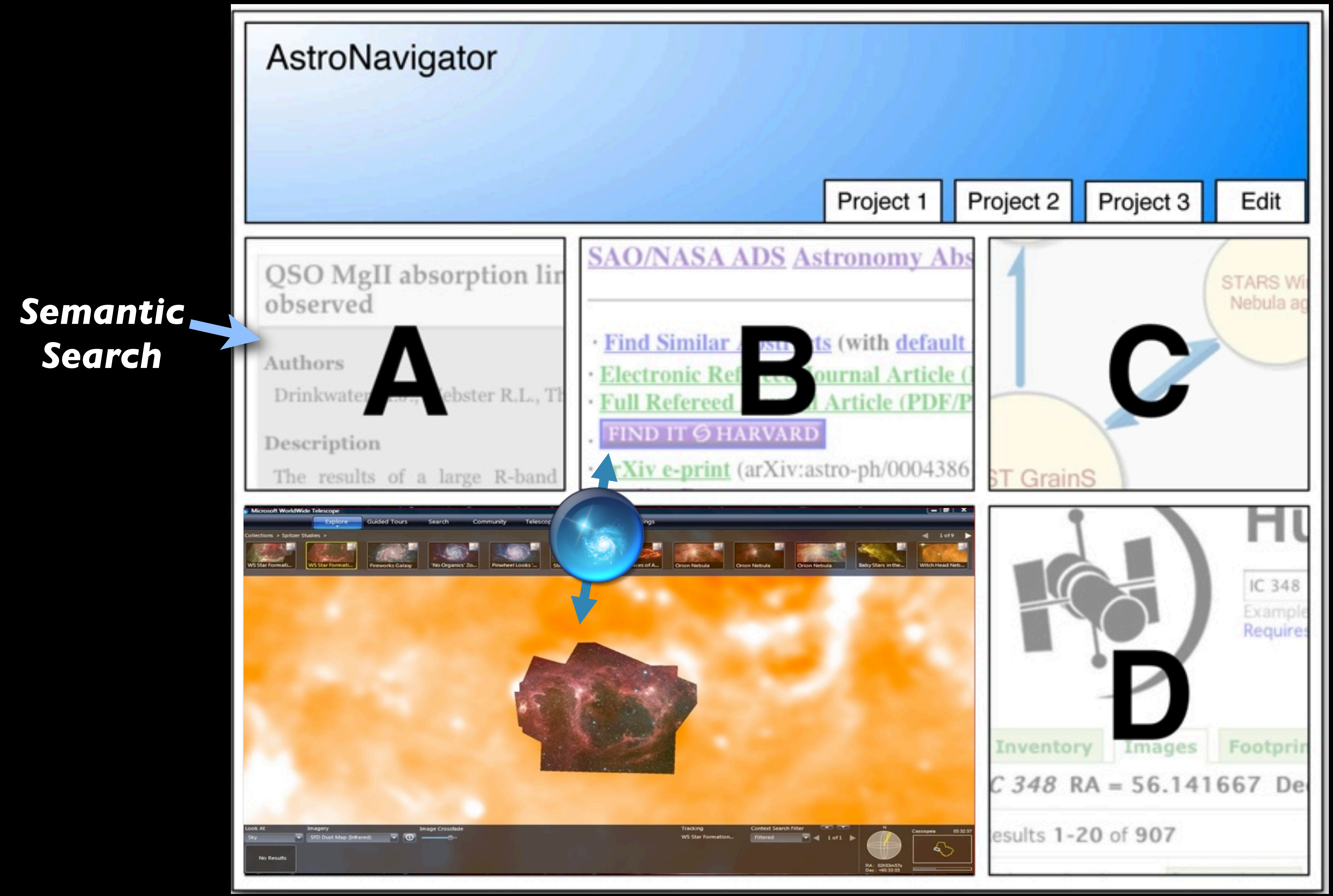
Seamless Astronomy: “Configure This”



Demo:
WWT to ADS, VO (SAMP), TSC, DASCH

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

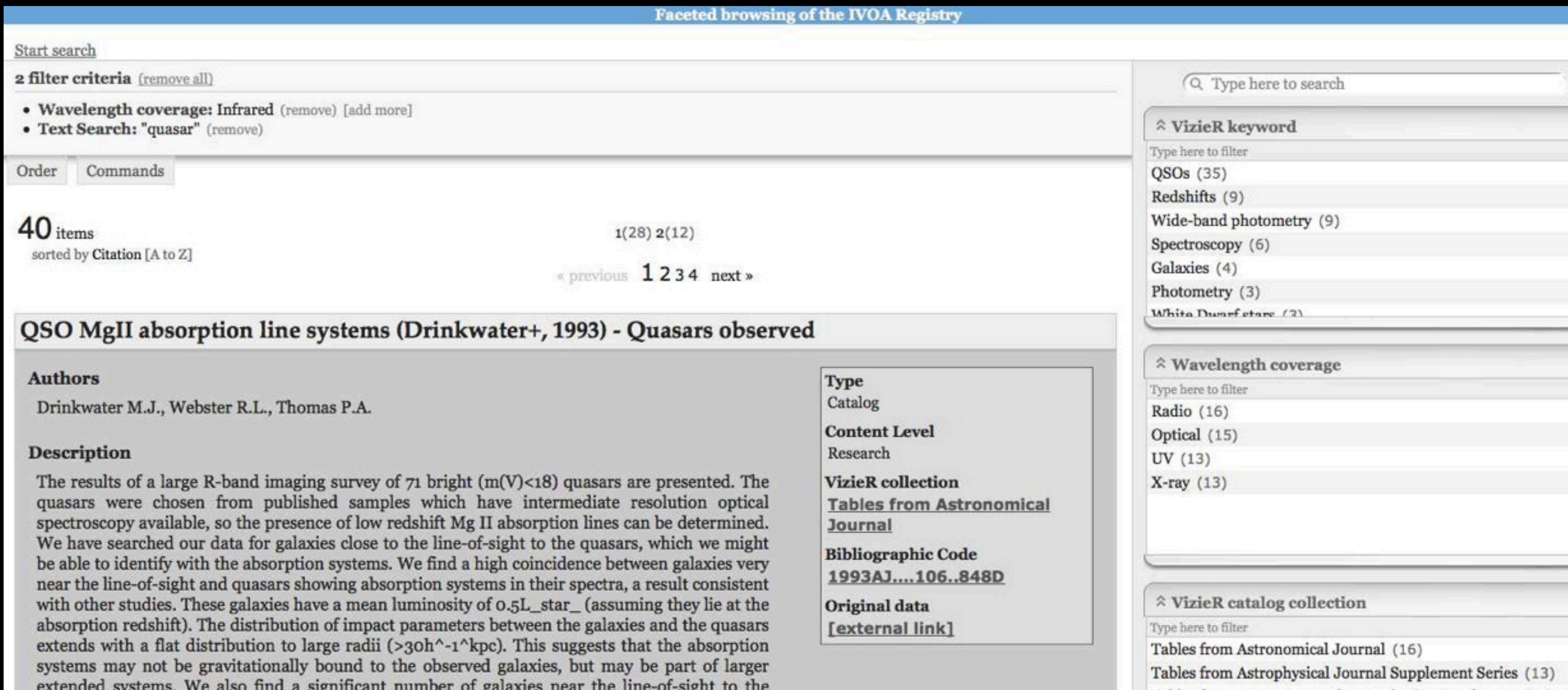
“Modular Craftsmanship”



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

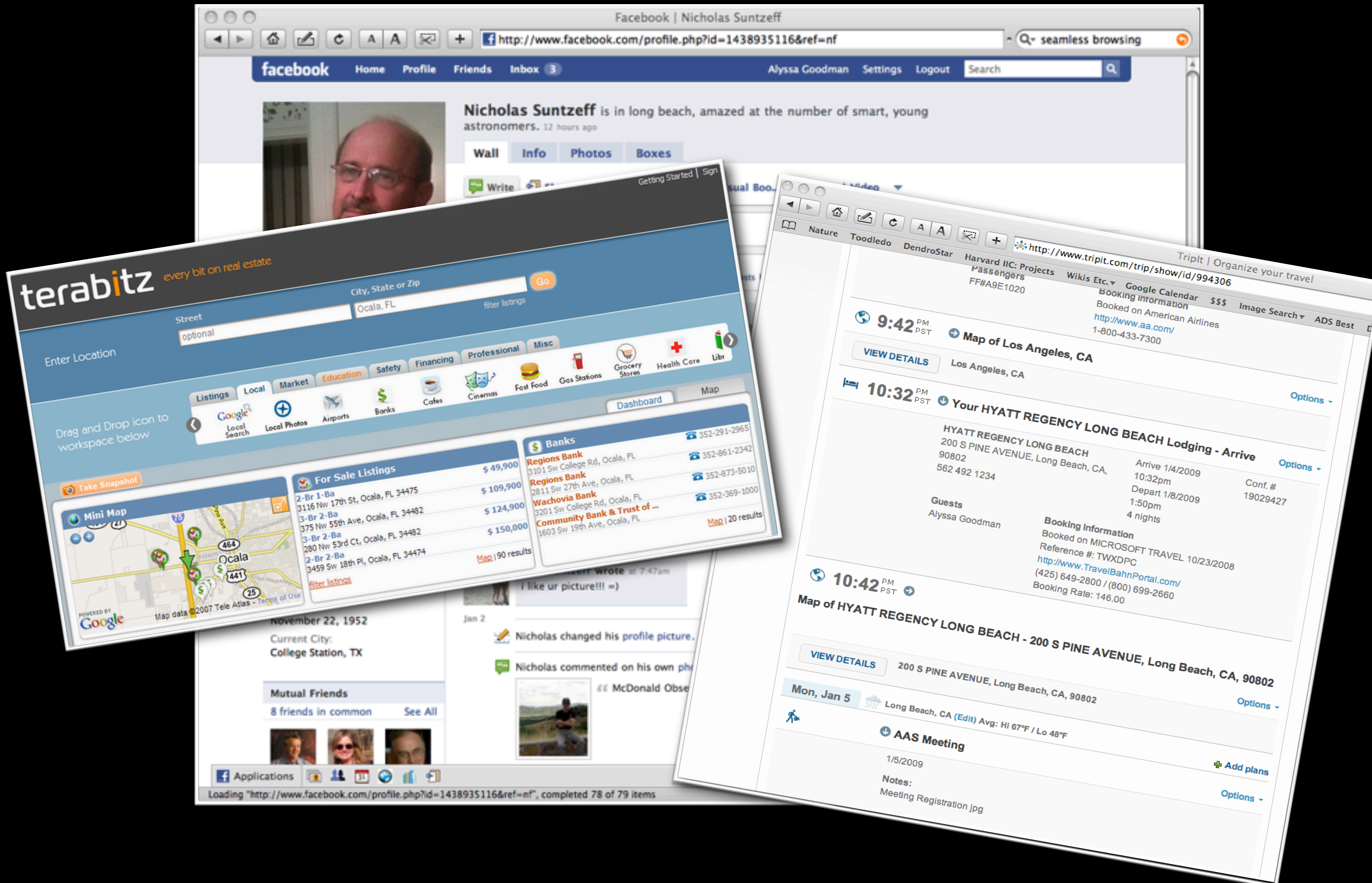
Prototype "Faceted" Browsing

(using very lightweight **"Ontology"***)*

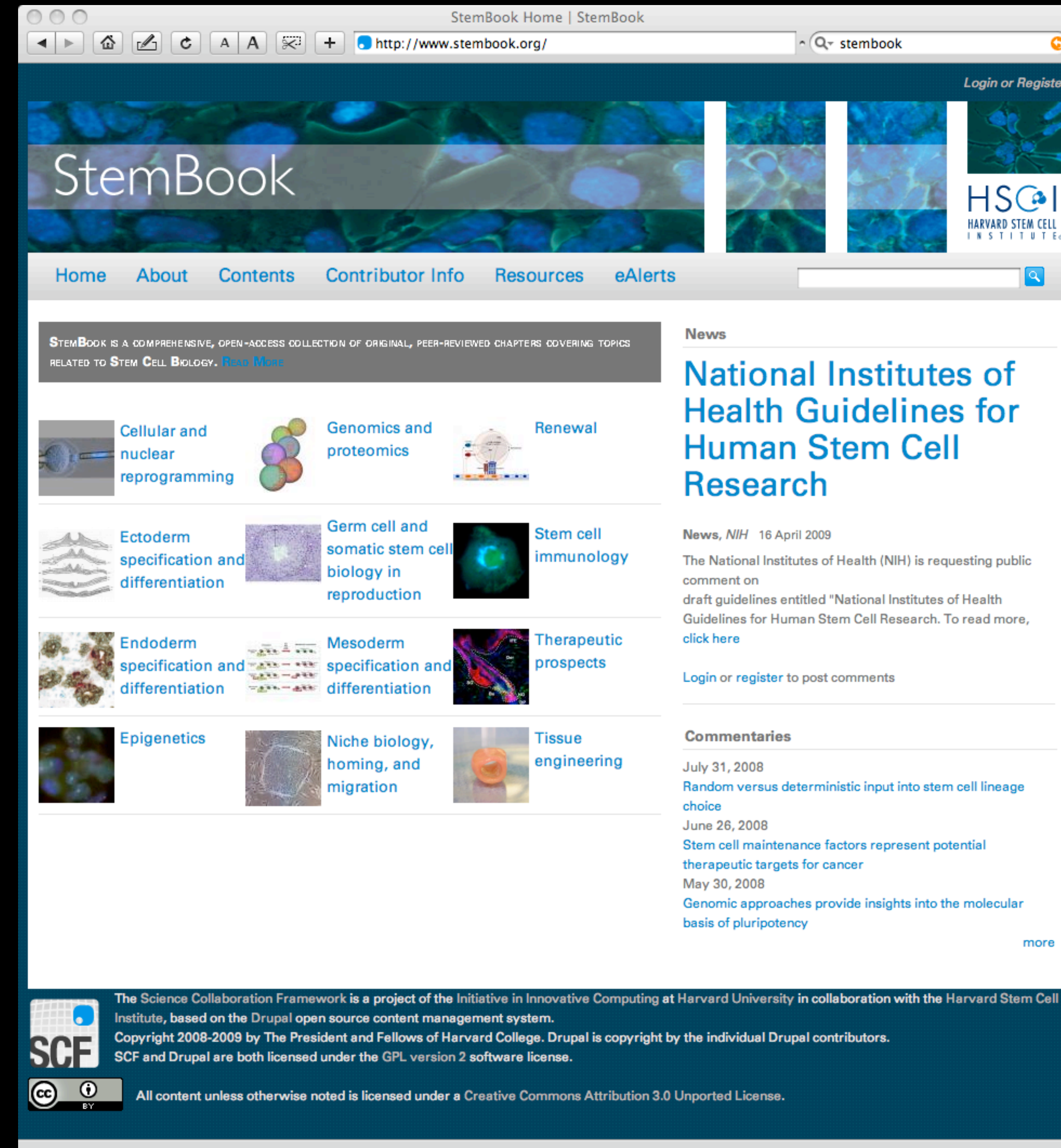


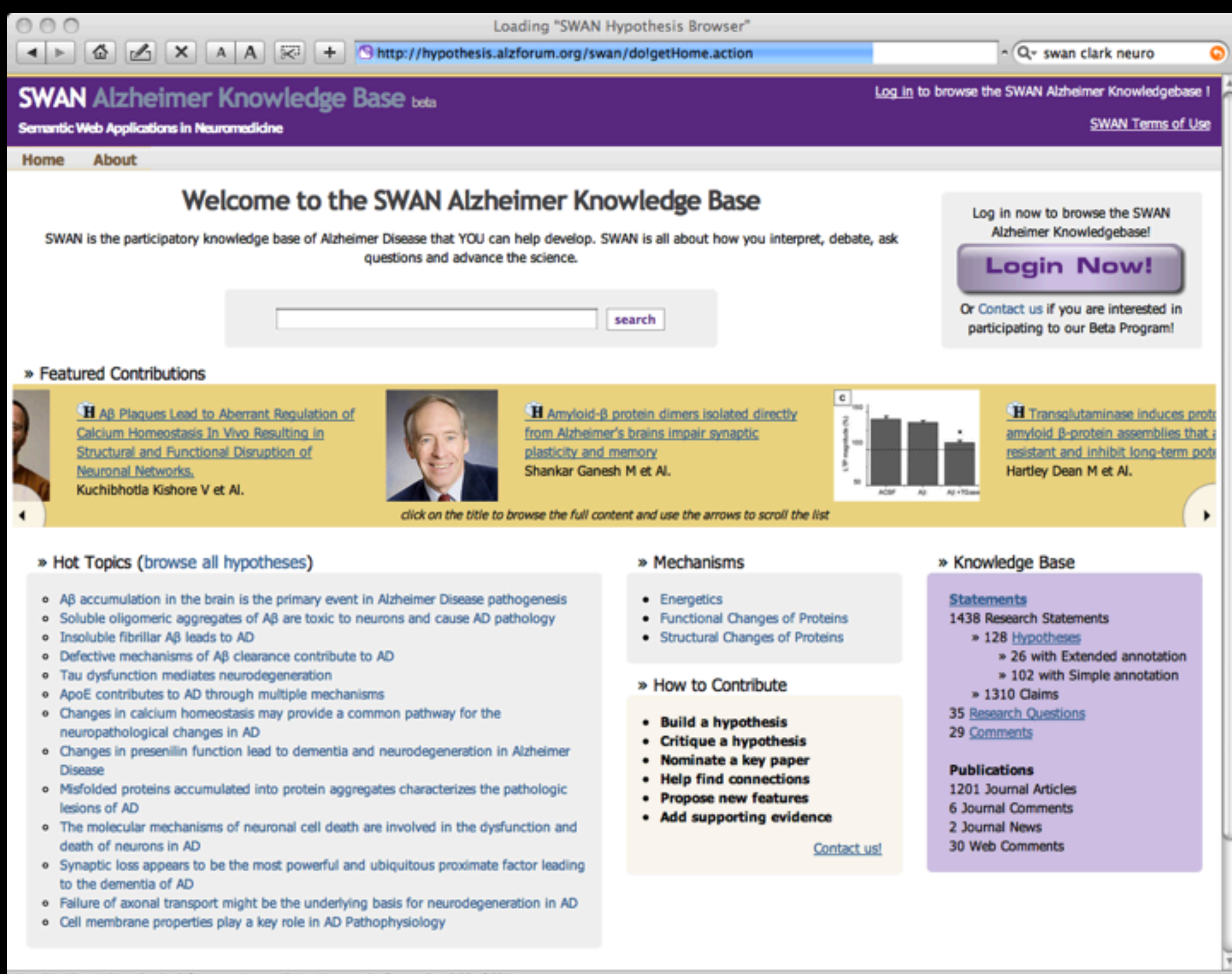
courtesy Douglas Burke, CfA/IIC

We need to catch up to this & go beyond...



= Opportunity to Generalize...





...from, e.g. "Semantic" Life Science Success (e.g. work of Clark, Das et al.)

Seamless AstroLife?

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

What about DDD...

...is easier now than before?

fast computation, animation, 3D

...was easier before than now?

craftsmanship

...should be easier in the future?

modular craftsmanship

What...

...is easier now than before?

I think we can aim for general, interoperable, (viz) tools with a "modular craftsmanship" approach.

fast computation, animation, 3D

...was easier before than now?

KIVA

craftsmanship

...should be easier in the future?

modular craftsmanship

Astronomy as I See, Touch, Taste, and Hear It

So many thanks, to...

Astronomical Medicine & 3D PDF: Mike Halle, Michelle Borkin, Jens Kauffmann, Doug Alan, Ron Kikinis, Erik Rosolowsky, Nick Holliman, Jonathan Foster, Jaime Pineda, Héctor Arce, Dave Kennedy, Mark Thomas, Timo Hannay & Phil Campbell

Touch: Chia Shen & Hanspeter Pfister

Taste: Erik Rosolowsky & Rahul Shetty

WorldWide Telescope: Curtis Wong, Jonathan Fay & Gus Muench + MSR supporters

Seamless Astronomy: Gus Muench, Eli Bressert , Doug Burke, Alberto Accomazzi, Michael Kurtz, Jim Hendler, Deborah McGuinness, Curtis Wong & Jonathan Fay + MSR supporters

and

IICers**:** Tim **Clark**, Felice Frankel, Hanspeter Pfister, Ros Reid, Helene Tingle, Lincoln Greenhill, Pavlos Protopapas, Tim Kaxiras ... +so many others!+

IIC Supporters: Steve Hyman, Venky Narayanamurti, Greg Morrisett, Joy Sircar, Ash Munshi, James Cuff, Jill Altshuler, April Edrington, Alan Gordon, Sarah Block & the IIC "Steering" Committee, including Kathy Buckley & Russ Porter + our fine Colloquium audiences!

...and my family, for putting up with all this.