Seamless Astronomy
How astronomers share, explore & discover

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with
Alberto Accomazzi, Douglas Burke, Raffaele D’Abrusco, Rahul Davé, Christopher Erdmann, Pepi Fabbiano, Jay Luker, Gus Muench, Michael Kurtz & Alberto Pepe (Harvard-Smithsonian CfA); Eli Bressert (U. Exeter); Tim Clark (Massachusetts General Hospital/Harvard Medical School); Mercé Crosas (Harvard Institute for Quantitative Social Science; Chris Borgman (UCLA); Jonathan Fay & Curtis Wong (Microsoft Research)
The (US) Backstory

2001 · · · · · · · · · · · · 2008 (2010)

NVO senior personnel:
Charles Alcock, University of Pennsylvania
Kirk Borne, Astronomical Data Center/Raytheon
Tim Cornwell, NSF National Radio Astronomy Observatory
David De Young, NSF National Optical Astronomy Observatory
Giuseppina Fabbiano, Smithsonian Astrophysical Observatory
Alyssa Goodman, Harvard University
Jim Gray, Microsoft Research
Robert Hanisch, Space Telescope Science Institute
George Helou, NASA Infrared Processing and Analysis Center
Stephen Kent, Fermilab
Carl Kesselman, University of Southern California
Miron Livny, University of Wisconsin
Carol Lonsdale, NASA Infrared Processing and Analysis Center
Tom McGlynn, GSFC/HEASARC/USRA
Reagan Moore, San Diego Supercomputer Center
Ray Plante, University of Illinois, Urbana-Champaign
Thomas Prince, California Institute of Technology
Nicholas White, NASA Goddard Space Flight Center

...the Universe at your fingertips

Science News
$10 Million NASA Science Grant

See Also:

NVO, headed by astronomer Alex Filippenko, is a network of research institutes that allows users to query the world's largest digital archive of astronomical data. The initiative was driven by the desire to make astronomical data more accessible to the public and support scientific research.

Management and Operation of the Virtual Astronomical Observatory

CONTACTS

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PROGRAM GUIDELINES

Solicitation 08-537

Please be advised that the NSF Proposal & Award Policies & Procedures Guide (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Grant Proposal Guide Chapter II for further information about the implementation of this new requirement).
and meanwhile...
The VO
Instead, we are building an integrated “seamless” virtual observatory
Disclaimer: This slide shows key excerpts from within the astronomy community & excludes more general s/w that is used, such as Papers, Zotero, Mendeley, EndNote, graphing & statistics packages, data handling software, search engines, etc.
"Seamless Astronomy" (Tools)

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SAMP
(Simple Application Messaging Protocol)

link to 12/2010 IVOA recommendation
"Seamless Astronomy" (Tools)

Disclaimer: This slide shows key excerpts from within the astronomy community & excludes more general s/w that is used, such as Papers, Zotero, Mendeley, EndNote, graphing & statistics packages, data handling software, search engines, etc.
3. 2010ApJ...716L...1A The J = 1-0 Transitions of 12CH+, 13CH+, and 12CD+  
Amano, T.  

4. 2009ApJ...705L.176S Detection of the Zeeman Effect in the 36 GHz Class I CH3OH  
Maser Line with the EVLA  
Sarma, A. P.; Momjian, E.  

11. 2003A&A...412..513B The molecular Zeeman effect and diagnostics of solar and  
stellar magnetic fields. II. Synthetic Stokes profiles in the Zeeman regime  
Berdyugina, S. V.; Solanki, S. K.; Frutiger, C.  

12. 2000PASP..112..873W Magnetism in Isolated and Binary White Dwarfs  
Wickramasinghe, D. T.; Ferrario, Lia  
Jul 2000
“shift-click” on object
click "Research, Information"

...more data
...or more literature
Disclaimer: This slide shows key excerpts from within the astronomy community & excludes more general s/w that is used, such as Papers, Zotero, Mendeley, EndNote, graphing & statistics packages, data handling software, search engines, etc.
“Seamless Astronomy”...
astrometry.net + flickr + WWT

A Photographic Atlas of Selected Regions of The Milky Way

Plates 13

[published 1927]
Coming (using astrometry.net++) in 2011...

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

Faceted Heat Map of Articles on the Sky
[e.g. ADS-CDS-WWT]

Collaborators: Alberto Accomazzi (CfA); Jonathan Fay (MSR); Alyssa Goodman (CfA); David Hogg (NYU); Gus Muench (CfA); Alberto Pepe (CfA)+advice from Pierre Fernique (CDS) & Thomas Bock (CDS)
This slide shows key excerpts from within the astronomy community & excludes more general s/w that is used, such as Papers, Zotero, Mendeley, EndNote, graphing & statistics packages, data handling software, search engines, etc.
Note: This work came from the “AstroMed” project am.iic.harvard.edu

Data in Literature

Figure 2: Comparison of the ‘dendrogram’ and ‘CLUMPFIND’ feature-identification algorithms as applied to 13CO emission from the L1448 region of Perseus. a, 3D visualization of the surfaces indicated by colors in the dendrogram shown in Figure 1. Purple highlights the smallest scale self-gravitating structures in the region corresponding to the leaves of the dendrogram; pink shows the smallest surface that contains 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 Xmb (main-beam temperature) test-level values for which the virial parameter is less than 2. The ‘x’ 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, decl., 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 leaves used in Fig. 1 and (c). As ‘clumps’ are not allowed to belong to larger structures, each pseudo-branch in (d) 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 colors in (c) and (d) can be related 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 (~9.6 km s\(^{-1}\)).

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 small steps (e.g., at 0.5 km s\(^{-1}\) and 1.0 km s\(^{-1}\)) until the local maxima and minima 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 data points 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.

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’. Although well-developed in other data-intensive fields, 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.

Four years before the advent of CLUMPFIND, ‘structure trees’ 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’. Although well-developed in other data-intensive fields, 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. However, there has been some recent interest in the use of ‘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, decl., 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 leaves used in Fig. 1 and (c). As ‘clumps’ are not allowed to belong to larger structures, each pseudo-branch in (d) 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 colors in (c) and (d) can be related 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 (~9.6 km s\(^{-1}\)).
More Data in/from Literature coming in 2011

Astronomy Dataverse, $\beta$

Harvard Institute for Quantitative Social Science (Gary King, Mercé Crosas) + Seamless Astronomy Group, (Chris Erdmann, Alberto Pepe, Gus Muench et al.)
But awareness is not high enough
...and skepticism is not hard to find.

Good news is that the young & young at heart
are headed in the right direction.

Funding agencies have been slow to come along
...industrial collaboration is a better bet at present
(e.g. Microsoft Research/WorldWide Telescope).
ADS may be our “way in” via killer apps
DATA IN "LITERATURE"
NUMBER OF ASTRONOMY PUBLICATIONS WITH LINKS, BY YEAR (ADS)

Source: Astronomical Data System
Welcome! This website provides a platform for sharing resources, workflows, and basic organizational information about networked tools, websites and databases in astronomy. Its intended audience is any scientist performing astronomical research online. It originated from the activities of scientists at the Harvard Smithsonian Center for Astrophysics in Cambridge, MA.

By online astronomy, we mean all forms of networked tools, databases and websites that are utilized for astronomical research, including scholarly discourse and social interactions through blogs, forums and other web media.

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

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

Kiva model: WWT Partners & “VAO Associates”
How do we organize such diverse tools, so as to make them interoperably useful?....

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

projects.iq.harvard.edu/seamlessastronomy

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“Citizen Science”