

Digital Science

Towards the Executable Paper

José Enrique Ruiz on behalf of the Wf4Ever and CANUBE Teams

Document Freedom Day

Centro de Enseñanzas Virtuales de la Universidad de Granada - CEVUG

Wednesday 26th March 2014



Wf4Ever

Advanced Workflow Preservation Technologies for Enhanced Science

2011 – 2013 EU FP7



1. Intelligent Software Components (ISOCO, Spain)
2. University of Manchester (UNIMAN, UK)
3. Universidad Politécnica de Madrid (UPM, Spain)
4. Poznan Supercomputing and Networking Centre (Poland)
5. University of Oxford and OeRC (OXF, UK)
6. Instituto Astrofísica Andalucía (IAA-CSIC, Spain)
7. Leiden University Medical Centre (LUMC, Netherlands)

Reproducible
Science

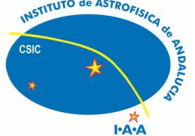


IAA – CSIC contribution through AMIGA Group

- **User Functional Requirements**
 - BioGenomics /BioInformaticians
 - Astronomers /AstroInformaticians
 - Publishers /Librarians
 - Computer Scientists
- **Software Development**
 - AstroTaverna Plugin
 - AstroTaverna Starter Pack and Workflows
- **Community Engagement and Collaborations**
 - Spanish Virtual Observatory
 - International Virtual Observatory Alliance
 - Action Spécifique Observatoires Virtuels France
 - Observatoire de Paris-Meudon
 - EU FP7 Projects: Er-Flow and VAMDC
 - SAO NASA /ADS Digital Library



Reproducible
Science





CANube Ciencia Abierta en la Nube

Mars – Dec 2013

Open Science Project granted by the Second Call for Proposals of the **Bio-TIC Campus of International Excellence** of the University of Granada.



- Universidad de Granada
- Instituto Astrofísica Andalucía - CSIC
- Campus CEI-BioTic

- Red del Sur
- Fidesol
- Intelify
- Grupo Trevenque



Open Science

Astronomy research lifecycle is **entirely digital**

- » Observation proposals 
- » Data reduction pipelines
- » Analysis of science ready data
- » Catalogs of objects and data archives
- » Publish process - ADS/arXiv
 - › Materials and Methods
 - › Results 
 - › Discussion

Reproducible research is still not possible in a digital world

A rich infrastructure of data is not efficiently used



A normalized preservation of methodology is needed

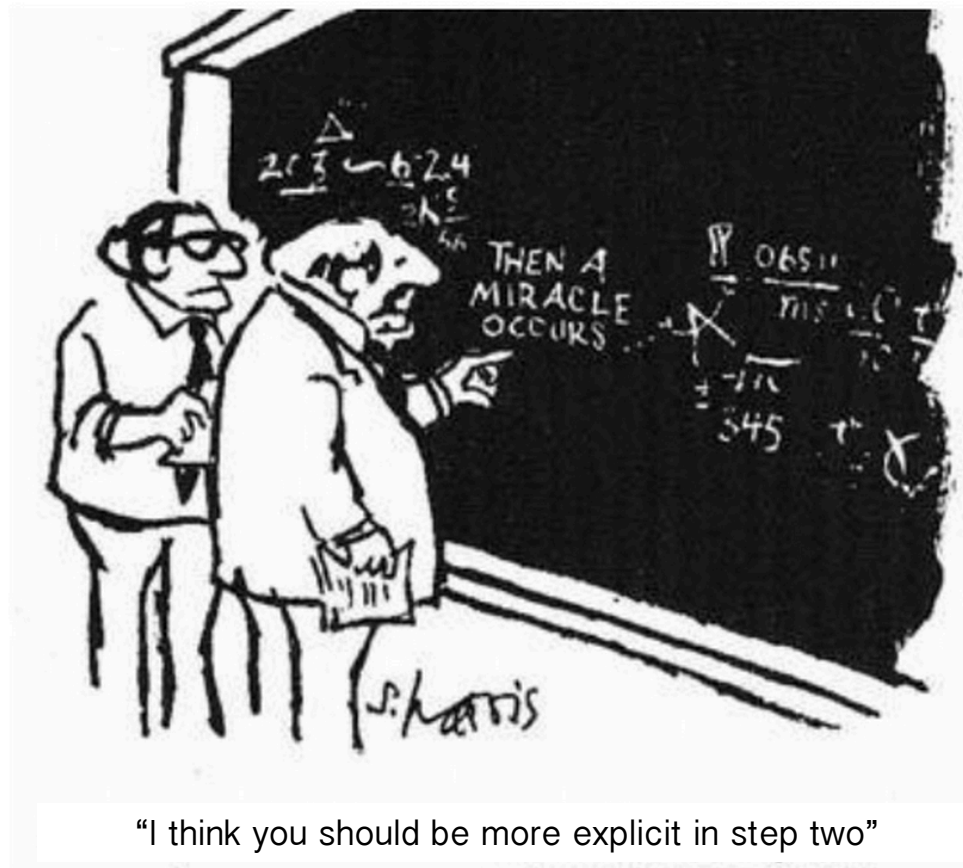
Tools

Digital Science - Towards the Executable Paper

The Reproducibility Crisis

“... up to 70% of research from academic labs **cannot be reproduced**, representing an enormous waste of money and effort.”

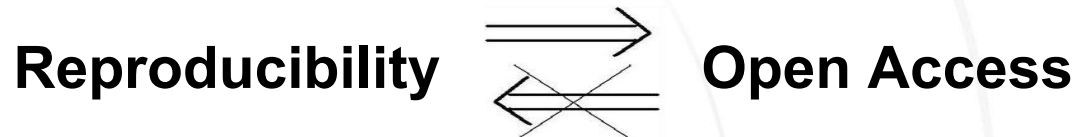
- Elizabeth Iorns, Science Exchange



Digital Science - Towards the Executable Paper

Open Science is much more than Open Data

Reproducibility is achieved when access is granted for all resources



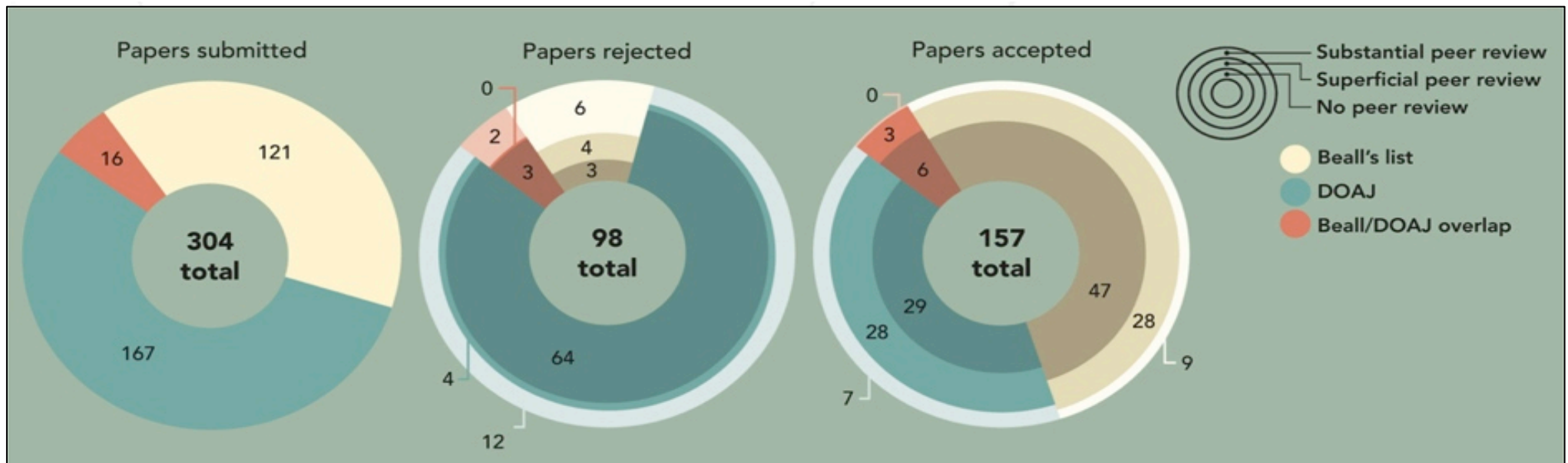
Clamorous fake methods and results published in 157 out of 304 Journals

Who's Afraid of Peer Review?

John Bohannon

Science 4 October 2013:
Vol. 342 no. 6154 pp. 60-65
DOI: 10.1126/science.342.6154.60

A spoof paper concocted by *Science* reveals little or no scrutiny at many open-access journals.



Digital Science - Towards the Executable Paper

Open Science is much more than Open Data

More trial, less error - An effort to improve scientific studies

Recomendar 322 personas recomiendan esto. Sé el primero de tus amigos.



Tweet 84

Share

Share this

+1 15

Email

nature

International weekly journal of science

Home | News & Comment | Research | Careers & Jobs | Current Issue | Archive | Audio & Video | For Au

Archive > Volume 501 > Issue 7468 > News > Article

NATURE | NEWS



Mozilla plan seeks to debug scientific code

Software experiment raises prospect of extra peer review.

Erika Check Hayden

24 September 2012

“One worry I have is that, with reviews like this, scientists will be even more **discouraged** from publishing their code [...] We need to get more code out there, **not improve how it looks.**”

incorrect claims that a new service has sprung up to fact-check reported findings by repeating the experiments.

A year-old Palo Alto, California, [company](#), Science Exchange, announced on Tuesday its "Reproducibility Initiative," aimed at improving the trustworthiness of published papers. Scientists who want to validate their findings will be able to apply to the initiative, which will choose a lab to redo the study and determine whether the results match.

[prisoners: rights group](#)
Thu, Aug 2 2012

[Scientists skeptical as athletes get all taped up](#)
Wed, Aug 1 2012

[Jon Torrent vies for \\$10 million genome prize](#)
Tue, Jul 24 2012

[Close relationships](#)

entered the debate, aiming to discover whether a review process could improve the quality of researcher-built software that is used in myriad fields today, ranging from ecology and biology to social science. In an experiment being run by the Mozilla Science Lab, software engineers have reviewed selected pieces of code from published papers in computational biology. "Scientific code does not have that comprehensive, off-the-shelf nature that we want to be associated with the way science is published and presented, and this is our attempt to poke at that issue," says Mozilla Science Lab director Kaitlin Thaney.

- [Cancer institute tackles sloppy data](#)
- [Publish your computer code: it is good enough](#)
- [Computational science: ...Error](#)

[More related stories](#)

Barriers to Data and Code Sharing in Computational Science

Survey of Machine Learning Community, NIPS (Stodden, 2010):

Code		Data
77%	Time to document and clean up	54%
52%	Dealing with questions from users	34%
44%	Not receiving attribution	42%
40%	Possibility of patents	-
34%	Legal Barriers (ie. copyright)	41%
-	Time to verify release with admin	38%
30%	Potential loss of future publications	35%
30%	Competitors may get an advantage	33%
20%	Web/disk space limitations	29%

Tools

Digital Science - Towards the Executable Paper

Open Science is much more than Open Data

Repeatable

The methodology is clearly exposed
I could repeat the experiment

Reproducible

Clear methodology and available resources
I could reproduce the results

Reusable

I know how it could be useful for my needs
I could use all or some parts as it is
I could modify and adapt it even for other purposes



Digital Science - Towards the Executable Paper

Open Science is much more than Open Data

Visibility, Efficiency and Reuse

Optimize return on investments made on big facilities

- » Avoid duplication of efforts and reinvention
- » How to discover and not duplicate ?
- » How to re-use and not duplicate ?
- » How to make use of best practices ?
- » How to use the rich infrastructure of data ?
- » **Intellectual contributions encoded in software**

More data in archives do not imply more knowledge

- » Expose **complete scientific record**, not the story
- » Allow easy **discovery** of methods and tools



Digital Science - Towards the Executable Paper

Open Science is much more than Open Data

Visibility and Social Discovery

The collage features several logos and interface elements:

- peeref** evaluation empowering scholars
- MENDELEY** logo with a red molecular structure icon and the text "Welcome back Lourdes Verdes-Montenegro"
- YouTube** logo
- citeulike** logo with a green and blue icon and a search bar with "Search citeulike" and "Browse | FAQ | Log in" links.
- BibSonomy** logo with a network diagram and the text "BibSonomy"
- ResearchGate** logo with a search bar.
- klænk** logo with a blue circle and the text "Spread your research results"
- delicious** social bookmarking logo.
- slideshare** logo with the text "BETA".
- AstroBetter** logo with the text "Tips and Tricks for Professional Astronomers" and a navigation menu (Blog, About, Archives, Support, Wiki).
- Collabgraph!** logo in green text.
- zotero** logo.
- twitter** logo.
- A snippet of a webpage with the text "collaborating in your field of research. Just ... or upload a bibtex file, containing your ... graph will create a fancy graph showing ..."

Digital Science - Towards the Executable Paper

Open Science is much more than Open Data

Visibility and Social Discovery

Pre-explosion Upper Limit on X-ray Emission from a Progenitor for SN 2014J

ATel #5798; [W. P. Maksym \(U. Alabama\)](#), [J. A. Irwin \(U. Alabama\)](#), [W. C. Keel \(U. Alabama\)](#), [D. Burke \(CFA-SAO\)](#), [K. Schawinski \(ETH Zurich\)](#)

on 23 Jan 2014; 20:50 UT

Credential Certification: Peter Maksym (peter.maksym@gmail.com)

Subjects: X-ray, Cataclysmic Variable, Supernovae

Referred to by ATel #: [5809](#), [5851](#)

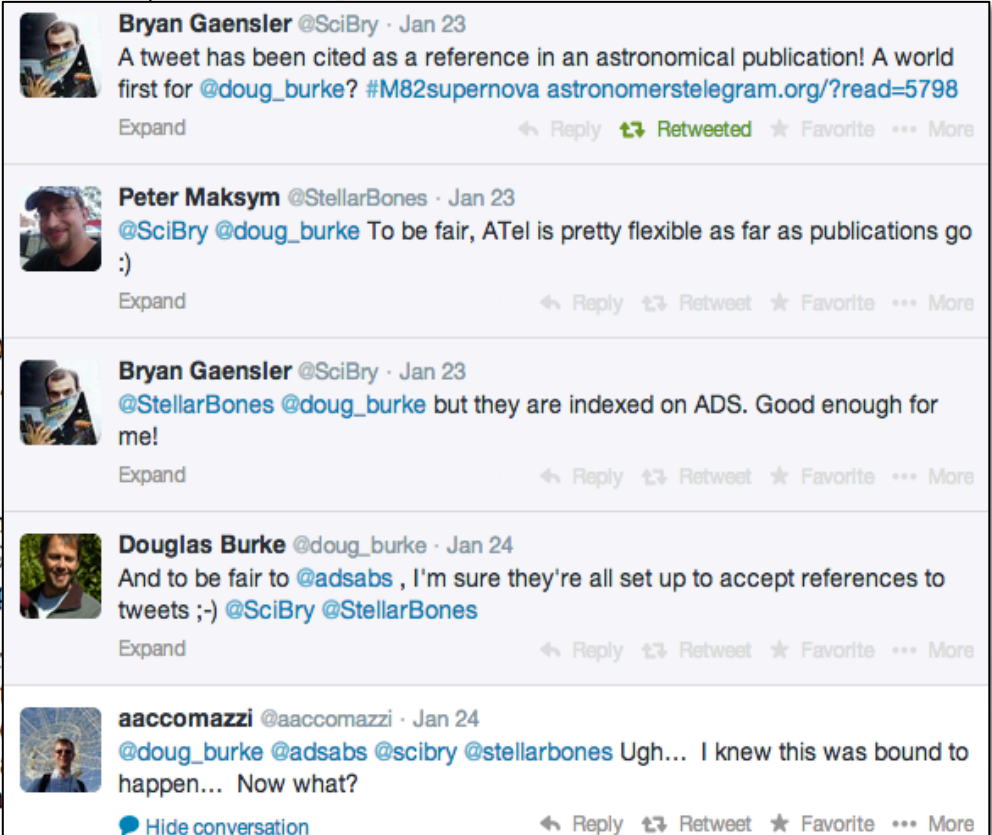
 Tweet 46  Recommend 5

To identify or set limits on any possible accreting white dwarf progenitor to SN 2014J (ATel #[3792](#), ATel #[5786](#)), we examined available pre-explosion archival Chandra data covering multiple observations of M82 dating back to 1999 Sep. 20.

Initial examination by D. Burke

(https://twitter.com/doug_burke/status/426065675497381888) covering ~820 ks of M82 and ACIS-S data with non-uniform coverage, and reveals no source at RA,Dec=09h 59m 49.8s, +69°40'26.0" (CBET #[3792](#)). The source is also not visible in the longest single exposure.

To minimize effects of off-axis spreading of the Chandra PSF, we examined the archival data using only the sixteen ACIS-S and ACIS-I epochs with off-axis angle < 2 arcmin, covering ~500 ks in the range of 0.1-8 keV. Within $r=0.5$ arcsec (~1 Chandra pixel), we find a 1-sigma upper limit of 5.7 counts using the NIRC2 localization by Tendulkar et al. (ATel #[5789](#)) RA,Dec=9:55:42.217,+69:40:26.56. In addition, none of the sixteen exposures has any evidence for X-ray flaring at the location of SN 2014J.



The screenshot shows a Twitter thread with five tweets. The first tweet by Bryan Gaensler (@SciBry) on Jan 23 states: "A tweet has been cited as a reference in an astronomical publication! A world first for @doug_burke? #M82supernova astronomerstelegram.org/?read=5798". The second tweet by Peter Maksym (@StellarBones) on Jan 23 replies: "@SciBry @doug_burke To be fair, ATel is pretty flexible as far as publications go :)". The third tweet by Bryan Gaensler (@SciBry) on Jan 23 replies to @StellarBones and @doug_burke: "but they are indexed on ADS. Good enough for me!". The fourth tweet by Douglas Burke (@doug_burke) on Jan 24 replies to @adsabs, @SciBry, and @StellarBones: "And to be fair to @adsabs, I'm sure they're all set up to accept references to tweets ;-)" . The fifth tweet by aaccomazzi (@aaccomazzi) on Jan 24 replies to @doug_burke, @adsabs, @scibry, and @stellarbones: "Ugh... I knew this was bound to happen... Now what?". Each tweet includes an "Expand" button and interaction options like "Reply", "Retweet", "Favorite", and "More".

Time has come to go **beyond the PDF**



Digital Science - Towards the Executable Paper

Digital Astronomy in the Local Desktop

Location: C:\user\research\data

Filename	Date Modified	Size	Type
data_2010.05.28_test.dat	3:37 PM 5/28/2010	420 KB	DAT file
data_2010.05.28_re-test.dat	4:29 PM 5/28/2010	421 KB	DAT file
data_2010.05.28_re-re-test.dat	5:43 PM 5/28/2010	420 KB	DAT file
data_2010.05.28_calibrate.dat	7:17 PM 5/28/2010	1,256 KB	DAT file
data_2010.05.28_huh??.dat	7:20 PM 5/28/2010	30 KB	DAT file
data_2010.05.28_... .dat			DAT file
data_2010.05.28_... .dat			DAT file
data_2010.05.28_... .dat			DAT file
data_2010.05.28_... .dat			DAT file
data_2010.05.28_... .dat			DAT file
data_2010.05.28_... .dat			DAT file
data_2010.05.29_USETHISONE.dat	5:08 AM 5/29/2010	2,894 KB	DAT file
analysis_graphs.xls	7:13 AM 5/29/2010	455 KB	XLS file
ThesisOutline!.doc	7:26 AM 5/29/2010	38 KB	DOC file
Notes_Meeting_with_ProfSmith.txt	11:38 AM 5/29/2010	1,673 KB	TXT file
JUNK...	2:45 PM 5/29/2010		Folder
data_2010.05.30_startingover.dat	8:37 AM 5/30/2010	420 KB	DAT file

Going beyond automation
Organization

Type: Ph.D Thesis Modified: too many times Copyright: Jorge Cham www.phdcomics.com

Digital Science - Towards the Executable Paper

Digital Astronomy in the Local Desktop

The image displays a collection of astronomical software interfaces and data. At the top center is the Python logo. Below it is a table of astronomical data. To the left are screenshots of VAO and IDL. To the right is the NASA/IPAC Extragalactic Database interface. At the bottom are screenshots of IRAF and VOSPEC. Red arrows indicate the flow of data and interaction between these tools.

#	CIG	Vhel	e_Vhel	r_Vhel	Dist	MType	e_MType	OptAssym	r_MType	Bmag	e_Bmag		
1	7299.0	3.0	1	96.9	5.0	1.5	1	14.167	0.271	0.173	0.571	0.040	13.383
2	6983.0	6.0	2	94.7	6.0	1.5	0	15.722	0.324	0.255	0.278	0.031	15.157
3				4.0	1.5	0	1	16.057	0.507	0.246	0.354		15.457
4	2310.0	1.0	3	31.9	3.0	1.5	0	12.818	0.424	0.252	0.863	0.017	11.685
5	7865.0	10.0	3	105.9	0.0	1.5	0	15.602	0.364	0.225	0.131	0.118	15.128
72	5164.0	9.0	2	68.5	5.0	1.5	1	14.445	0.325	0.315	0.367	0.028	13.735

Digital Science - Towards the Executable Paper

Digital Astronomy in the Local Desktop

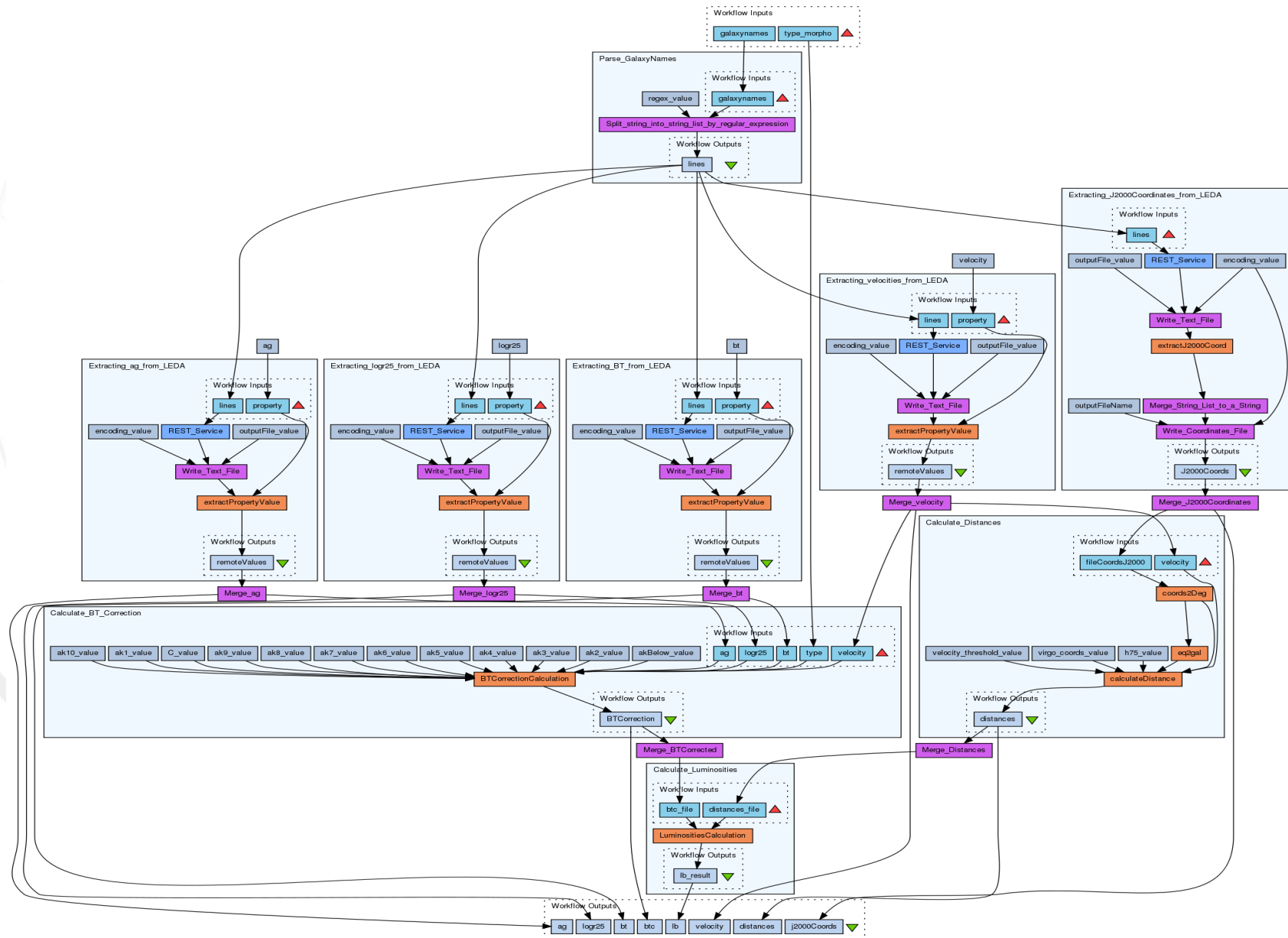
**Capture
Actions, Tasks, Dependencies, Provenance**

**Improve
Clarity and Reproducibility**

FORTRAN

The collage includes several software interfaces: **VAO** (Virtual Astronomical Observatory) showing a table of objects and a spectral plot; **NASA/IPAC EXTRAGALACTIC DATABASE** with a table of objects and a news update; **IDL** (Interactive Data Language) logo; **CDS** (Centre for Data Services) logo; **Image Reduction and Analysis Facility (IRAF)** showing a search criteria panel and a plot; and a **FASTA** search interface for DNA vs. Pfam.

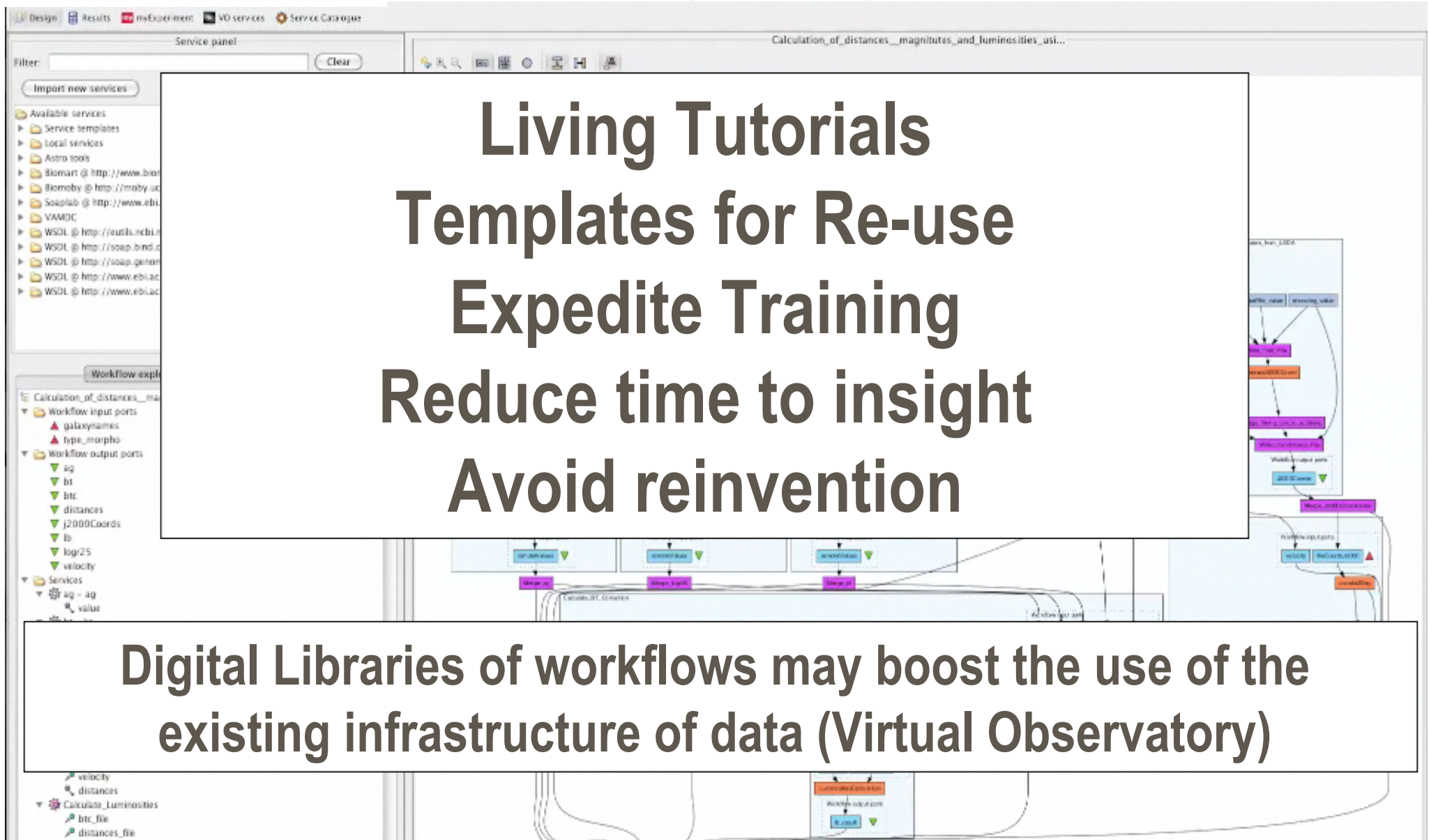
Digital Science - Towards the Executable Paper Scientific Workflows



Digital Science - Towards the Executable Paper Scientific Workflows

Living Tutorials
Templates for Re-use
Expedite Training
Reduce time to insight
Avoid reinvention

**Digital Libraries of workflows may boost the use of the
existing infrastructure of data (Virtual Observatory)**



Digital Science - Towards the Executable Paper Scientific Workflows

Related Initiatives

- › ER-Flow
- › VAMDC
- › HELIO
- › Cyber-SKA
- › IceCore
- › Montage
- › Astro-WISE
- › AstroGrid

Software

- › Taverna
- › Kepler
- › Pegasus
- › Triana
- › ESO Reflex

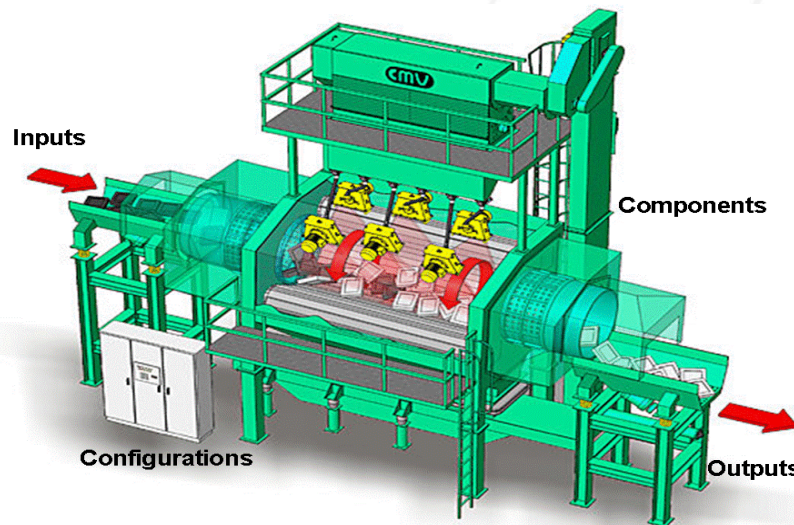
IVOA



- › AstroGrid
- › Grid&WS WG
- › VO France Wf WG

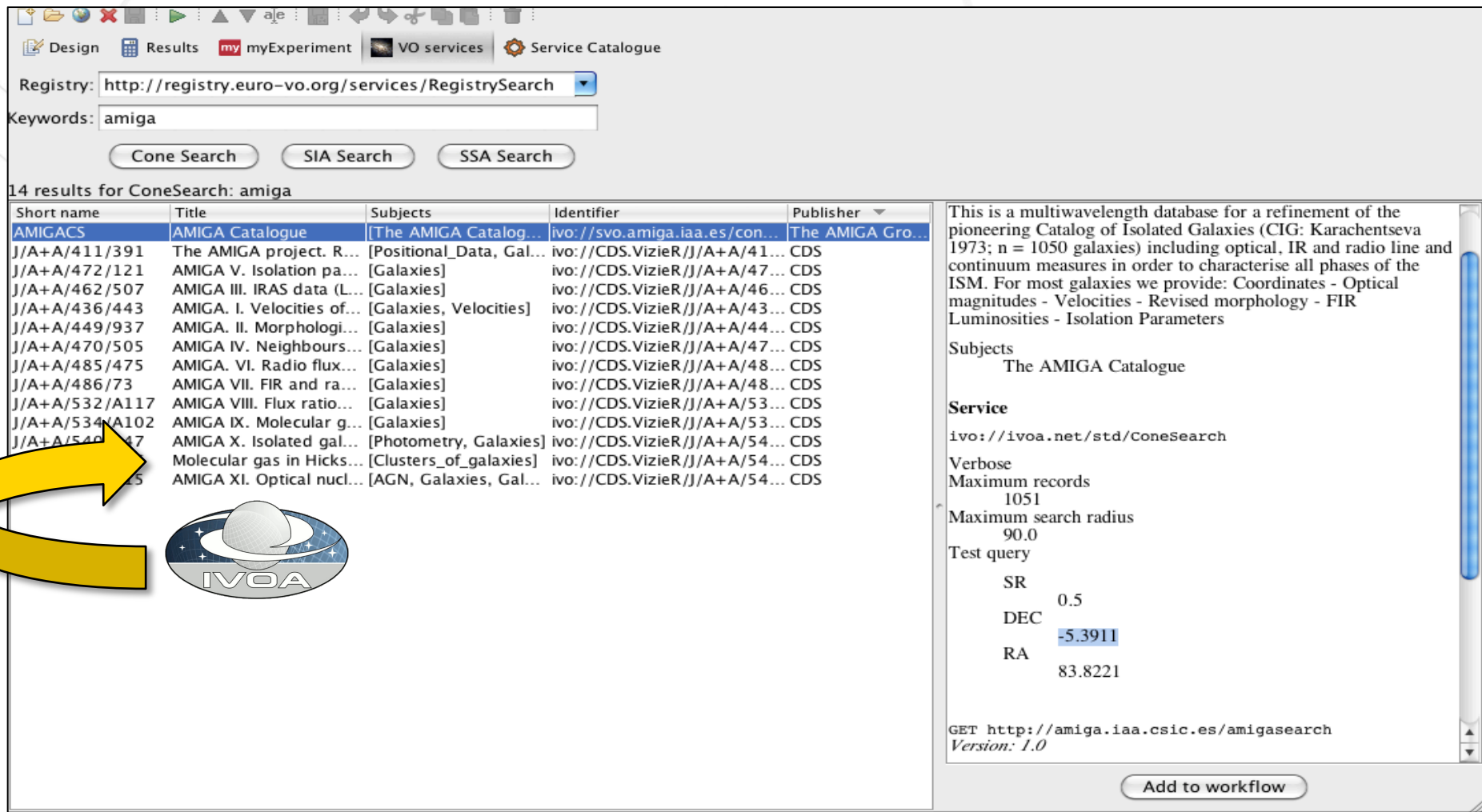
Self descriptive WS

- › PDL
- › SimDAL, S3



Interoperability
Standards

AstroTaverna: Create, annotate and run a workflow



Registry: <http://registry.euro-vo.org/services/RegistrySearch>

Keywords:

14 results for ConeSearch: amiga

Short name	Title	Subjects	Identifier	Publisher
AMIGACS	AMIGA Catalogue	[The AMIGA Catalog...	ivo://svo.amiga.iaa.es/con...	The AMIGA Gro...
J/A+A/411/391	The AMIGA project. R...	[Positional_Data, Gal...	ivo://CDS.VizieR/J/A+A/41...	CDS
J/A+A/472/121	AMIGA V. Isolation pa...	[Galaxies]	ivo://CDS.VizieR/J/A+A/47...	CDS
J/A+A/462/507	AMIGA III. IRAS data (L...	[Galaxies]	ivo://CDS.VizieR/J/A+A/46...	CDS
J/A+A/436/443	AMIGA. I. Velocities of...	[Galaxies, Velocities]	ivo://CDS.VizieR/J/A+A/43...	CDS
J/A+A/449/937	AMIGA. II. Morphologi...	[Galaxies]	ivo://CDS.VizieR/J/A+A/44...	CDS
J/A+A/470/505	AMIGA IV. Neighbours...	[Galaxies]	ivo://CDS.VizieR/J/A+A/47...	CDS
J/A+A/485/475	AMIGA. VI. Radio flux...	[Galaxies]	ivo://CDS.VizieR/J/A+A/48...	CDS
J/A+A/486/73	AMIGA VII. FIR and ra...	[Galaxies]	ivo://CDS.VizieR/J/A+A/48...	CDS
J/A+A/532/A117	AMIGA VIII. Flux ratio...	[Galaxies]	ivo://CDS.VizieR/J/A+A/53...	CDS
J/A+A/534/A102	AMIGA IX. Molecular g...	[Galaxies]	ivo://CDS.VizieR/J/A+A/53...	CDS
J/A+A/540/47	AMIGA X. Isolated gal...	[Photometry, Galaxies]	ivo://CDS.VizieR/J/A+A/54...	CDS
J/A+A/540/47	Molecular gas in Hicks...	[Clusters_of_galaxies]	ivo://CDS.VizieR/J/A+A/54...	CDS
J/A+A/540/47	AMIGA XI. Optical nucl...	[AGN, Galaxies, Gal...	ivo://CDS.VizieR/J/A+A/54...	CDS

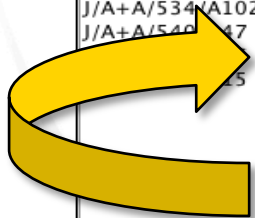
This is a multiwavelength database for a refinement of the pioneering Catalog of Isolated Galaxies (CIG: Karachentseva 1973; n = 1050 galaxies) including optical, IR and radio line and continuum measures in order to characterise all phases of the ISM. For most galaxies we provide: Coordinates - Optical magnitudes - Velocities - Revised morphology - FIR Luminosities - Isolation Parameters


Subjects
The AMIGA Catalogue

Service
ivo://ivoa.net/std/ConeSearch

Verbose
Maximum records
1051
Maximum search radius
90.0
Test query
SR
DEC 0.5
RA -5.3911
83.8221

GET <http://amiga.iaa.csic.es/amigasearch>
Version: 1.0



 <http://amiga.iaa.es/p/290-astrotaverna.htm>

AstroTaverna: Create, annotate and run a workflow

The screenshot displays the AstroTaverna interface. On the left, the 'Service panel' shows a list of services under 'Astro tools', with 'List from column - Get list from column in a votable' highlighted. A yellow arrow points from this service to the 'Workflow explorer' tab. The main area shows a workflow diagram titled 'Querying_SDSS_DR8_to from /Users/julian/Documents/interop...'. The diagram illustrates the flow from input ports (column_DEC, votable, column_RA) through a 'Select_columns' step to output ports (votable). A yellow arrow also points from the service list to the workflow diagram.

Workflow Diagram:

Workflow input ports:

- column_DEC (value)
- votable
- column_RA (value)

Intermediate Steps:

ColumnName	voTable
DEC_list	list
RA_list	list
SR_value	report

filter_value	DEC	RA	SR
value	SDSS_DR8		
	responseBody	status	

Workflow output ports:

- votable

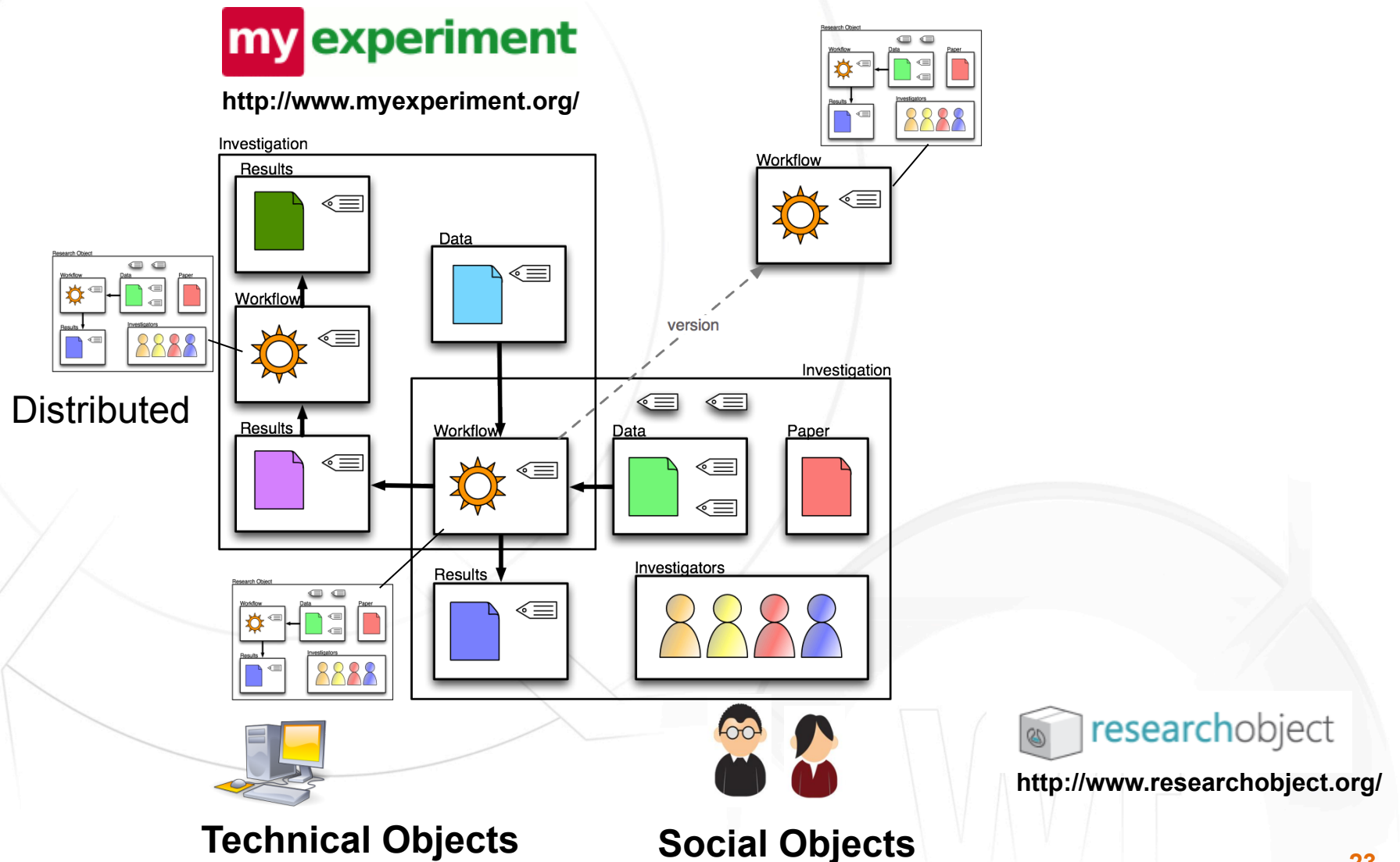
Service List:

- Service templates
- Local services
- Astro tools
 - Add Column - Add column using a expression
 - Add sky coordinates - Add sky coordinates
 - Cat n-tables - Cat a list of tables
 - Cat tables - Cat two tables
 - Check template filler - Check Template filler
 - Coordinates transformation - Coordenates transformation in a table
 - Format conversion - Table format conversion
 - List from column - Get list from column in a votable
- Services
 - Cat_n-tables
 - votableList
 - outputFileOut
 - report
 - column_DEC - dec
 - value

<http://amiga.iaa.es/p/290-astrotaverna.htm>

Digital Science - Towards the Executable Paper Research Objects

Expose **experimental context** in a structured way in order to be **understood**



Digital Science - Towards the Executable Paper

Working with Research Objects

IPython Notebook Viewer

A simple way to share your IPython Notebooks

Share your own notebook, and browse others!

Programming Languages

IPython Examples



IRuby Notebook



An IJulia Preview



Books

Python for Signal Processing



O'Reilly Book

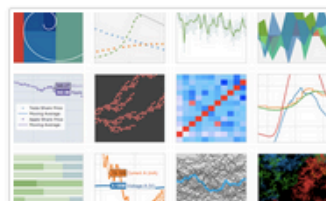


Probabilistic Programming

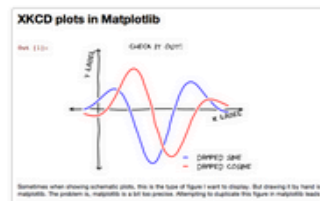


Misc

Interactive plots with Plotly



XKCD Plot With Matplotlib



Non Parametric Regression



Exploring R formula

Nose testing

Working with pandas

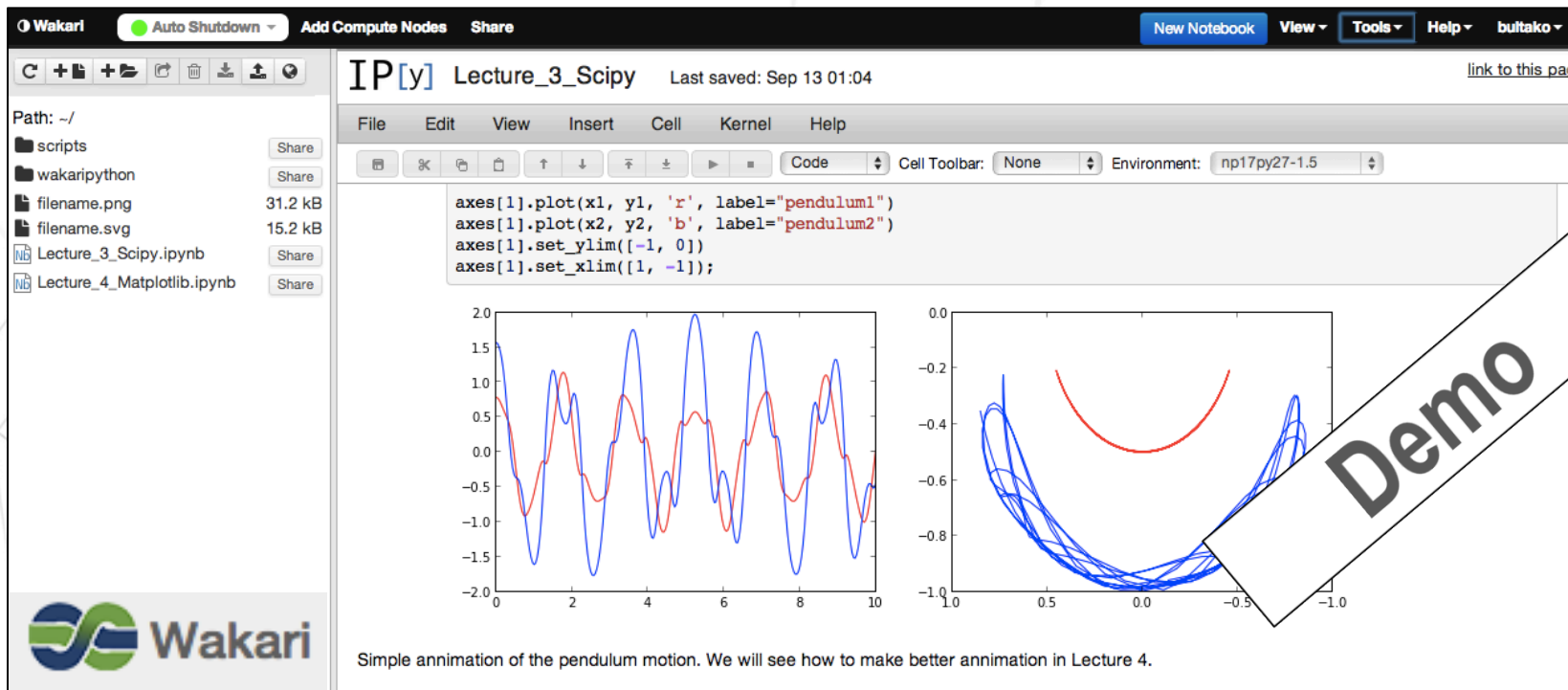
Demo

Digital Science - Towards the Executable Paper

Working with Research Objects

IPython Notebook based working environments

- » **Web-browser** as the working desktop
- » Python code, plots and data, living with **rich-text documentation**
- » Cloud-based adaptive **scalable computing environment**
- » Wikis fully **shareable**, re-usable and **executable**
- » **Social** platform and Git **versioning**



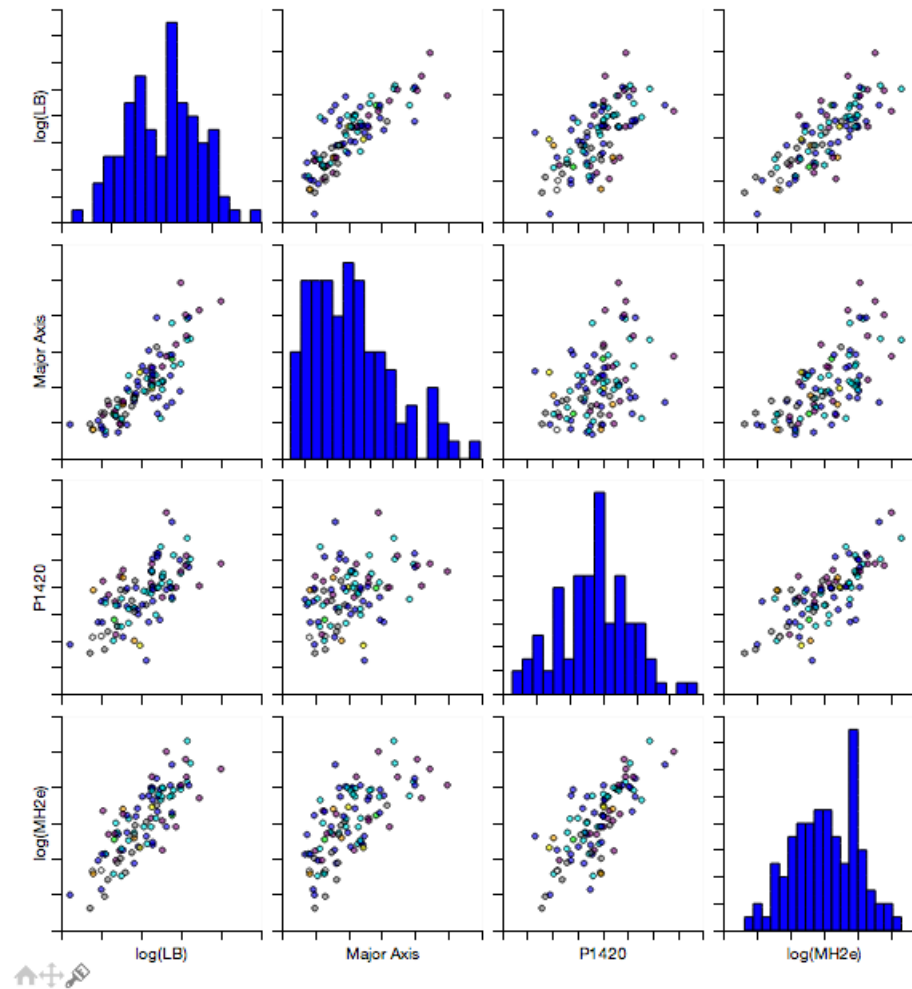
The screenshot displays the Wakari IPython Notebook interface. The top bar includes the Wakari logo, an 'Auto Shutdown' indicator, and buttons for 'Add Compute Nodes' and 'Share'. The notebook title is 'IP[y] Lecture_3_Scipy' with a 'Last saved: Sep 13 01:04' timestamp. The left sidebar shows a file explorer with a 'Path: ~/' and a list of files: 'scripts', 'wakaripython', 'filename.png' (31.2 kB), 'filename.svg' (15.2 kB), 'Lecture_3_Scipy.ipynb', and 'Lecture_4_Matplotlib.ipynb'. The main area contains a code cell with the following Python code:

```
axes[1].plot(x1, y1, 'r', label="pendulum1")
axes[1].plot(x2, y2, 'b', label="pendulum2")
axes[1].set_ylim([-1, 0])
axes[1].set_xlim([1, -1]);
```

Below the code are two plots. The left plot shows a time series of two pendulum positions (red and blue lines) over 10 seconds. The right plot shows the phase space trajectory of the two pendulums, with a red curve representing the potential energy and blue lines representing the trajectories. A large white diagonal banner with the word 'Demo' is overlaid on the right side of the plots.

Simple animation of the pendulum motion. We will see how to make better animation in Lecture 4.

Enhanced IPython Notebook's Server in AMIGA group



<http://nbviewer.ipython.org/gist/Bultako/9648249>

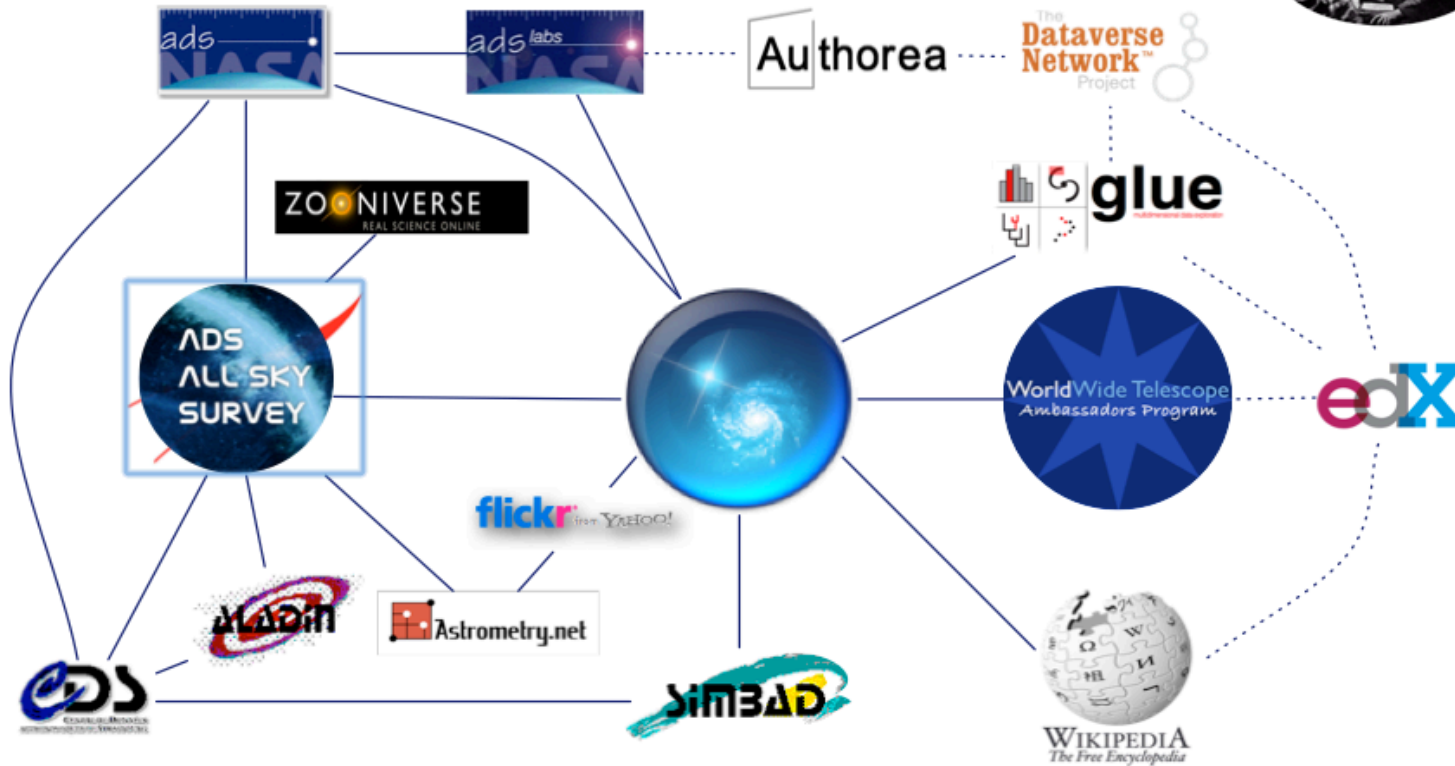
Demo

Write science together.

Authorea

Authorea is the collaborative platform for research. Write and manage your technical documents in one place.

Digital Science - Towards the Executable Paper Collaborative Writing and Versioning

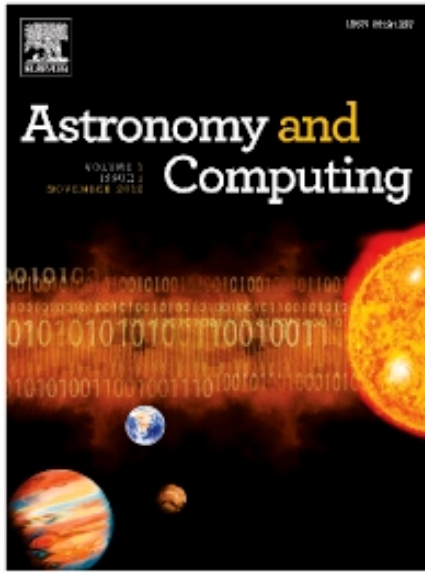


<http://youtu.be/ObJG3i3jjPg>



article of the future

Digital Science - Towards the Executable Paper Publishing Research Objects



Graphical abstract

Source code repositories

The journal strongly encourages authors to make source code available where appropriate, especially in the case of

Video data

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Digital Science - Towards the Executable Paper Publishing Research Objects

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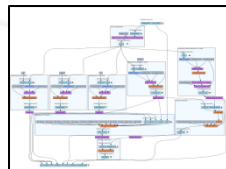
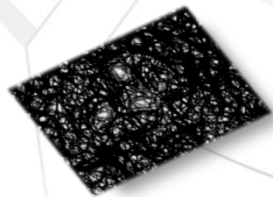
<http://youtu.be/FQ5FaeHcdwo>

Digital Science - Towards the Executable Paper Research Objects in Astronomy

ADSLabs

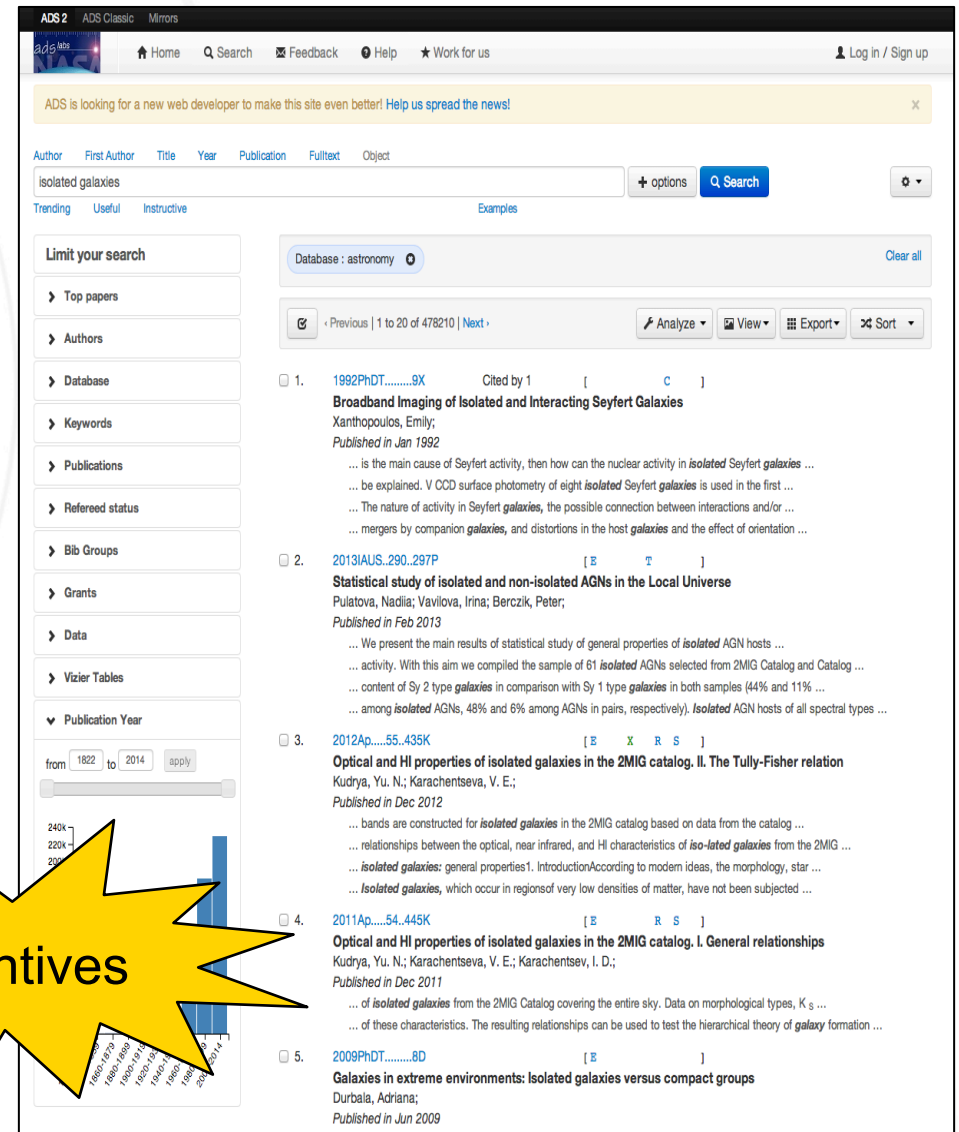
ADO Linked Components

- » Authors
- » Publications
- » Journals
- » Objects SIMBAD
- » Tabular data behind the plots CDS
- » Observing time Proposals
- » Used facilities, surveys or missions
- » ASCL reference of used software



Incentives

 <http://labs.adsabs.harvard.edu/>



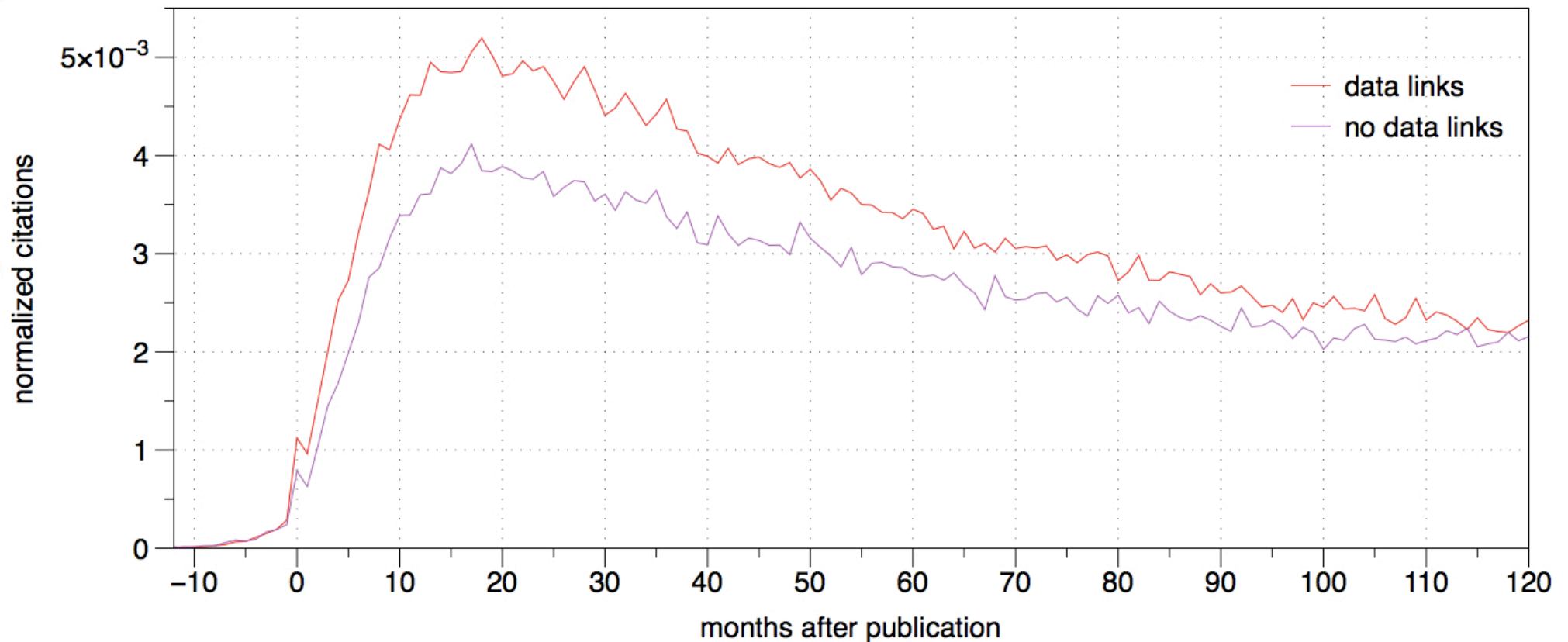
The screenshot shows the ADS 2 search interface. The search term 'isolated galaxies' is entered in the search bar. The results list includes:

- 1. 1992PhDT.....8X Cited by 1 [C]
Broadband Imaging of Isolated and Interacting Seyfert Galaxies
Xanthopoulos, Emily;
Published in Jan 1992
... is the main cause of Seyfert activity, then how can the nuclear activity in *isolated* Seyfert galaxies ...
... be explained. V CCD surface photometry of eight *isolated* Seyfert galaxies is used in the first ...
... The nature of activity in Seyfert galaxies, the possible connection between interactions and/or ...
... mergers by companion galaxies, and distortions in the host galaxies and the effect of orientation ...
- 2. 2013IAUS..290..297P [E T]
Statistical study of isolated and non-isolated AGNs in the Local Universe
Pulatova, Nadia; Vavilova, Irina; Berczik, Peter;
Published in Feb 2013
... We present the main results of statistical study of general properties of *isolated* AGN hosts ...
... activity. With this aim we compiled the sample of 61 *isolated* AGNs selected from 2MIG Catalog and Catalog ...
... content of Sy 2 type galaxies in comparison with Sy 1 type galaxies in both samples (44% and 11% ...
... among *isolated* AGNs, 48% and 6% among AGNs in pairs, respectively). *Isolated* AGN hosts of all spectral types ...
- 3. 2012Ap....55..435K [E X R S]
Optical and HI properties of isolated galaxies in the 2MIG catalog. II. The Tully-Fisher relation
Kudrya, Yu. N.; Karachentseva, V. E.;
Published in Dec 2012
... bands are constructed for *isolated* galaxies in the 2MIG catalog based on data from the catalog ...
... relationships between the optical, near infrared, and HI characteristics of *iso-lated* galaxies from the 2MIG ...
... *isolated* galaxies: general properties1. IntroductionAccording to modern ideas, the morphology, star ...
... *Isolated* galaxies, which occur in regions of very low densities of matter, have not been subjected ...
- 4. 2011Ap....54..445K [E R S]
Optical and HI properties of isolated galaxies in the 2MIG catalog. I. General relationships
Kudrya, Yu. N.; Karachentseva, V. E.; Karachentsev, I. D.;
Published in Dec 2011
... of *isolated* galaxies from the 2MIG Catalog covering the entire sky. Data on morphological types, K_S ...
... of these characteristics. The resulting relationships can be used to test the hierarchical theory of galaxy formation ...
- 5. 2009PhDT.....8D [E]
Galaxies in extreme environments: isolated galaxies versus compact groups
Durbala, Adriana;
Published in Jun 2009

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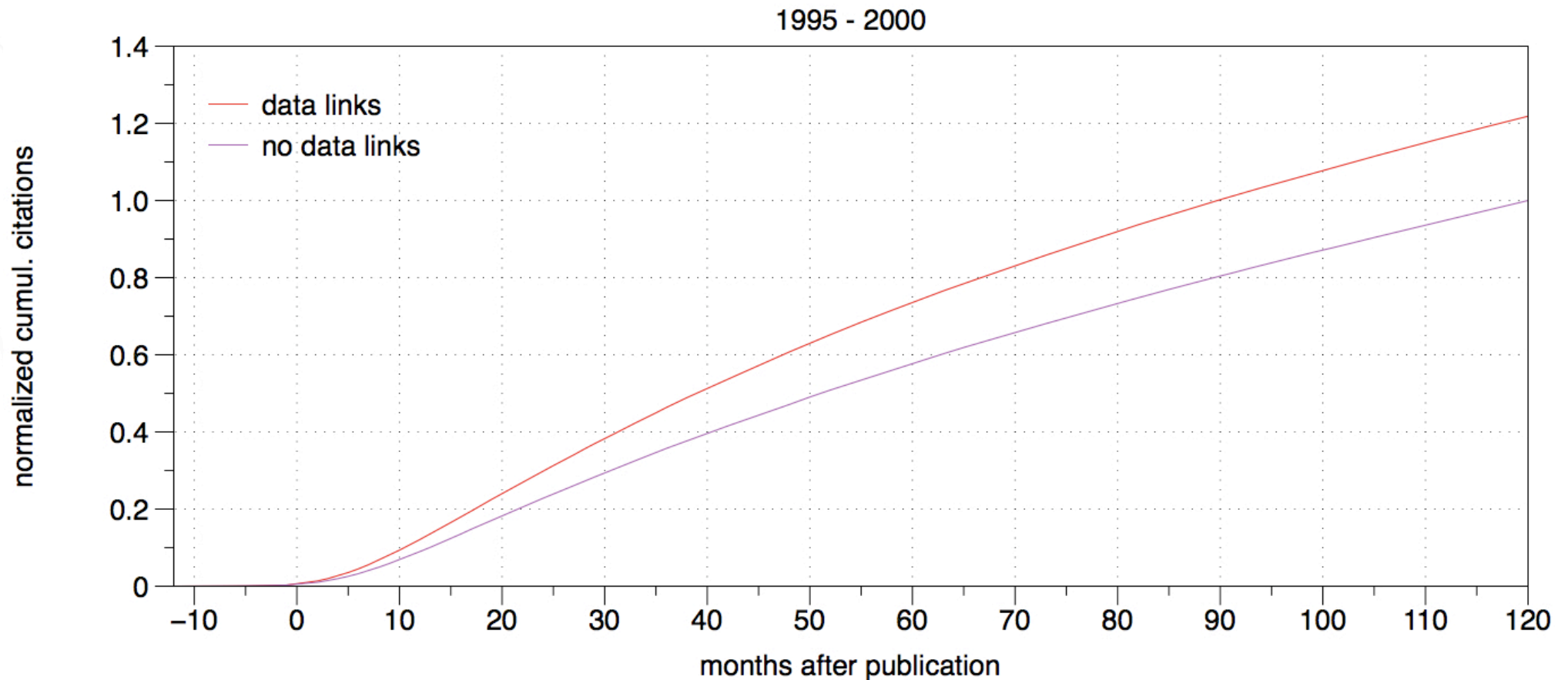
1995 - 2000



Effect of E-printing on Citation Rates in Astronomy and Physics
2006. Edwin A. Henneken et al.

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Effect of E-printing on Citation Rates in Astronomy and Physics
2006. Edwin A. Henneken et al.

Digital Science - Towards the Executable Paper

Conclusions


- » **AMIGA** group invests in projects for reproducible science
- » **Reproducibility** is at the very heart of the scientific method
- » **Open access** to all resources involved must be granted
- » **Re-use** is needed in highly specialized science to achieve efficiency
- » **Social dimension of science** stressed in the discovery process
- » Improving **visibility** is key in order to avoid reinvention
- » Time has come to go **Beyond the PDF**
- » Capture provenance and structure in the **local desktop**
- » Scientific workflows **go beyond automation** – provide clarity and structure
- » **Research Object**
 - › Modular distributed aggregation of digital resources
 - › Executable, re-usable, documented, socially curated and inspected..
- » **Other initiatives**
 - › IPython notebooks-based solutions
 - › Elsevier Paper of the Future, Authorea collaborative writing, ADSLabs, ..

How NOT to be a good Astronomer in XXI Century

- » Do marketing, just advertise your results – but do not say how to reproduce them
- » Do things quickly and forget about them once you've submitted the paper
- » Be untidy – spread your code and data in a variety of formats, folders and disks
- » Do not provide tabular data results – including the plots is just fine
- » Practise the “data mine-ing” – input data and/or results are mine
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- » Always cite the same authors and papers or those that cite you
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 <http://amiga.iaa.es/p/212-workflows.htm>

 <http://www.wf4ever-project.org>

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