



# The Semantic Astronomer?

Doug Burke

<http://hea-www.harvard.edu/~dburke/>

Chandra X-ray Center



Harvard-Smithsonian  
Center for Astrophysics



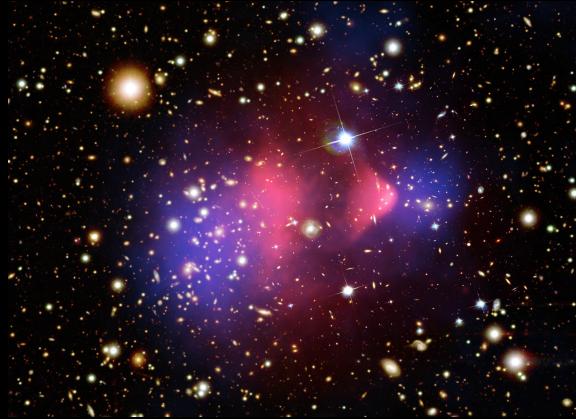
# How can semantics ...



Help me in my work?

- documentation for software use and data analysis
- build better, more intelligent, software
- finding information and data

# How can semantics ...



The bullet cluster, M. Markevitch et al. 2006

Help me in my research?

- find, reduce, and analyze data on clusters of galaxies
- formation and evolution of structure in the Universe

# How can semantics ...



**chandraxray**

Chandra is 6 km from Balabeit in Kazakhstan, at an altitude of 107,906 km

9 minutes ago from web

Help me with fun projects?

- Chandra twitter feed <http://twitter.com/chandraxray/>

Help the general Astronomical community?

Help the general public?

- ⇒ How different are the two groups?
- ⇒ Are Astronomy's semantic needs unique?

# The Chandra X-ray Observatory

Random facts from <http://chandra.harvard.edu/>

# The Chandra X-ray Observatory

Random facts from <http://chandra.harvard.edu/>

One of NASA's four “Great Observatories”

# The Chandra X-ray Observatory

Random facts from <http://chandra.harvard.edu/>

One of NASA's four “Great Observatories”

Named after the Indian/US physicist  
Subrahmanyan Chandrasekhar



# The Chandra X-ray Observatory

Random facts from <http://chandra.harvard.edu/>

One of NASA's four “Great Observatories”



Named after the Indian/US physicist  
Subrahmanyan Chandrasekhar

If Colorado were as smooth as Chandra's mirrors, Pikes Peak  
would be less than one inch tall!

# The Chandra X-ray Observatory

Random facts from <http://chandra.harvard.edu/>

One of NASA's four “Great Observatories”

Named after the Indian/US physicist  
Subrahmanyan Chandrasekhar

If Colorado were as smooth as Chandra's mirrors, Pikes Peak  
would be less than one inch tall!

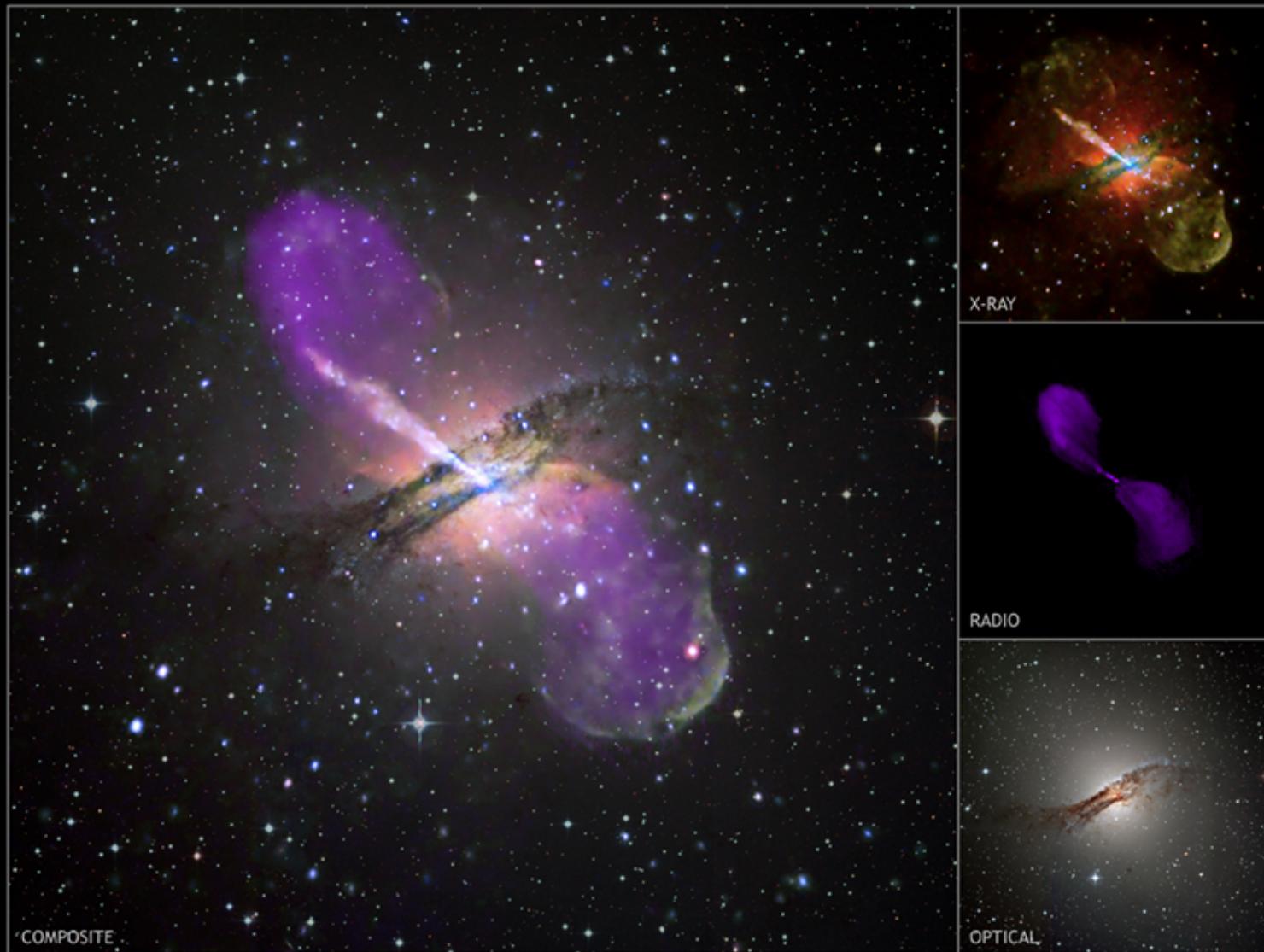
The electrical power required to operate the Chandra  
spacecraft and instruments is 2 kilowatts, about the same  
power as a hair dryer.



Photograph by [http://www.flickr.com/photos/sailor\\_coruscant/](http://www.flickr.com/photos/sailor_coruscant/)

# The Chandra X-ray Observatory

<http://chandra.harvard.edu/photo/2008/cena/>



# SAO/NASA ADS

<http://adswww.harvard.edu/>

## SAO/NASA ADS Astronomy Query Form for Mon Jul 7 16:50:57 2008

[Sitemap](#) [What's New](#) [Feedback](#) [Basic Search](#) [Preferences](#) [FAQ](#) [HELP](#)

Hint: How many papers were published in AJ Vol. 57? Find out using the [Bibcode Query](#)

[Send Query](#)

[Return Query Form](#)

[Store Default Form](#)

[Clear](#)

Databases to query:  [Astronomy](#)

[Physics](#)  [arXiv e-prints](#)

Authors: (Last, First M, one per line)

[SIMBAD](#)  [NED](#)  [LPI](#)  [IAUC Objects](#)

[Exact name matching](#)

[Object name/position search](#)

[Require author for selection](#)

[Require object for selection](#)

( [OR](#)  [AND](#)  [simple logic](#))

(Combine with:  [OR](#)  [AND](#))

[^burke, d](#)

Publication Date between

2000

(MM)

and

(YYYY)

(MM)

(YYYY)

Enter [Title Words](#)

[Require title for selection](#)

(Combine with:  [OR](#)  [AND](#)  [simple logic](#)  [boolean logic](#))

Enter [Abstract Words/Keywords](#)

[Require text for selection](#)

(Combine with:  [OR](#)  [AND](#)  [simple logic](#)  [boolean logic](#))

# SAO/NASA ADS

- [Find Similar Abstracts \(with default settings below\)](#)
- [Also-Read Articles \(Reads History\)](#)
- [Translate This Page](#)

**Title:** A Common Question From The Chandra Help Desk: How Do You Combine Or Merge Observations?

**Authors:** [Burke, Douglas J.; X-ray Center, Chandra](#)

**Affiliation:** AA(SAO), AB0

**Publication:** American Astronomical Society, HEAD meeting #10, #34.03

**Publication Date:** 03/2008

**Origin:** [AAS](#)

**Abstract Copyright:** (c) 2008: American Astronomical Society

**Bibliographic Code:** 2008HEAD...10.3403B

## Abstract

As the archive of Chandra observations grows, and the scheduling constraints on new observations becomes ever-more stringent, the number of Help Desk questions about how one should combine or merge observations has increased. In this presentation we shall describe the main scientific and technical issues behind analyzing multi-observation imaging datasets from Chandra, highlight the present support for the tasks in CIAO, and provide a forum for discussing future improvements.

---

[Bibtex entry for this abstract](#) [Preferred format for this abstract \(see Preferences\)](#)

---

[Add this article to private library](#)

[Remove this article from private library](#)

Digital Library for  
Physics &  
Astronomy.

Machine-readable  
access.

Links papers and  
data.

Looking to use  
semantic  
information.

# NED, SIMBAD, and APOD too

## NASA/IPAC Extragalactic Database

<http://nedwww.ipac.caltech.edu/>

## SIMBAD Astronomical Database

<http://simbad.u-strasbg.fr/simbad/>

## Astronomy Picture of the Day

<http://apod.nasa.gov/apod/astropix.html>

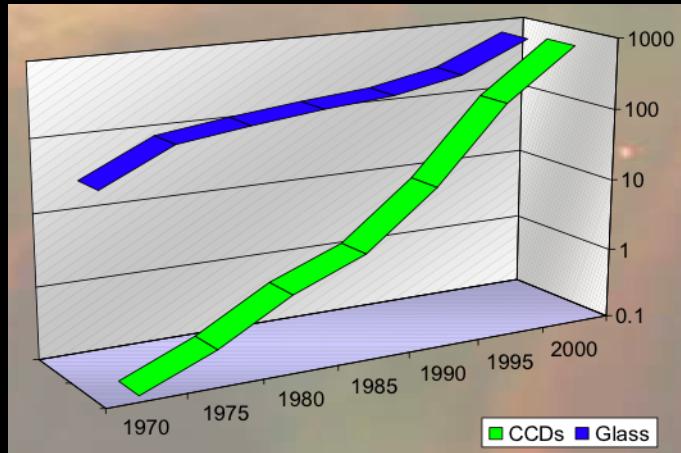
# The story so far

- ⇒ FOAF and Dublin Core, but (do we?) need something more specific to Astronomy
- ⇒ Tie in to UMBEL for general audiences?
- ⇒ Tagging/smart extraction of terms (NASA ROSES application is imminent)

# The Virtual Observatory



# The Virtual Observatory



Digital Data in Astronomy, Hanisch et al, 2008

With enough data, the numbers speak for themselves. ... There is now a better way. Petabytes allow us to say: "Correlation is enough."

Chris Anderson, Wired, 2008

Astronomy's defense against the incoming flood of data from new facilities (both observational and simulated)

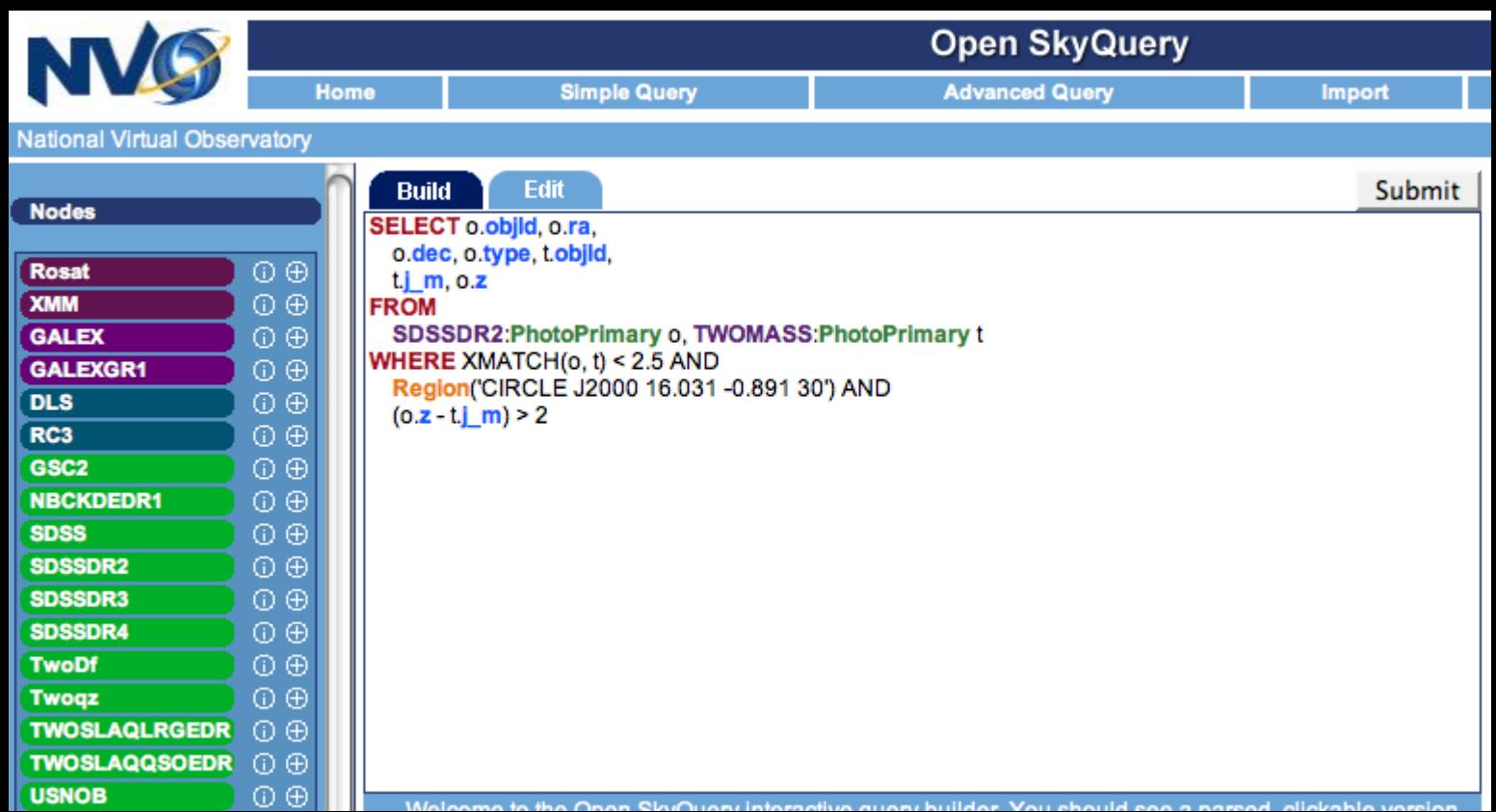


Illustration: Marian Bantjes

# The Virtual Observatory

Standards: e.g. Space-Time Coordinate Metadata

Services: e.g. cross-correlate data



The screenshot shows the Open SkyQuery interface. The top navigation bar includes the NVO logo, Home, Simple Query, Advanced Query, and Import buttons. The main area has tabs for Build (selected) and Edit. The query text is as follows:

```
SELECT o.objId, o.ra,
       o.dec, o.type, t.objId,
       t.j_m, o.z
  FROM SDSSDR2:PhotoPrimary o, TWOMASS:PhotoPrimary t
 WHERE XMATCH(o, t) < 2.5 AND
       Region('CIRCLE J2000 16.031 -0.891 30') AND
       (o.z - t.j_m) > 2
```

The left sidebar lists various data nodes: Rosat, XMM, GALEX, GALEXGR1, DLS, RC3, GSC2, NBCKDEDR1, SDSS, SDSSDR2, SDSSDR3, SDSSDR4, TwoDf, Twoqz, TWOSLAQLRGEDR, TWOSLAQQSOEDR, and USNOB. The Rosat node is currently selected, highlighted in purple.

# The Virtual Observatory

Tied together by the *registry*

No single, all-encompassing entity (although we do have a RofR)

Defines URIs using the ivo scheme

Provides information on standards, services, institutions, observatories, data, ...

⇒ Astronomy's hub for LOD (or re-inventing the web)?

# The Virtual Observatory

## “Best Practices” for Astronomy vocabularies

<http://www.astro.gla.ac.uk/users/norman/ivoa/vocabularies/vocabularies-609.xhtml>

Based on SKOS, RFC soon

- ⇒ How to deal with change?
- ⇒ How to map between vocabularies?

## Proposed RDF schema for registry data

<http://ivoa.net/Documents/latest/RDFVORRegistry.html>

## Faceted browsing of the registry with Longwell

<http://vo.cfa.harvard.edu/reports/>

# The Virtual Observatory



<http://devblogzone.blogspot.com/2008/05/worldwide-virtual-telescope-from.html>