Science Communication and Literature Searches

*If a supernova explodes in the galaxy and no one observes it does it make a flash?*

*If a supernova explodes in the galaxy and someone observes it, but nobody publishes it, does it make a flash?*

- Scientific “success” rest on the quality, but also the visibility, of your work.
- The impact of a scientific result depends on how well it is communicated, as well as on its intrinsic merit.
Whether writing a paper or giving a talk, be mindful of the composition of your audience. Frame and structure your presentation accordingly. Are they...

- Experts in the subject at hand?
- Experts in the relevant astronomy sub-field?
- Members of the astronomical community?
- Physicists?
- A proposal review panel that might include any combination of the above?
- Science media?
- Current or prospective employers?
- Non-scientists: e.g., non-science media, members of congress, the public at large, schoolchildren..?
The technical level, and amount of background material, depend on the audience, setting, and format.

Let’s suppose that you’ve just completed a major project involving X-ray observations of Active Galactic Nuclei (AGN)...

<table>
<thead>
<tr>
<th>Venue</th>
<th>Level</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGN Conference</td>
<td>Very Technical</td>
<td>None</td>
</tr>
<tr>
<td>X-ray Astronomy Conference</td>
<td>Very Technical</td>
<td>Little</td>
</tr>
<tr>
<td>Astronomy Conference, Journal Article</td>
<td>Very Technical</td>
<td>Some</td>
</tr>
<tr>
<td>Physics Seminar, Job Talk</td>
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<td>Lots</td>
</tr>
<tr>
<td>Astr288c Class Project</td>
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</tr>
<tr>
<td>Observing Proposal</td>
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<tr>
<td>Funding Proposal</td>
<td>Somewhat Technical</td>
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</tr>
<tr>
<td>Sky &amp; Tel Article or Interview</td>
<td>Slightly Technical</td>
<td>Some</td>
</tr>
<tr>
<td>Press Release or Press Conference</td>
<td>Non-technical</td>
<td>Lots</td>
</tr>
<tr>
<td>Talk at Local High School</td>
<td>Non-technical</td>
<td>Some</td>
</tr>
</tbody>
</table>

There are also time and space (page limits) considerations.
Writing and Publishing Papers: The Literature


<table>
<thead>
<tr>
<th>Type of Paper</th>
<th>Length</th>
<th>Content</th>
</tr>
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<tbody>
<tr>
<td>Letter</td>
<td>Short</td>
<td>Timely, significant result</td>
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<tr>
<td>Standard Article</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Supplement</td>
<td>Long</td>
<td>Details of a long program, new technique...</td>
</tr>
<tr>
<td>Review</td>
<td>Long</td>
<td>Existing research, in context</td>
</tr>
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</table>
http://arxiv.org/ -- a preprint server where papers often first appear
arXiv preprints are often posted before they are reviewed...

Open access to 632,567 e-prints in Physics, Mathematics, Computer Science, Quantitative Biology, and more. Subject search and browse:

Physics
Mathematics
Computer Science
Quantitative Biology

New submissions
- Astro
- Cond
- Soft
- Gene
- Replacements

Submissions received from Mon 11 Oct 10 to Tue 12 Oct 10, announced Wed 13 Oct 10.

New submissions for Wed 13 Oct 10


Binaries are the best single stars
S.E. de Mink, N. Langer, R.C. Izzard

Abstract: Stellar models of massive single stars are still plagued by major uncertainties. For this purpose one preferably uses observed stars that have never experienced strong binary interaction, i.e. "true single stars". However, the binary fraction among massive stars is high and identifying "true single stars" is not straightforward. Binary interaction affects systems in such a way that the initially less massive star becomes, or appears to be, single. For example, mass transfer results in a widening of the orbit and a decrease of the luminosity of the donor star, which makes it very hard to detect. After a merger or disruption of the system by the supernova explosion, no companion will be present.
...and often appear in multiple updated versions.
...and often appear in multiple updated versions.
Searching the Literature

• The Astrophysics Data System (ADS) at http://adsabs.harvard.edu/ has a nearly complete database of articles, and may be searched using many kinds of keys.
• Published articles may be downloaded from journal websites (if you or your institution has a subscription).
• NED can be used to search for articles related to a particular (extragalactic) object.
• arXiv.org also has a search interface.
The SAO/NASA Astrophysics Data System

Welcome to the Digital Library for Physics and Astronomy

This site is hosted by the High Energy Astrophysics Division at the Harvard-Smithsonian Center for Astrophysics

The SAO/NASA Astrophysics Data System (ADS) is a Digital Library portal for researchers in Astronomy and Physics, operated by the Smithsonian Astrophysical Observatory (SAO) under a NASA grant. The ADS maintains three bibliographic databases containing more than 8.6 million records: Astronomy and Astrophysics, Physics, and arXiv e-prints. The main body of data in the ADS consists of bibliographic records, which are searchable through highly customizable query forms, and full-text scans of much of the astronomical literature which can be browsed or searched via our full-text search interface. Integrated in its databases, the ADS provides access and pointers to a wealth of external resources, including electronic articles, data catalogs and archives. We currently have links to over 8.6 million records maintained by our collaborators.

http://adsabs.harvard.edu/
Examples of searches by author and object follow....
Full Text Search: Search OCRd text of scanned articles
## Query Results from the ADS Database

Retrieved 200 abstracts, starting with number 1. Total number selected: 341.

<table>
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<td>1</td>
<td>2010MNRAS.tmp.1460D</td>
<td>1.000</td>
<td>09/2010</td>
<td>A E F X R U</td>
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<td></td>
<td>Dauser, T.; Wilms, J.; Reynolds, C. S.; Brenneman, L. W.</td>
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<td></td>
<td>Broad emission lines for a negatively spinning black hole</td>
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<td>Gallo, L. C.; Miniutti, G.; Miller, J. M.; Brenneman, L. W.; Fabian, A. C.; Guainazzi, M.; Reynolds, C. S.</td>
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<td></td>
<td>Multi-epoch X-ray observations of the Seyfert 1.2 galaxy Mrk 79: bulk motion of the illuminating X-ray source</td>
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<td>Reynolds, Christopher S.; Brenneman, L. W.; AGN Spin Team</td>
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<td>A Long Suzaku Observation Of The Seyfert Galaxy NGC3783</td>
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<td>Schmoll, S.; Miller, J. M.; Volonteri, M.; Cackett, E.; Reynolds, C. S.; Fabian, A. C.; Brenneman, L. W.; Miniutti, G.; Gallo, L. C.</td>
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<td></td>
<td>Constraining the Spin of the Black Hole in Faintari 9 with Suzaku</td>
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**Full Text Search**: Search OCRd text of scanned articles
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<td>1</td>
<td>2010MNRAS.407..59P</td>
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<td>A E F X R U</td>
<td>Porter, R. L.</td>
<td>Broad and luminous [OIII] and [NII] in globular cluster ULXs</td>
</tr>
</tbody>
</table>

**Full Text Search:** Search OCRd text of scanned articles

Return 200 items starting with number 1
Writing and Publishing Papers: Content

Title

Authors, Affiliations

Abstract (summary, punchline)

Main body, (start with intro)

Be complete, but brief!

Context counts!
2.6. Iron and Nickel

Iron has the strongest set of lines observable in the X-ray spectrum. High-temperature clusters above 3 keV primarily have as their strongest lines the Kα set at about 6.97 and 6.67 keV for H-like and He-like iron, while lower temperature clusters excite the L-shell complex of many lines between about 0.6 and 2.0 keV. Hwang et al. (1999) have shown that ASCA determinations of iron abundances from just the L or K shell give consistent results. Iron and nickel are predominantly produced by SNe Ia.

Like iron, nickel also has L-shell lines that lie in the X-ray band. But unlike iron, the abundance determinations are driven almost entirely by the H-like and H-like K-shell lines at 7.77 and 8.10 keV. This is because the abundance of nickel is about an order of magnitude less than iron, and the nickel L-shell lines are blended with iron’s. Nickel abundances using the H-like and He-like lines are most reliable for temperatures above ~4 keV since there is little excitation of the K-shell line below this energy.

3. SOLAR ABUNDANCES

There has been some controversy in the literature as to the canonical values to use for the solar elemental abundances. The values for the elemental abundances by number that are found by spectral fitting to cluster data do not depend on the chosen values for the solar abundances. However, for the sake of consistency of elemental abundances are often reported with respect to the solar values.

Manchotzky et al. (1996) in their paper report cluster abundances with respect to the photospheric values in Anders & Grevesse (1989). In Andem & Grevesse (1989), the authors comment on how the photospheric and meteoritic values for the solar abundances were coming into agreement with better measurement techniques and improved values of physical constants, and give numbers for both the photospheric and meteoritic values. While almost all the elements were in good agreement, the iron abundance still showed discrepancies between the photospheric and meteoritic values.

There should be sufficient info (directly/indirectly) that your results can, in principle, be reproduced.
A picture is worth a thousand words...
And a table is worth at least 357.3!
9. SUMMARY

We have presented internuclear element abundances for galaxy clusters based on ASCA observations. Our measurements of the iron and silicon abundances agree with the published ASCA results of Fukazawa (1997) and Mushotzky et al. (1996) but achieve much higher precision and extend the temperature range from 0.5 to 12 keV. The measurements of the individual element abundances show some surprising results: silicon and sulfur do not track each other as a function of temperature in clusters, and argon and calcium have much lower abundances than expected.

These results show that the α-elements do not behave homogeneously as a single group. The unexpected abundance trends with temperature probably indicate that different enrichment mechanisms are important in clusters with different masses. The wide scatter in α-element abundances at a single temperature could indicate that SN models need some fine-tuning of the individual element yields, or that a different population of SNe needs to be considered an important source of metal enrichment in clusters.

We have also attempted to use our measured abundances to constrain the SN types that caused the metal enrichment in clusters. A first attempt to split the metal content into contributions from canonical SNe Ia and SNe II led to inconsistent results with both the individual elemental abundances and with the metal abundance patterns of our well-measured clusters. An investigation of different SN models also could not lead to a scenario consistent with the measured data, and we deduce that no combination of SNe Ia and SNe II fits the data. Another source of metals is needed.

acknowledgements

Credit where credit is due

Tell us what was accomplished, what remains to be done in the future, and what it all means!
LaTeX

LaTeX ([http://www.latex-project.org/](http://www.latex-project.org/)) is a typesetting (as opposed to a word processing) system where manuscript format and structure are automatically generated.

LaTeX is

• free and easily available
• commonly used for scientific documents
• can easily accommodate mathematical expressions

Many journal articles and conference proceedings, require (or strongly encourage) submitted manuscripts to be created with LaTeX, and provide templates.
LaTeX

_**LaTeX** is very powerful for typesetting mathematics._

The solution to $\sqrt{x} = 5$ is $x = 25$.

\[
\begin{equation}
\sqrt{x} = 5.
\end{equation}
\]

produces

```
The solution to $\sqrt{x} = 5$ is $x = 25$.
```

See [http://en.wikibooks.org/wiki/LaTeX/Mathematics](http://en.wikibooks.org/wiki/LaTeX/Mathematics) for list of symbols.
LaTeX

LaTeX is run in command-line mode as follows:

- `latex paper.tex` compiles the `paper.tex` LaTeX source file, producing the `dvi paper.dvi` (run this twice).
- `dvips paper.dvi -o paper.ps` produces a postscript file.
- `ps2pdf paper.ps paper.pdf` converts it into a pdf file.

LaTeX may be learned by experimenting with revisions of pre-existing source files, and referring to manuals (e.g., [http://www.giss.nasa.gov/tools/latex/](http://www.giss.nasa.gov/tools/latex/)). The homework assignment will give you an opportunity to do this.
A Little More on IDL Basics

• Lines starting with “;” are not executed (used for comments)
• These comments can be “inline.”
• help prints the name, type, and value [size] of scalar [array] arguments
• float converts from integer data type
• findgen(N) produces an array [0.0,1.0...float(N-1)]
• fltarr(I,J) creates a floating point array with I columns and J rows; all entries are initialized at 0

http://www.astro.virginia.edu/class/oconnell/astr511/IDLguide.html has useful information and a nice tutorial.
Scalars, Vectors, and Arrays in IDL

IDL> value=3.3
IDL> array=[1,2,3]
IDL> flarr=float(array)
IDL> help, value, array, flarr
VALUE      FLOAT     =          3.30000
ARRAY      INT       = Array[3]
FLARR      FLOAT     = Array[3]
IDL> print, flarr
        1.00000  2.00000  3.00000
IDL> a=fltarr(3,2)
IDL> print, a
        0.00000  0.00000  0.00000
        0.00000  0.00000  0.00000
IDL> array1=[array,array]
IDL> help, array1
ARRAY1      FLOAT     = Array[6]
IDL> print, array1
        0.00000  1.00000  2.00000  0.00000  1.00000  2.00000
IDL> array2=[[array],[array]]
IDL> help, array2
ARRAY2      FLOAT     = Array[3, 2]
IDL> print, array2
     0.00000  1.00000  2.00000
     0.00000  1.00000  2.00000
IDL> array2=[[array],[2.0*[array]+1]]
IDL> print, array2
     0.00000  1.00000  2.00000
     1.00000  3.00000  5.00000
IDL> array3=REFORM(array2[1,*])
IDL> help, array3
ARRAY3 FLOAT = Array[2]
IDL> print, array3
     1.00000  3.00000
IDL> array3=array2[1,*]
IDL> help, array3
ARRAY3 FLOAT = Array[1, 2]
IDL> print, array3
     1.00000
     3.00000
     3.00000
IDL> array4=REFORM(array3)
IDL> help, array4
ARRAY4 FLOAT = Array[2]
IDL> print, array4
     1.00000  3.00000