

Preparing figures for publication and presentations

Ram Seshadri

Materials Department and Department of Chemistry & Biochemistry
Materials Research Laboratory
University of California, Santa Barbara, CA 93106

Thanks to:

The Seshadri group (UCSB)

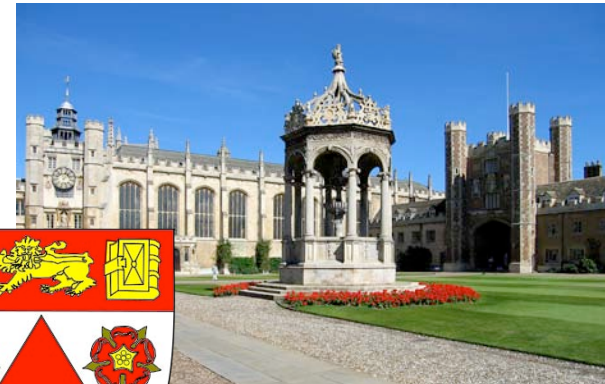
<http://www.mrl.ucsb.edu/~seshadri>



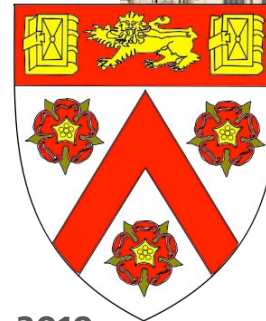
UC SANTA BARBARA
science & engineering

The Cheetham group (Cambridge)

<http://www.msm.cam.ac.uk/fihm>



Jamie Neilson (Morse group, UCSB)



Philosophy

As researchers, we expend a great deal of thought, time, and money to generate data.

Surely it makes sense to treat data with respect, and to present them in the best possible manner, paying heed to *verity*, *legibility*, and *æsthetics*.

Thoughts on fonts

Serif-free (Frutiger Linotype)

Lorem ipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum

Good for labeling, and for short strings of text. NOT good with paragraphs. Projects well.

Serif (Minion Pro)

Lorem ipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum

NOT good for labeling, or for short strings of text. Good with paragraphs. Prints well.

Thoughts on comic sans

A fun font to use in the invitation you send to your friends Heather and Pedro and Dylan and Kumar and Jazmyn and Fatima, to your 8th birthday party. Yay!



<http://www.bbc.co.uk/news/magazine-11582548>

Thanks to Jamie Neilson for the link.

If you do want to use a less formal font:

Try Andika Basic (www.sil.org)

Lorem ipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum

Caveat:

Ensure that you embed fonts in presentations (pptx) and in pdf files. In general, share pdf files rather than pptx, or at least, share both.

Fonts that do not need embedding, usually:

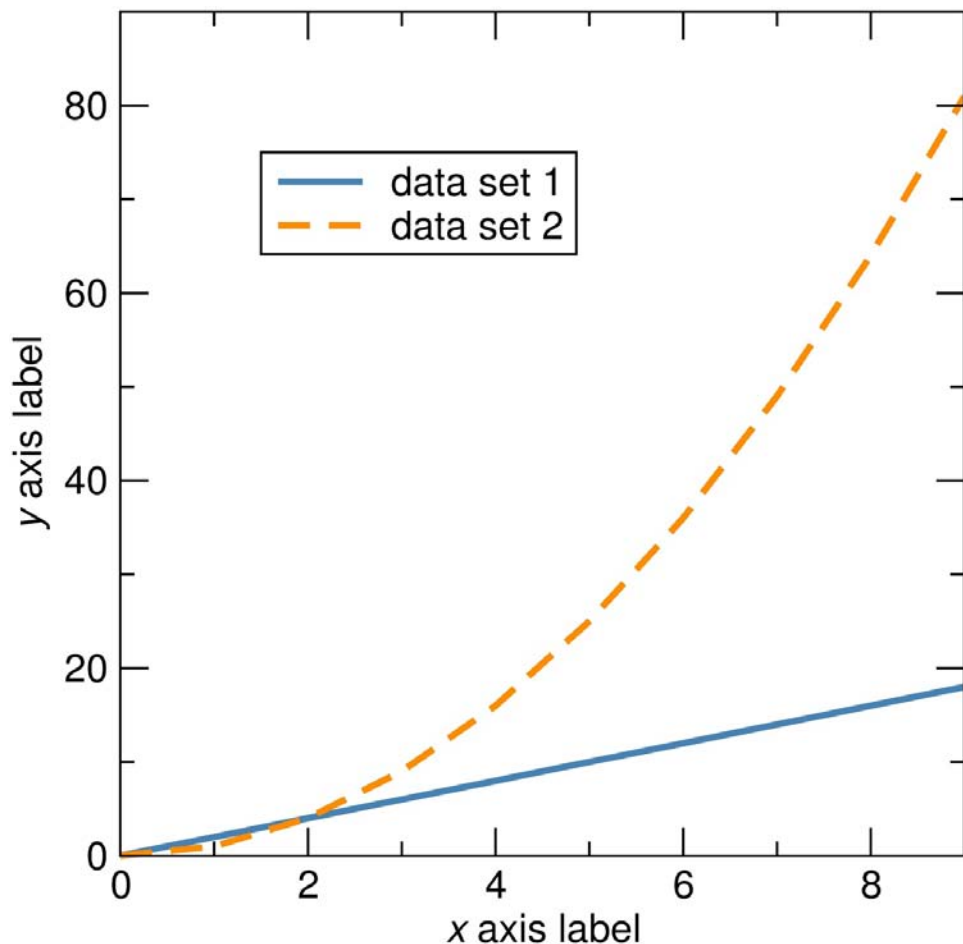
Arial/Helvetica

Times New Roman

Palatino Linotype

Trebuchet MS

A good plot



Square plots are aesthetically appealing, convey information, and *shrink gracefully*. It is easy to use them in theses, single column journal articles, and talks.

Blue and orange are contrasting colors and have high visibility. They are usually visible to most color-blind people as well.

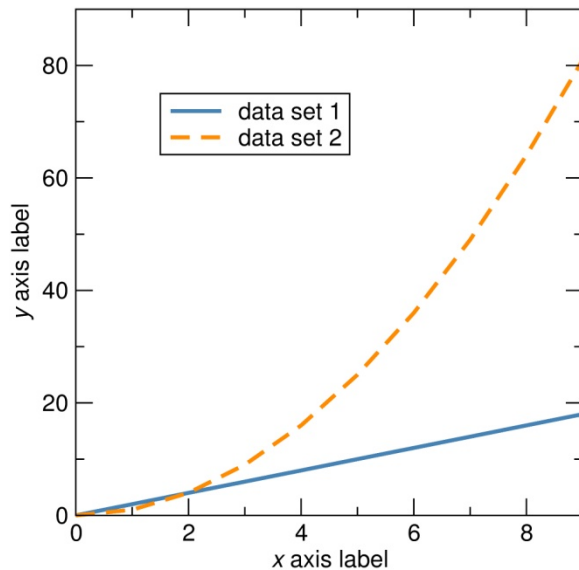
Using *redundant coding* is helpful. The plot shown here would be legible when reproduced in black and white as well, because one of the lines is dashed.

An appropriate frequency of tick labels should be used. Tick and axes labels should be the same size, preferably.

Serif-free fonts have higher legibility. Calibri, Gill Sans, and Helvetica look nicer than Arial. Times New Roman is a bad idea.

5 in

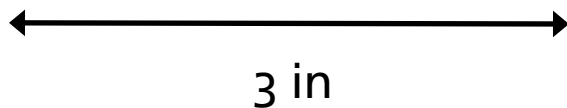
A good plot



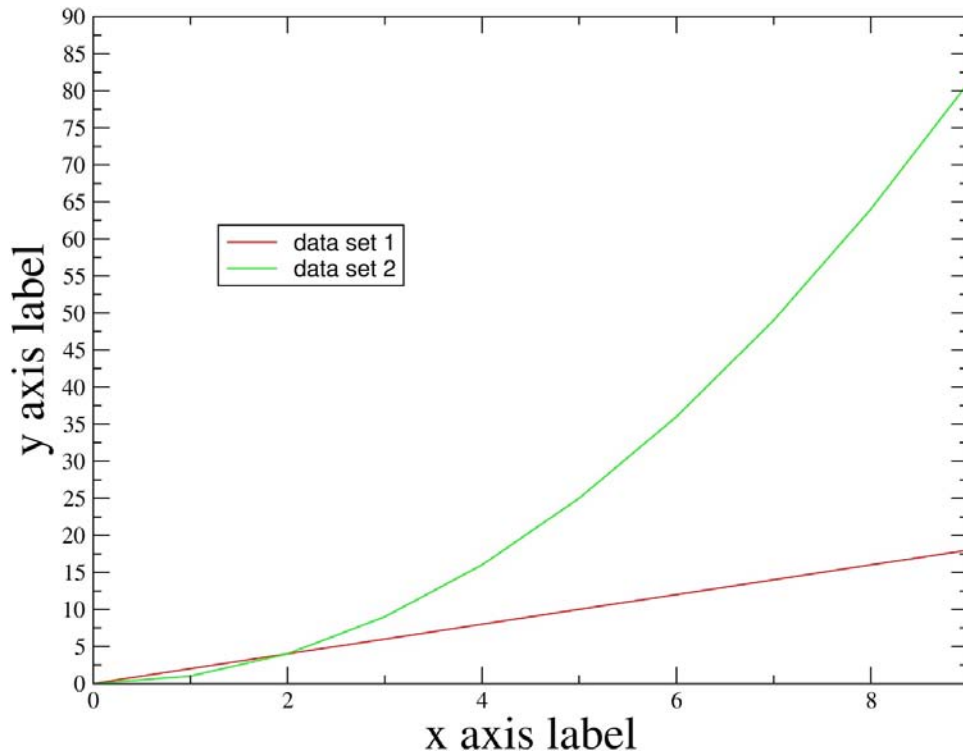
The square plot reduces in size in a manner that retains legibility. It is important to create the original plot in a size that is close to what will appear in final use.

In particular, one should pay attention to the ratio of the size of the font used – in tick and axes labels, and in legends – to the height and width of the plot as it appears in the final document or presentation.

Place legends in the plot. Don't use terms like "dashed orange line" in the figure caption.



A bad plot



Rectangular plots (the default with some graphing programs) are less aesthetically pleasing, and the horizontal and vertical axes are imbalanced.

Such a plot may appear acceptable when printed out fully in landscape mode on a sheet of a4 or US letter paper, but does not shrink gracefully in publications.

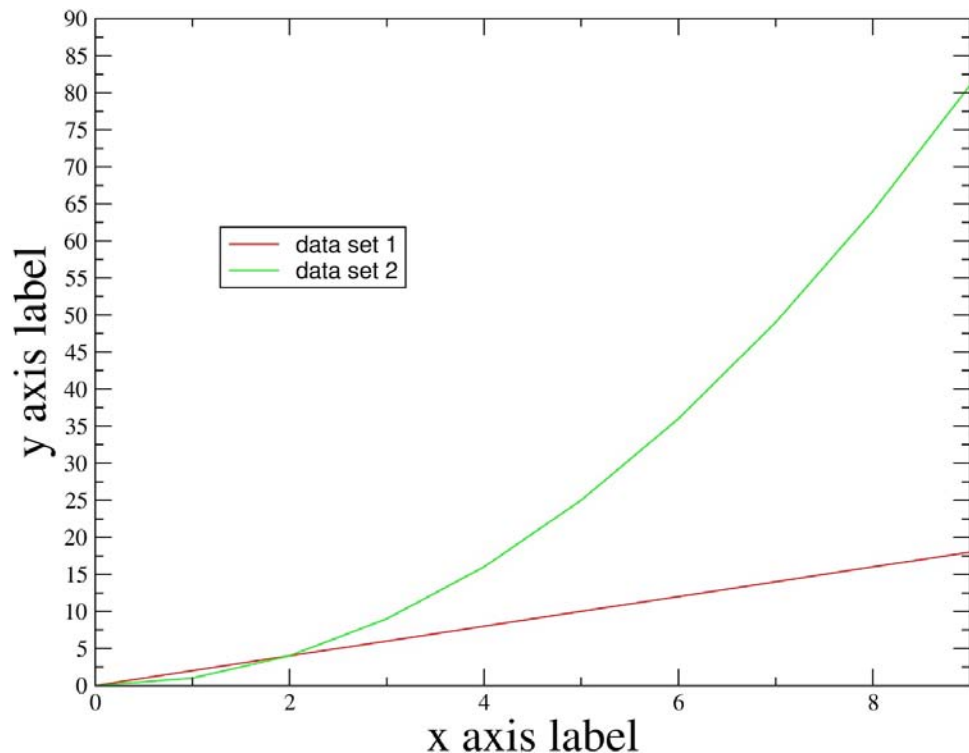
In this plot, there are many other problems:

Red and green are bad choices, with rather low visibility. A significant proportion of the population would not distinguish them. The lines in this plot are too thin as well.

Avoid primary red, blue, green, YELLOW

There is no *redundant coding* used. In a b&w printout, it would be hard to distinguish the lines.

A bad plot



Problems (contd.):

The lines are too thin (*the plot thickens?*)

Fonts with serifs are used. These have reduced legibility, particularly when shrunk.

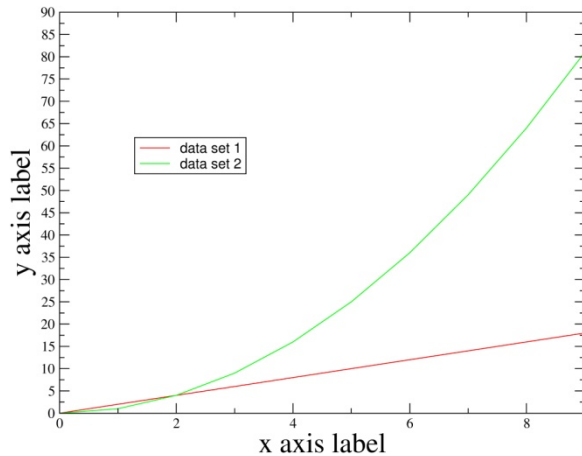
The tick labels are too small. *Why use different font sizes for the tick and axes labels?*

The vertical axis has too many tick labels and tick marks. The vertical and horizontal axes are imbalanced in that sense.

The plot could be worse. At least it is not pixelated or badly aliased, and the resolution is acceptable.

←—————→
5 in

A bad plot, compared

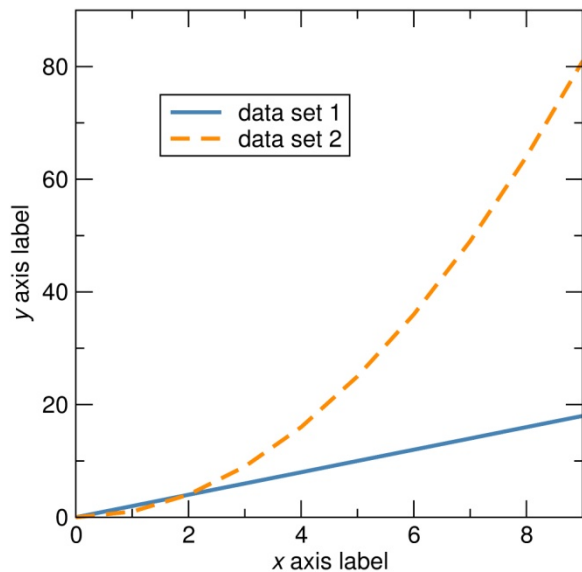


This plot absolutely does not shrink gracefully.

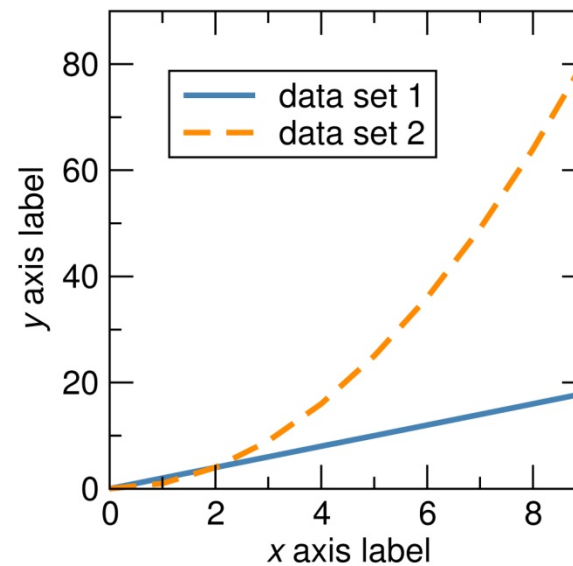
Compare it with our better example.

However, if this were the final size sought, *both* plots have labels that are too small.

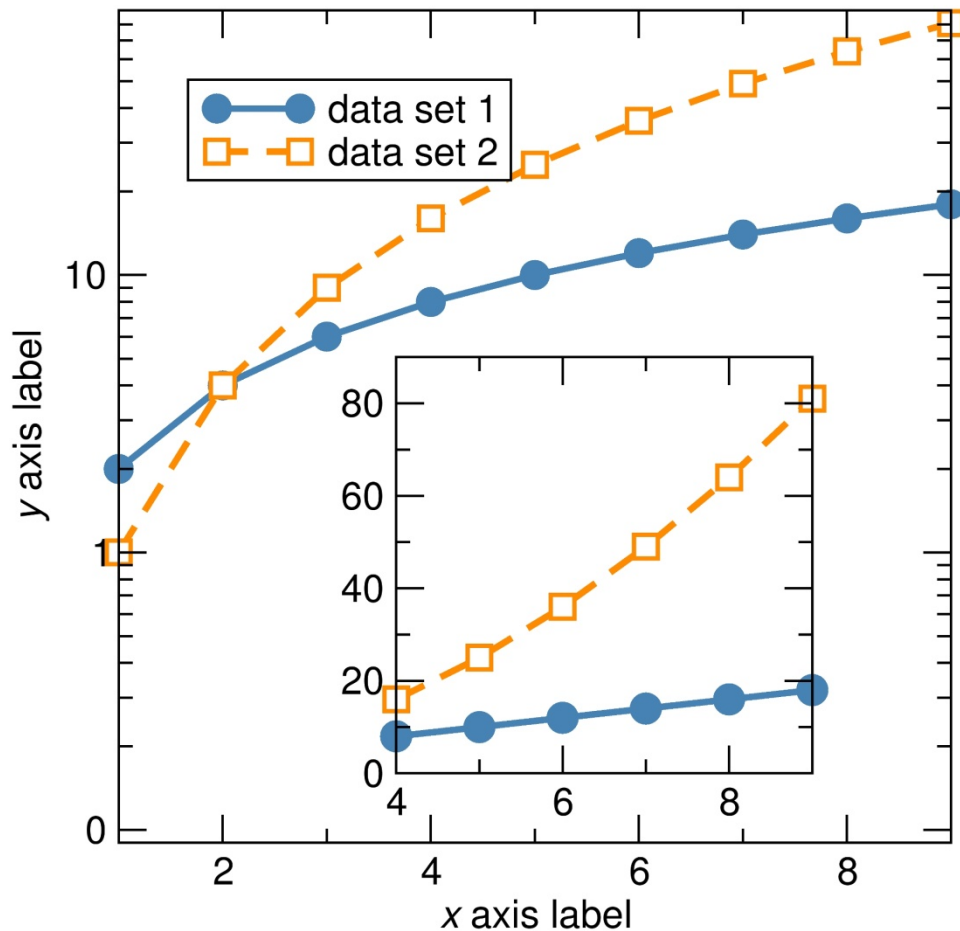
The solution would have been to resize the plot in the original plotting software, as shown below in order to obtain an appropriate ratio between font size and plot size.



←—————→
3 in



Insets (how to make them)



A common problem with insets is that they are frequently shrunk in every sense ... symbols, text *etc.*

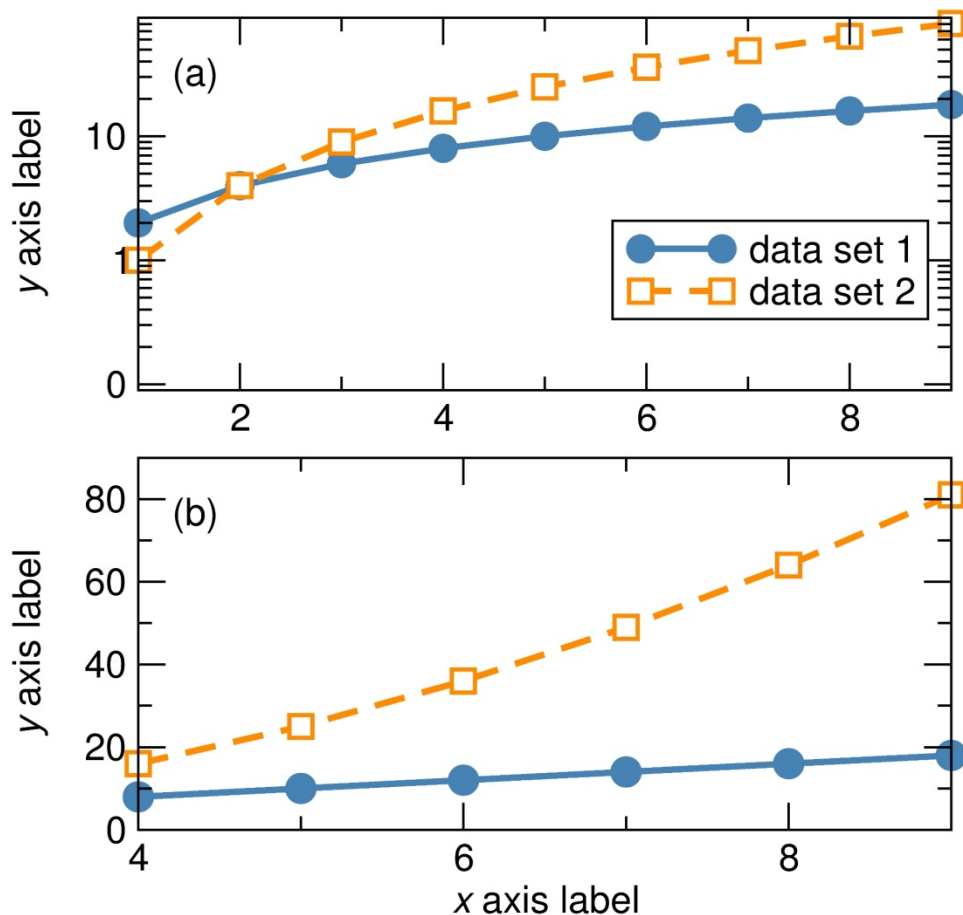
There is no need to shrink down the size of symbols, axes labels, tick labels *etc.*

Also, there is no need to provide axes labels for the inset if the inset only expands (or otherwise displays) the same data.

Note that in this and the next plot, we make use of symbols, with further *redundant coding*.

We use distinct symbols for the two datasets, in addition to using color-filled and white-filled (or unfilled) symbols.

Insets (alternatives to them)



However, insets frequently do not do justice to data.

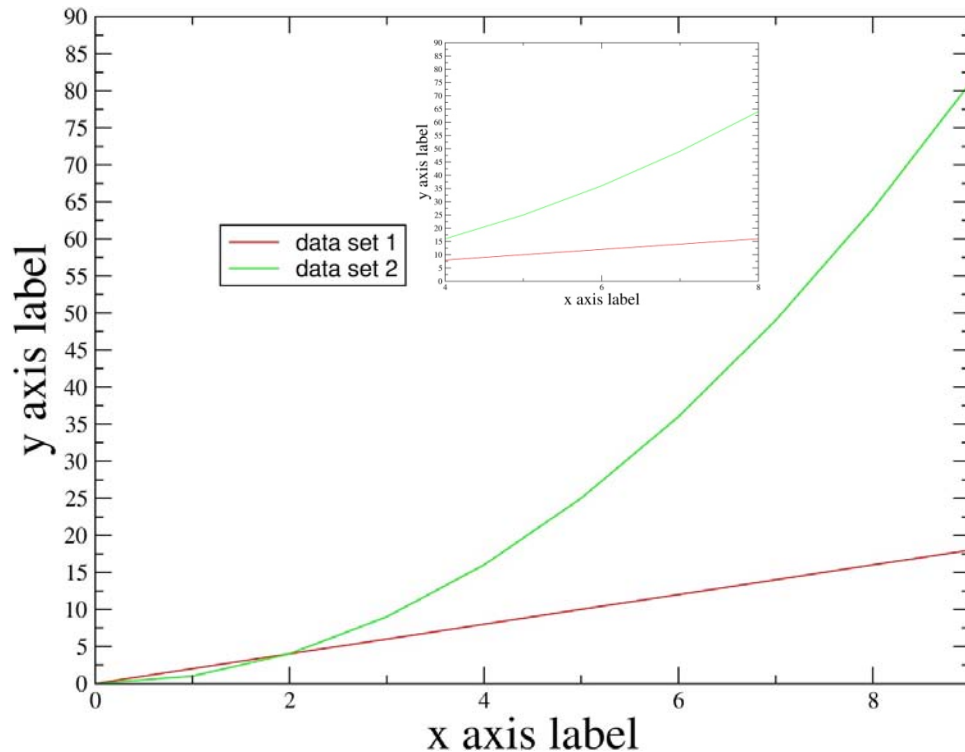
Consider multiple panels instead. Do note that in plotting the data as performed here, there is no more (screen/paper) real estate used than in the case when the inset was employed.

Note that the label on the horizontal axis is provided only once, since it is shared between panels (a) and (b).

Also note that the labels on the vertical axes are aligned, as are "(a)" and "(b)"

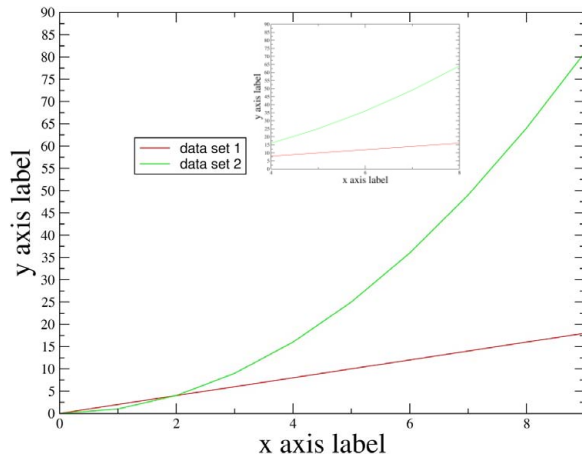
Insets (the example not to follow)

Perhaps an extreme example, but unfortunately not rare.



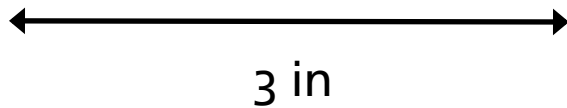
← 5 in →

Insets (the example not to follow)

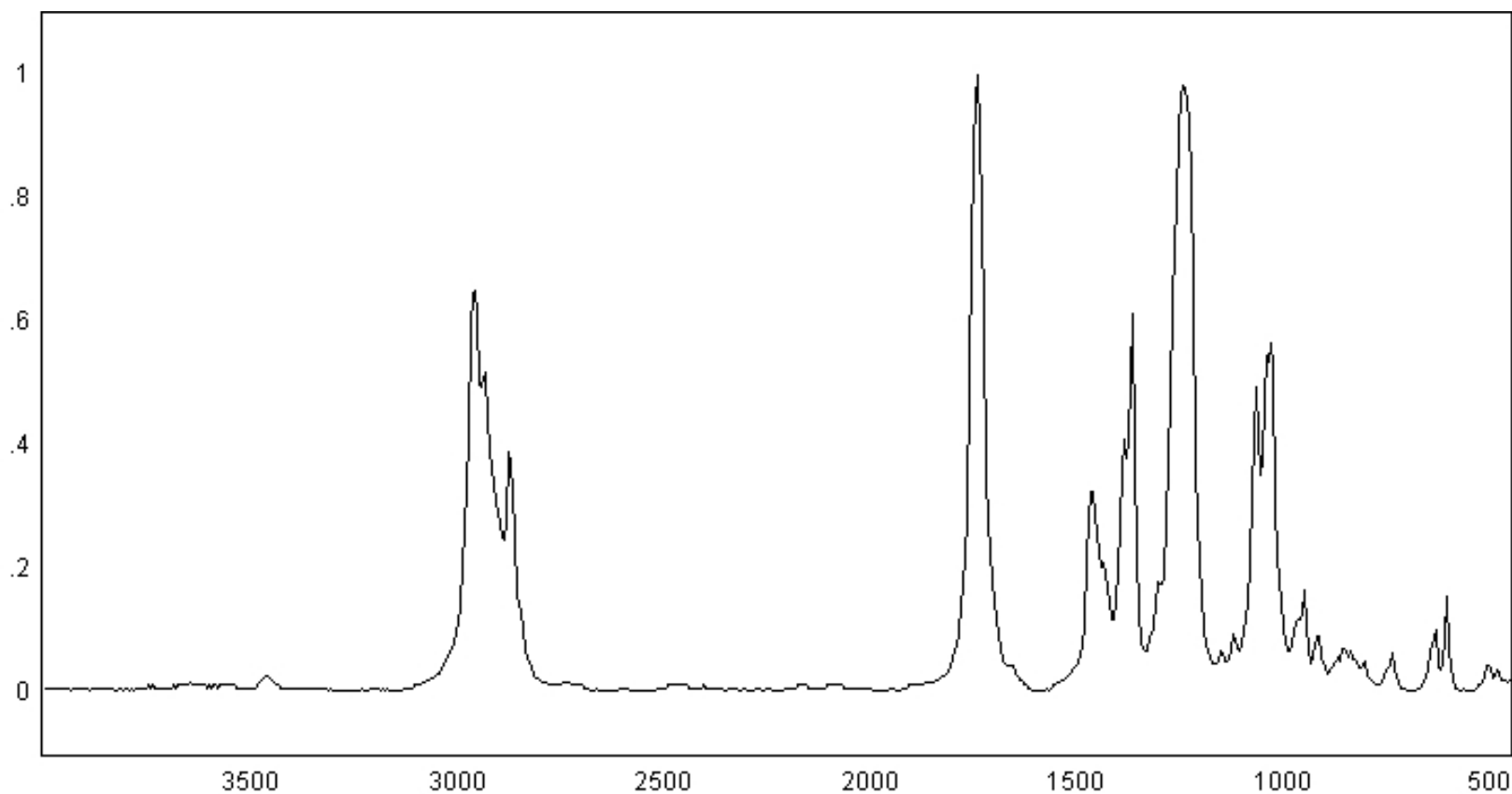


And just when you thought it couldn't get worse !

Remember that journals *will* reduce figures to the width of a single column.



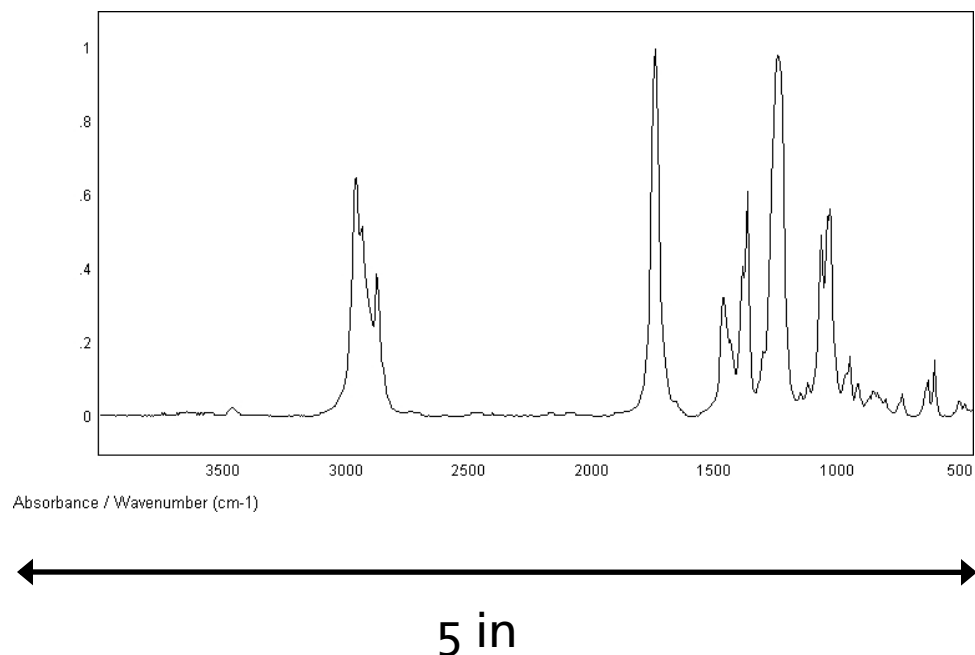
Plots from instruments



Absorbance / Wavenumber (cm-1)

Vendors of commercial instruments (FTIR spectrum from a manufacturer's website shown here) are interested in presenting their data for A4/US letter landscape printouts ...

Plots from instruments

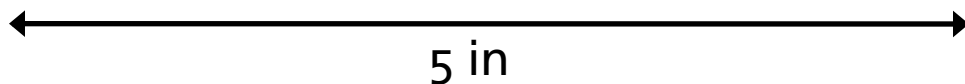
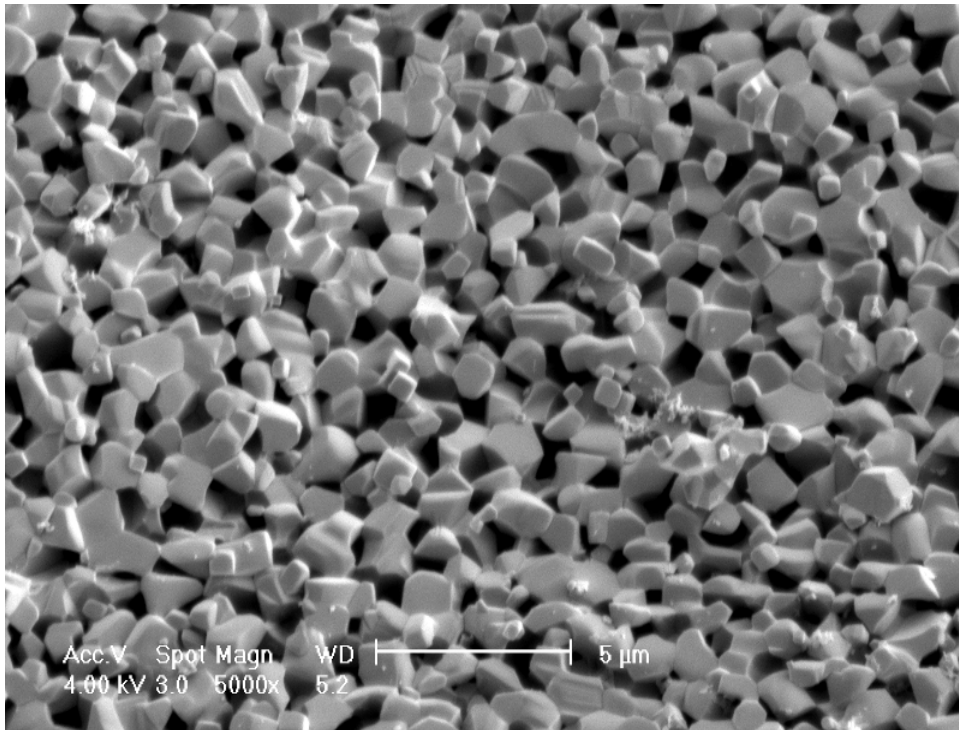


... *not* for reproduction in the scientific literature (or even in talks !) Also cm⁻¹ is not a unit, cm⁻¹ is. "0.2" and "0.4" etc. are preferred over ".2" and ".4"

The saving grace in this example is that the figure is not pixelated. Where are the tick marks ?

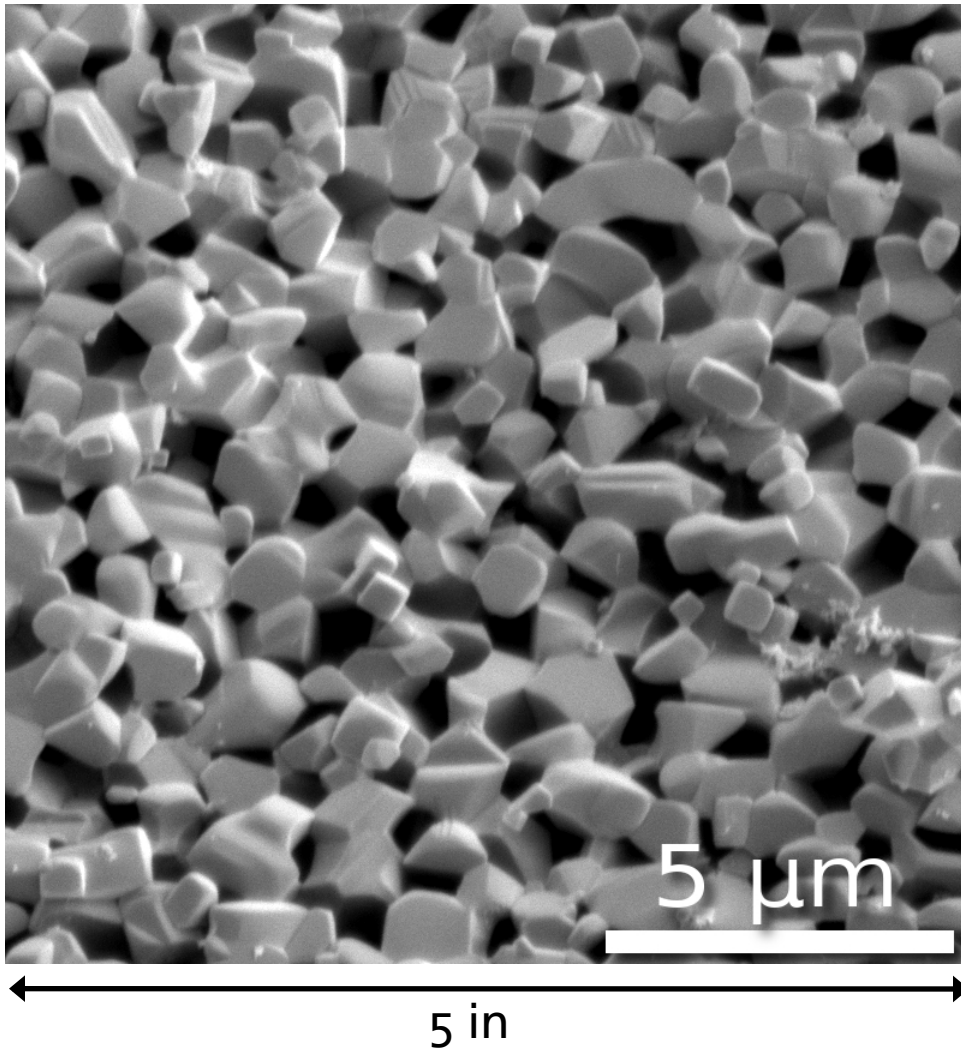
Do export ASCII (txt) files from the instrument and re-plot the data using appropriate graphing software.

Microscopy and images



The text on micrographs (SEM image from Eric Toberer) as obtained directly from the instrument, frequently carries useless information, and the scale bar is usually too small.

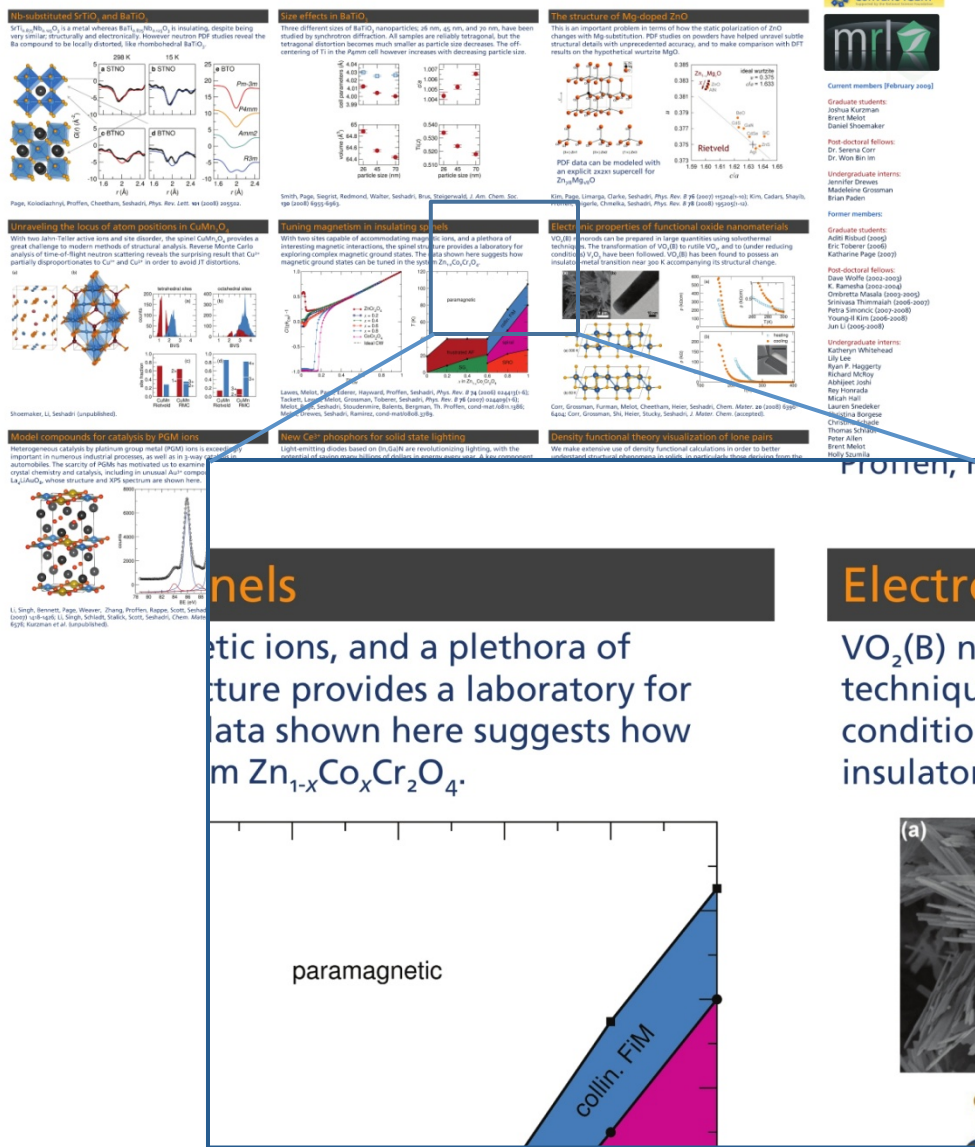
Microscopy and images



With a little effort using GIMP (www.gimp.org), a much more usable image can be created. The (personal) preference is for square images. Shadowing enhances text legibility here.

Exporting an annotated figure from PowerPoint

Ram Seshadri Group: Structure-Property Relations in Functional Inorganic Materials
Materials Department, and Department of Chemistry and Biochemistry
University of California, Santa Barbara CA 93106. <http://www.mrl.ucsb.edu/~seshadri>



Plots and images are annotated with ease, and the preparation of schematic images is convenient within PowerPoint.

How are these best exported? The resolution of jpg files (or other bitmap formats) saved from PowerPoint is rather low.

One solution is to export as a print quality PDF which can then be opened in GIMP with near arbitrary resolution, and then saved as a bitmap image. An example is displayed on the left, created from a PowerPoint poster. A portion of the jpg is shown as well, in order to show the resolution of the original image.



ConvEne IGERT



Current members (February 2008)

Graduate students:
Jaffar Karimian
Brent Meier
Daniel Srinivasar
Post-doctoral fellows:
Dr. Serena Carr
Dr. Won Bin
Undergraduate interns:
Jennifer Drees
Maddeline Grossman
Brian Padden

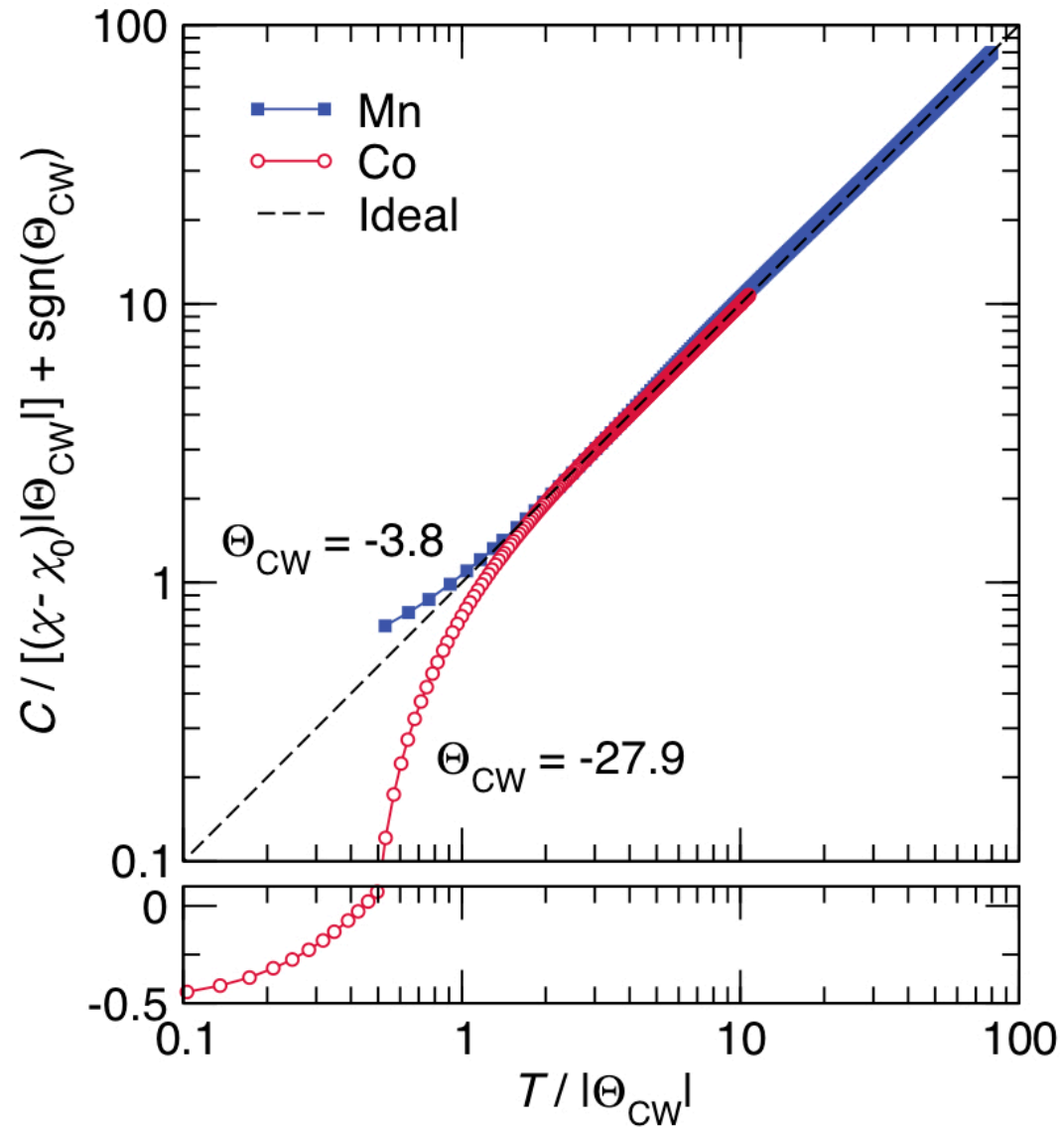
Former members:

Graduate students:
Adil Kulkarni (2003)
Eric Toberer (2003)
Katherine Page (2003)
Post-doctoral fellows:
Dave Wolfe (2002-2003)
K. Ramakrishna (2002)
Ombretta Mariani (2002-2003)
Srinivas Thirumalaiah (2002-2003)
Petra Simonovic (2002-2003)
Young Il Kim (2002-2003)
Jun Li (2002-2003)

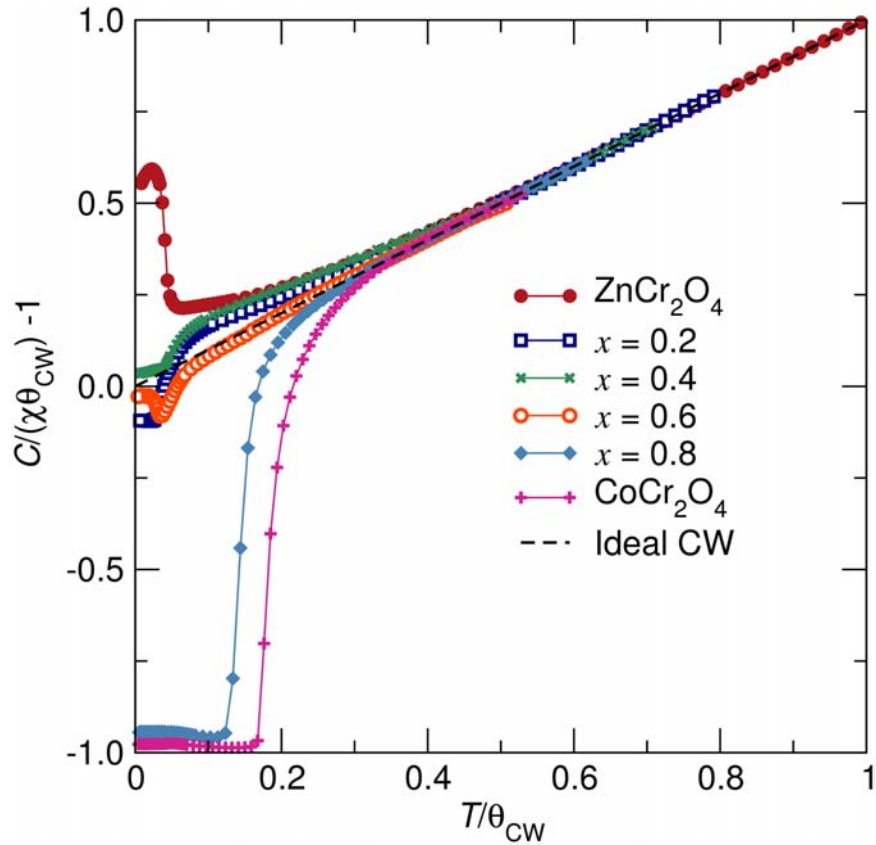
Undergraduate interns:
Katherine Srinivasar
Lily Lee
Paul P. Haggerty
Richard McKay
Ashley Boyd
Ray Hernandez
Mikah Hall
Lauren Smedley
Thomas Srinivasar
Peter Allen
Brian Meier
Emily Stanton

Examples of acceptable figures

Jamie Neilson

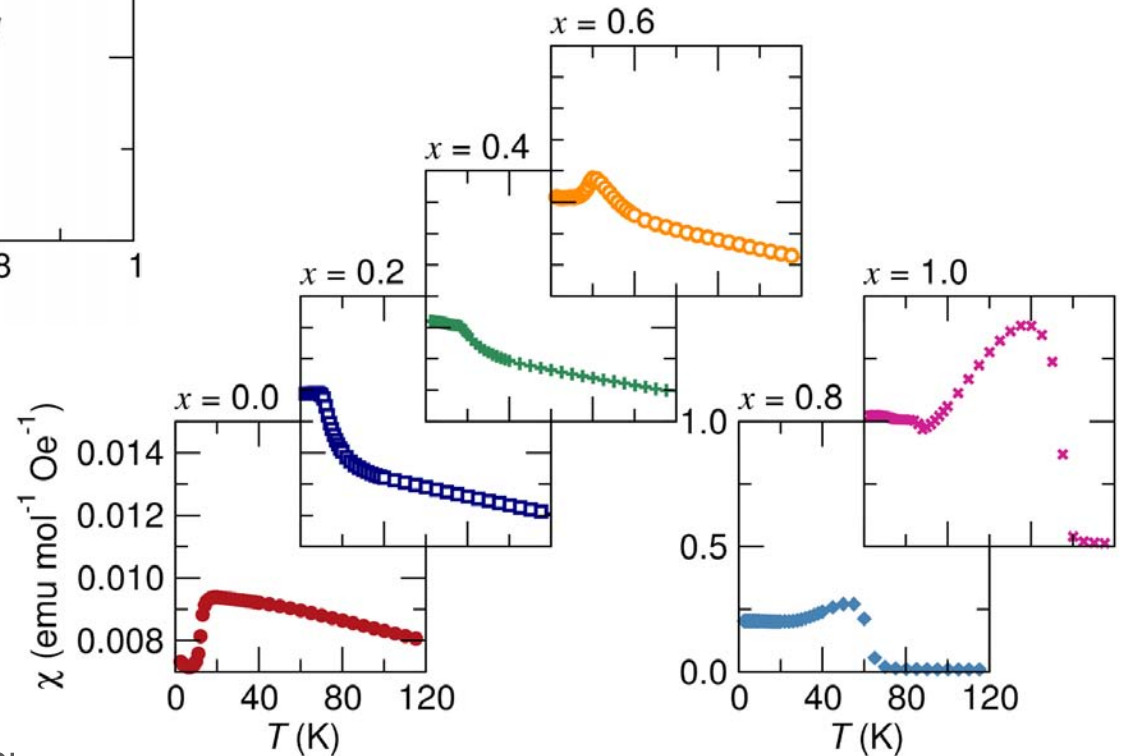


Examples of acceptable figures

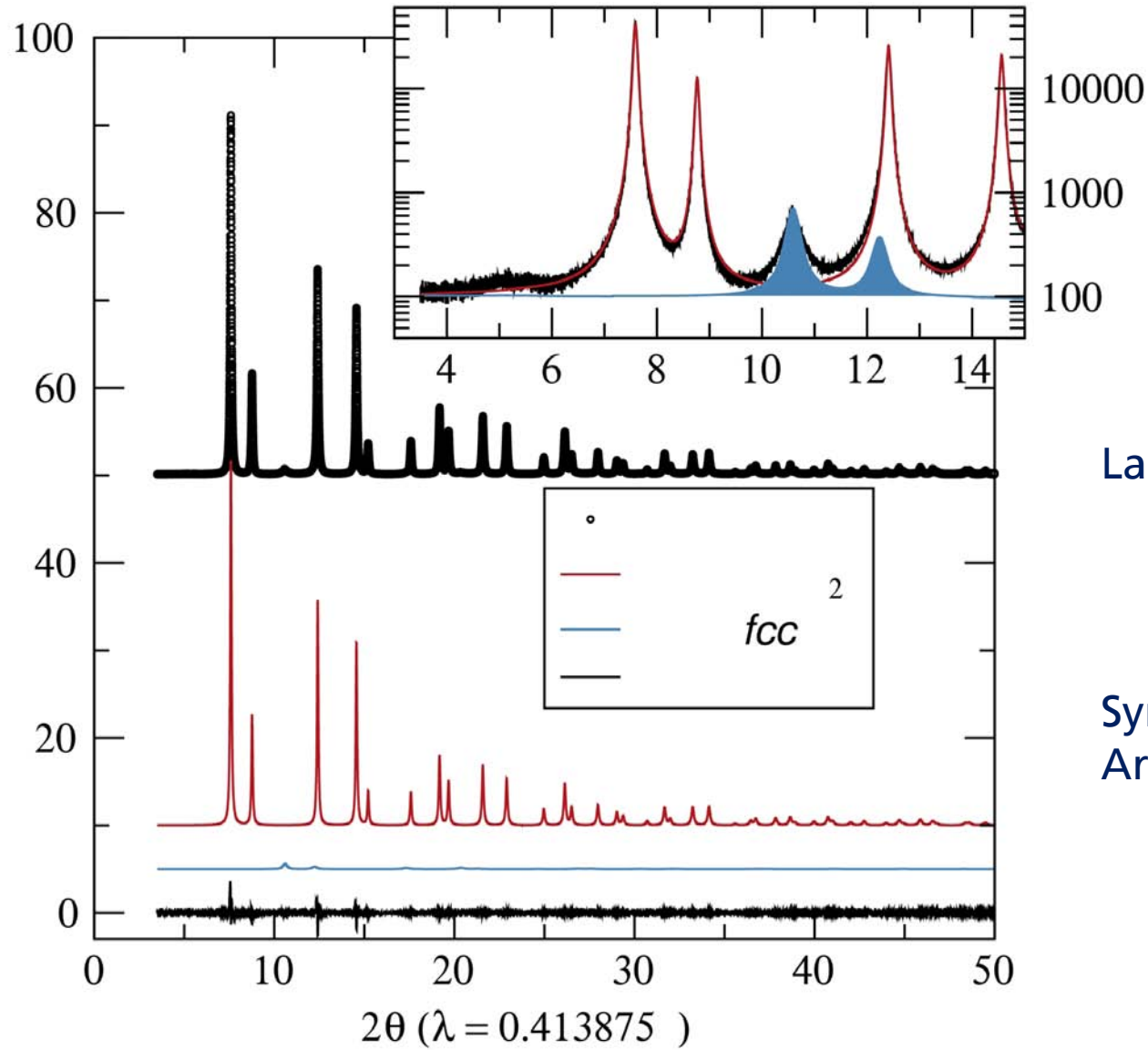


Brent Melot

Melot, Drewes, Seshadri,
Stoudenmire, Ramirez,
J. Phys.: Condensed Matter **21**
(2009) 216007(1–7).



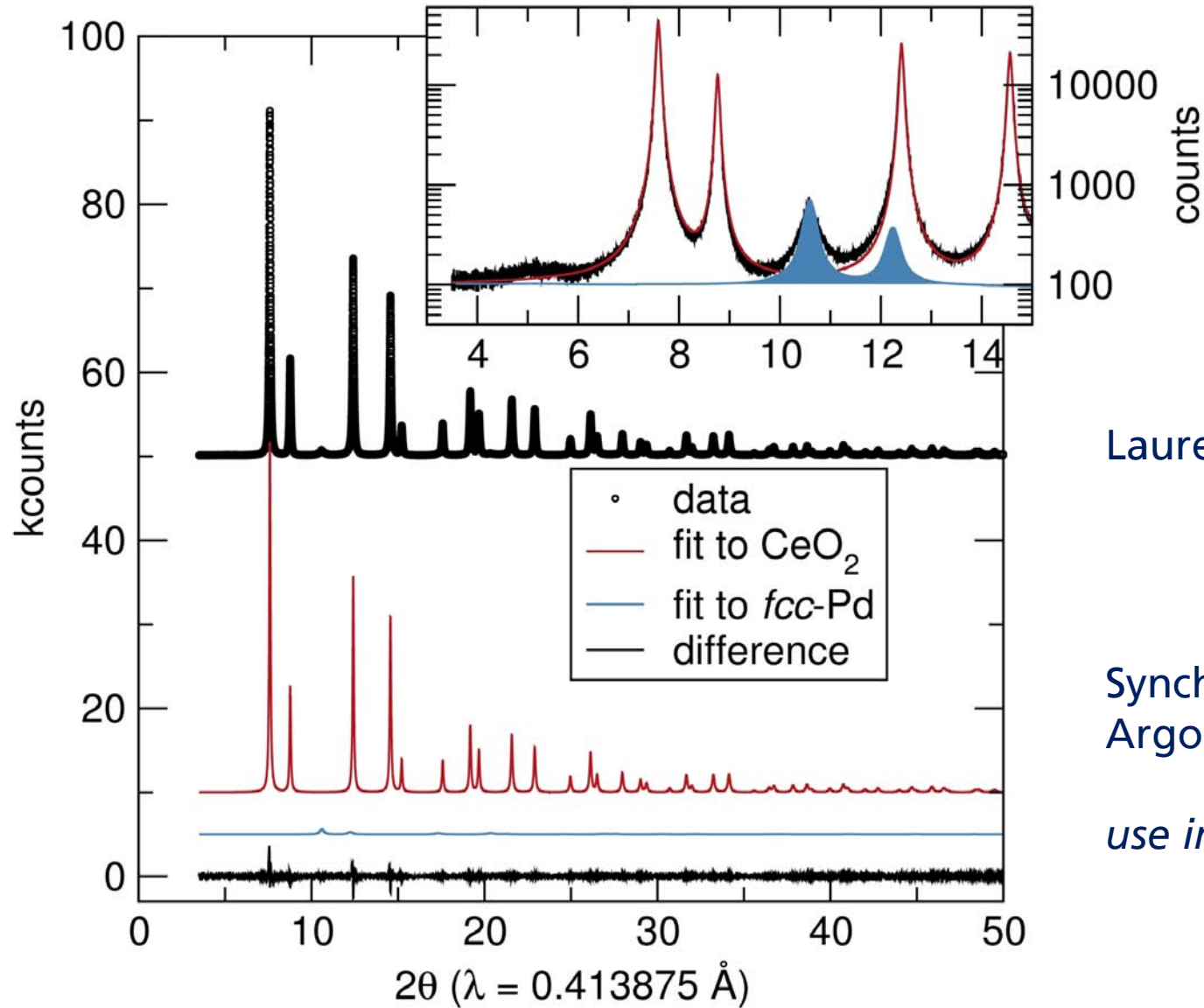
Examples of acceptable figures (oops !)



Lauren Misch

Synchrotron X-ray (APS,
Argonne 11-BM) data

Examples of acceptable figures

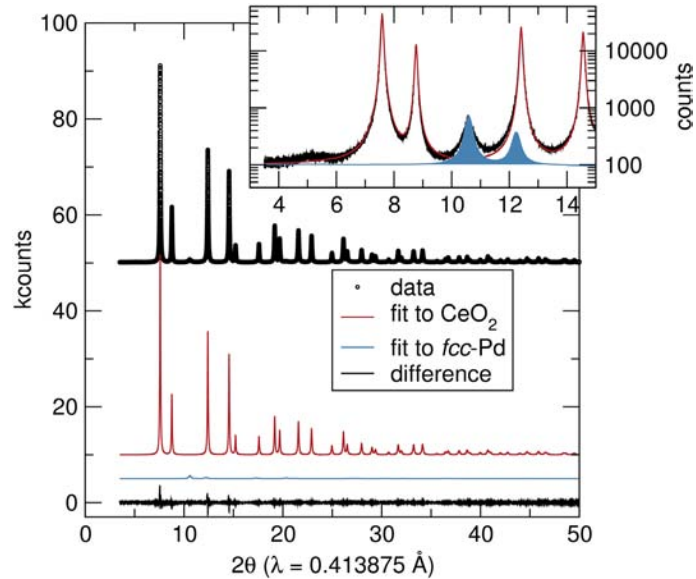


Lauren Misch

Synchrotron X-ray (APS,
Argonne 11-BM) data

use images! (jpg or png)

Examples of acceptable figures



Lauren Misch

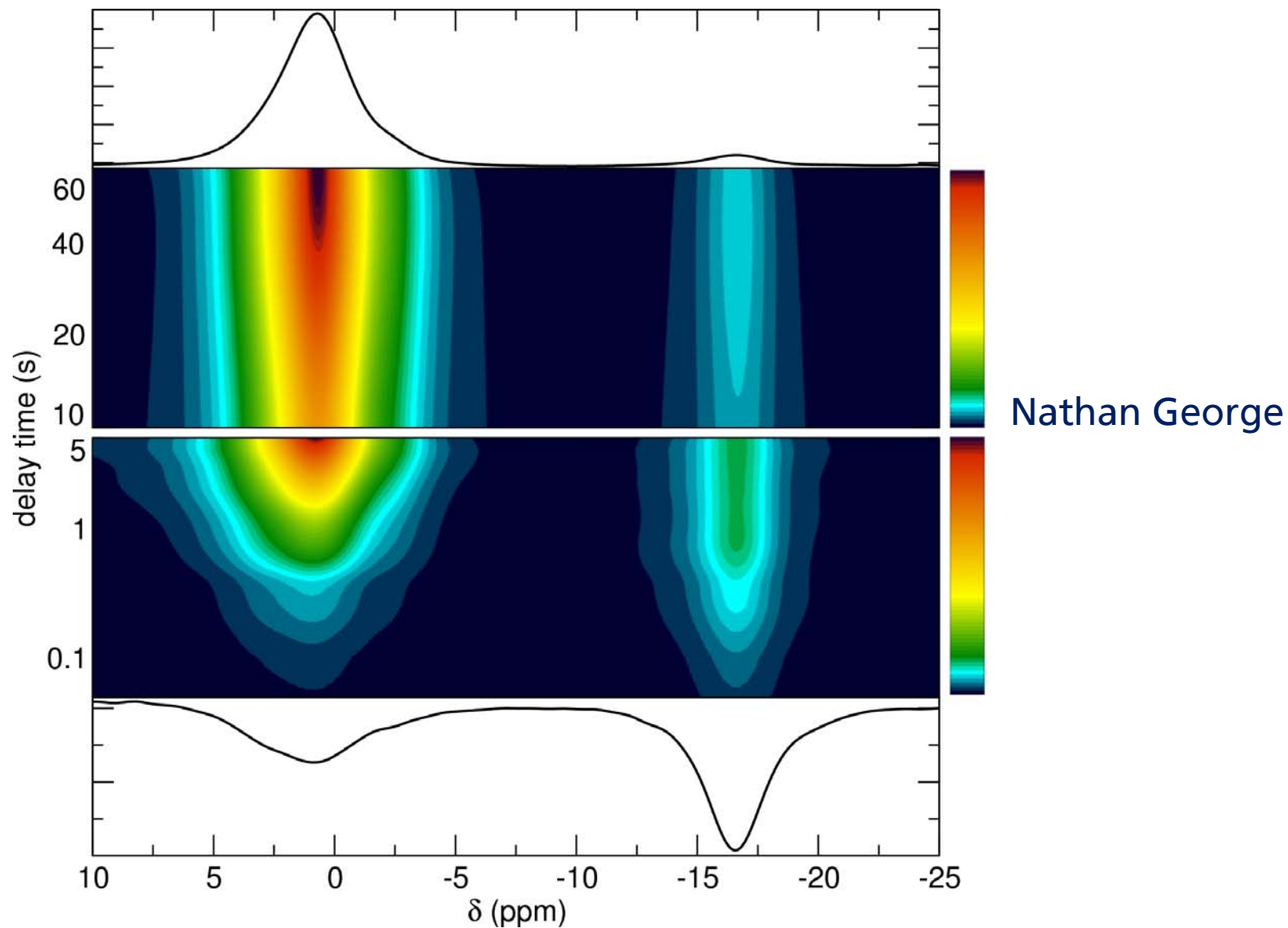
Yes, it shrinks gracefully.

Text size in inset is NOT shrunk.

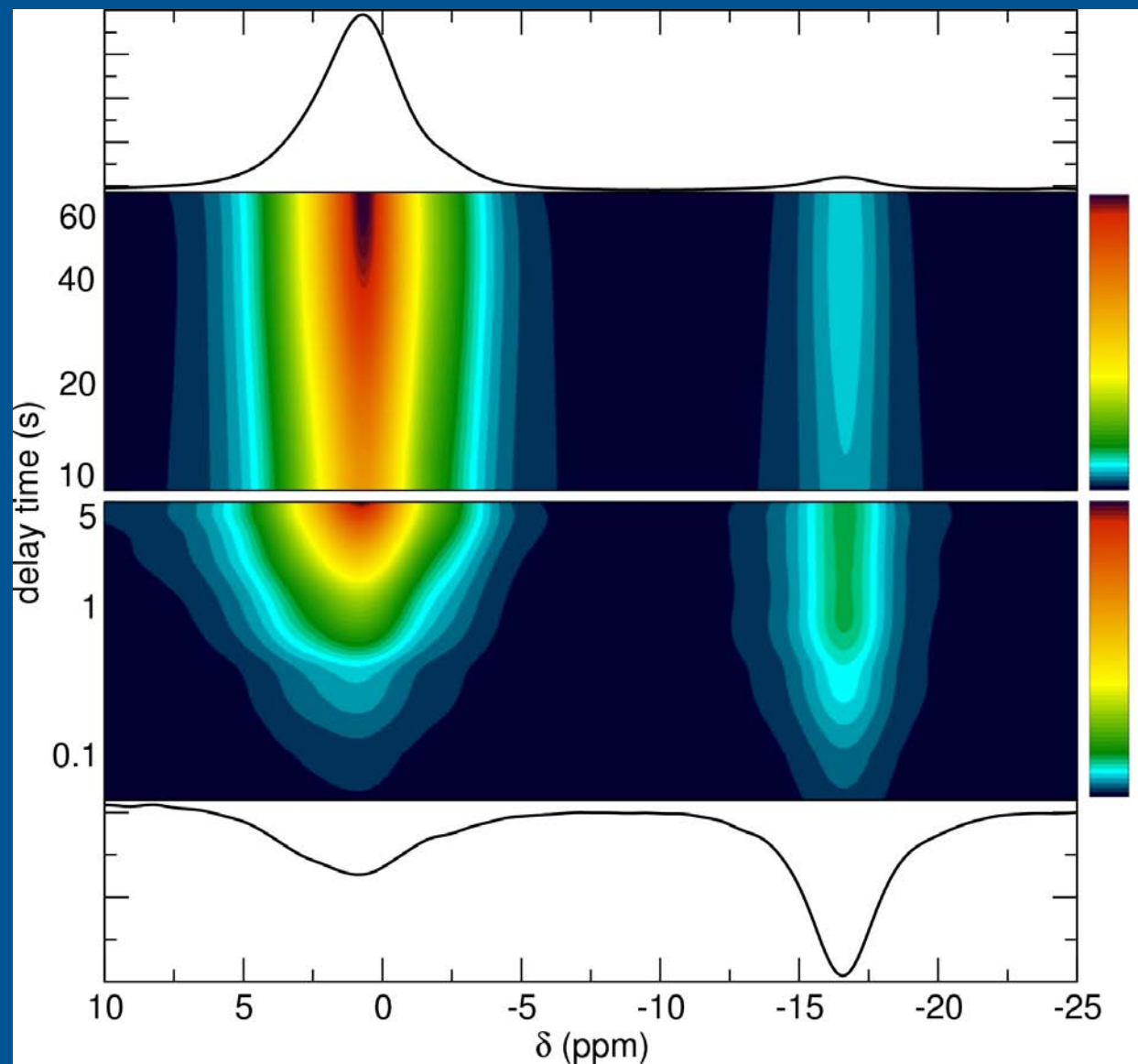
The inset is NOT log counts.

Omit redundant axis labels.

Examples of acceptable figures

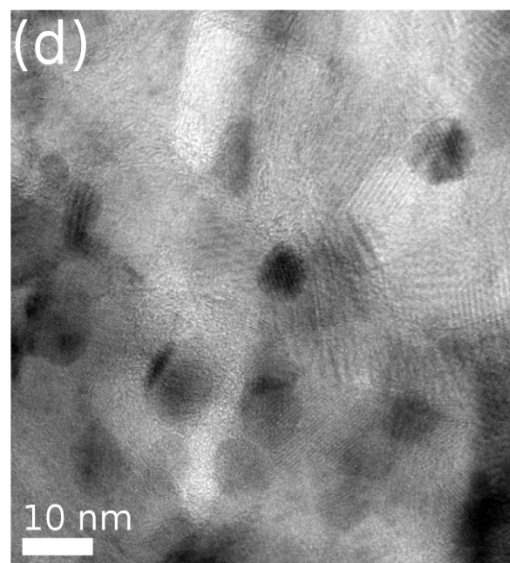
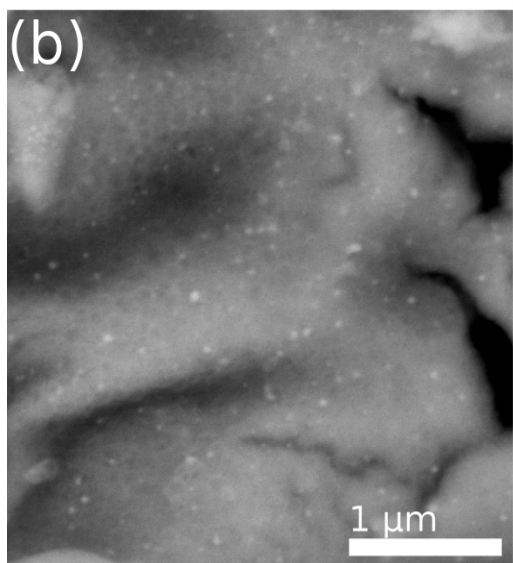
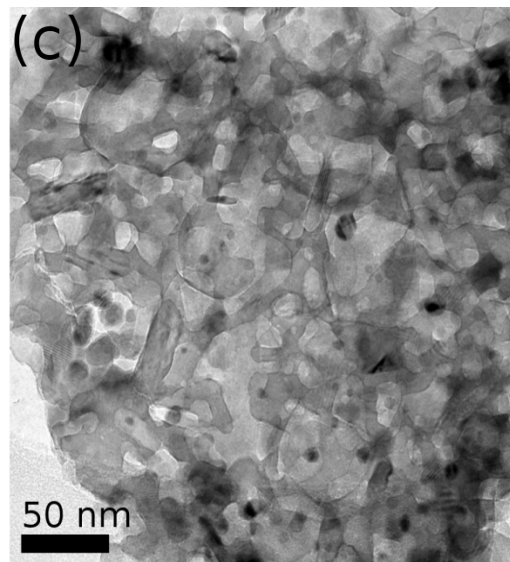
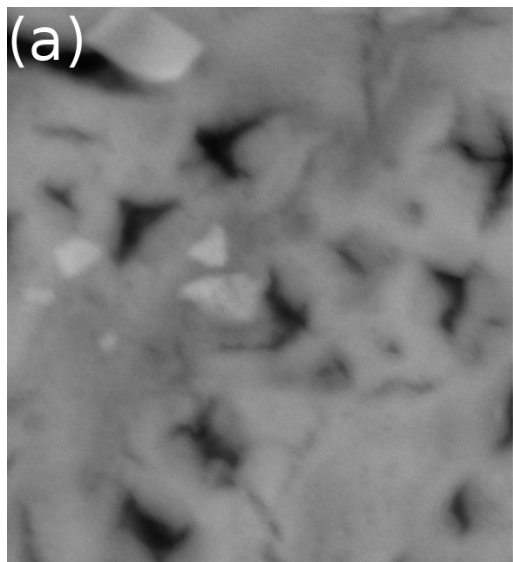


Dark backgrounds (to be avoided)



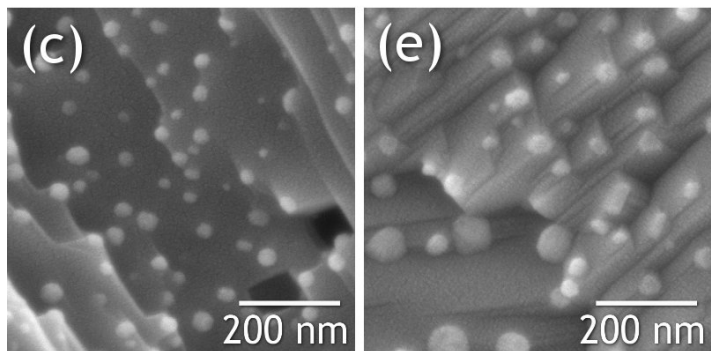
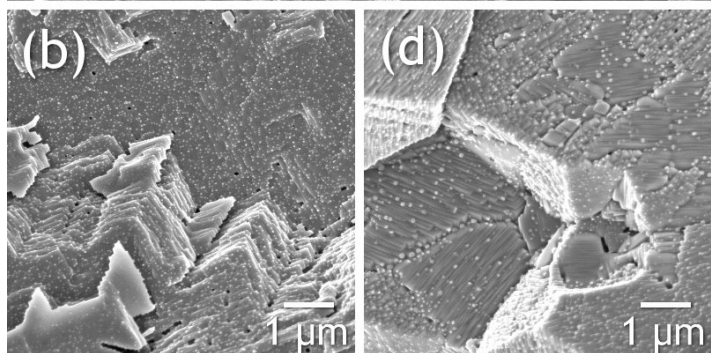
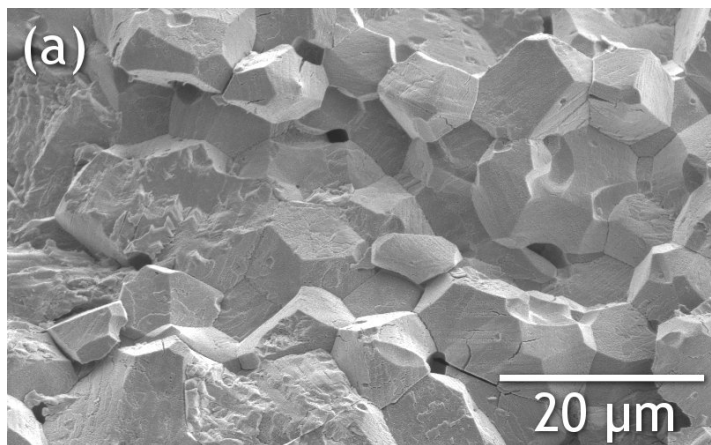
Nathan George

Examples of acceptable figures



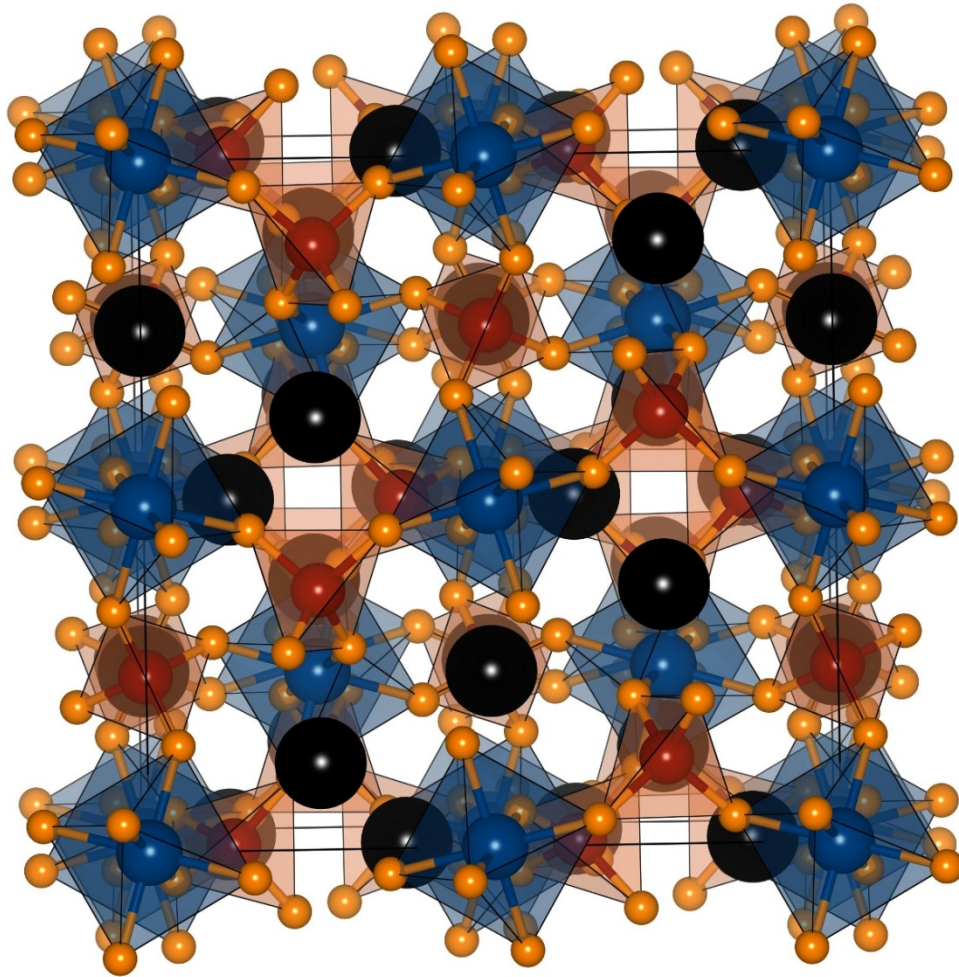
Jun Li

Examples of acceptable figures



Daniel Shoemaker

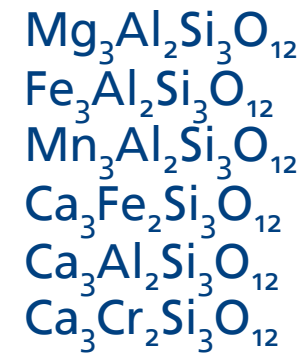
Examples of acceptable figures



Garnet crystal structure: AlO_4 tetrahedra and AlO_6 octahedra, all completely corner-connected.

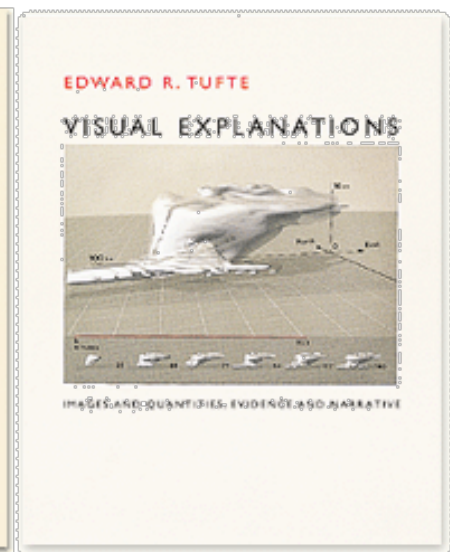
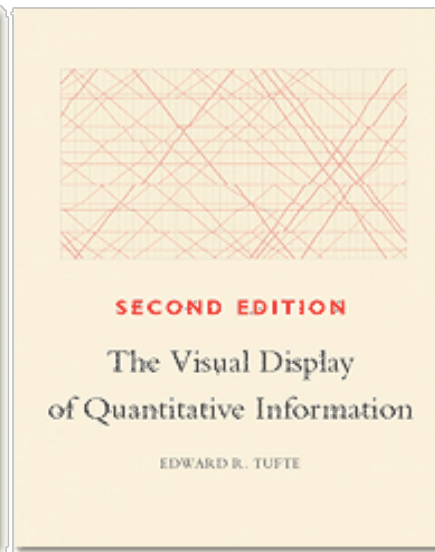
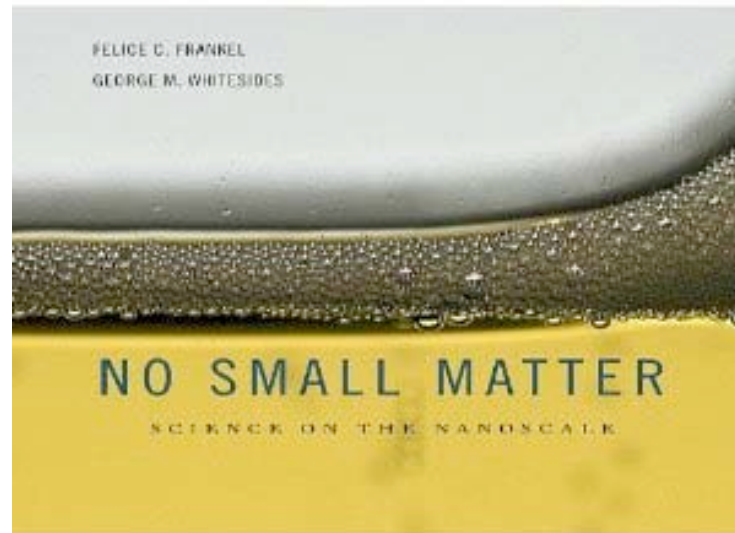
Y occupies 8-coordinate voids formed by AlO_n polyhedra.

Pyrope
Almandine
Spessartine
Andradite
Grossular
Uvarovite



Drawn with VESTA (Momma and Izumi)

Resources: Books by Felice Frankel and Edward Tufte



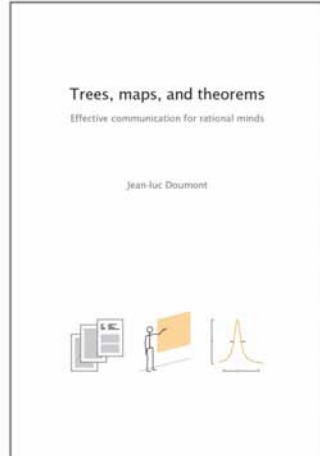
Resources: The book by Jean-Luc Doumont

Trees, maps, and theorems

Effective communication for rational minds

"A stunning piece of work: artfully written, beautifully designed, altogether respectful of the reader."

— Thomas N. Huckin



Discover the book

Find out about the book and its author,
and download sample pages in PDF

Order the book

96 USD in the United States and Canada
80 EUR everywhere else in the world

Explore the topics

Download summaries, additional examples,
and helper documents (checklists, etc.)

This document

Production notes:

Most were produced using XMGRACE (<http://plasma-gate.weizmann.ac.il/Grace/>; free software that runs under Linux and Mac).

Vector graphics (eps files) were exported from XMGRACE and opened with GIMP (<http://www.gimp.org/>; also freely available for all platforms) at 600 dpi with strong text antialiasing, and converted into jpg images (100% quality) with widths of 2000 pixels.

These were imported into PowerPoint. For publication, the eps files (or vector PDF made from them) should be submitted.

As a general rule, directly copying and pasting from graphing software into Word or PowerPoint is ill-advised, and creates problems associated with cross-OS (in)compatibility and missing fonts. It is always preferred to export high resolution image files.

All image widths and positions have been specified using the size and position commands in PowerPoint.

Thank you