Figures, tables and other non-text materials

PH403
Winter 2018
Janet Tate
General comments

Figures and tables ...
• have a clear message and are important to the explanation (not just filler). Ask: “What does this figure clarify?”
• are not too busy, and not too dense, but also not too trivial
• use large font sizes to be easily readable
• always have a number and an informative caption. The number must be referred to in the text (no hanging figures)
• almost always stand by themselves (do not need the main text to understand the main point; caption suffices)
• acknowledge sources in caption if info or parts of figures come from elsewhere
Ten Simple Rules for Better Figures
Nicolas P. Rougier, Michael Droettboom, Philip E. Bourne
(2014) DOI: 10.1371/journal.pcbi.1003833

http://journals.plos.org/ploscompbio/article?id=10.1371/journal.pcbi.1003833

1. Know Your Audience
2. Identify Your Message
3. Adapt the figure to the support medium
4. Captions Are Not Optional
5. Do Not Trust the Defaults
6. Use Color Effectively
7. Do Not Mislead the Reader
8. Avoid “Chartjunk”
9. Message Trumps Beauty
10. Get the Right (Software) Tool
Captions are not optional

• Every figure has a caption with a figure number.
• Figure 2.3 for the third figure in chapter 2.
• Every figure is referred to in the text.
• Caption is informative
• Acknowledge sources in caption if info or parts of figures come from elsewhere
• Do not introduce new information in the caption
Graphs

• Font is simple, sans serif (e.g. Arial)
• Font size is large enough to withstand reduction
• Axis numbers have fewest possible significant figures (and consistent)
• Axes are labeled; have units where appropriate
• No title (in a thesis or paper), but indicate on graph what is being plotted (a title is desirable in oral presentations and proposals)
Graphs

• Lines and points should be thicker than you think
• Points not so big as to obscure others
• Use points for experimental data and lines for models (usually)
• Use color for clarity, but pay attention to how graph reproduces in black & white
• Bold colors are better than pastels
• Use open and closed symbols, color, lines etc. to code different information sets (e.g. open = high temp, closed = low temp; squares = NaCl sample, circles = KCl sample, so open square = NaCl at high temp)
One of the most striking aspects of the presented data is the dramatical disappearance of the plasmon peak in the optical conductivity spectra, which indicates that above 9 GPa the gap feature in the electronic structure is gone.

The loss function, $-\text{Im}(1/\varepsilon(\omega))$, shows a maximum at 14.7 GPa, which suggests a coherent charge transport in the low pressure regime.

The conductivity $\sigma(\omega)$ shows a Drude contribution at highest pressures, with a peak at 0.5 GPa.

In the range 1.7 GPa, a quantum phase transition is observed, which is evidenced by a change in the spectral weight of the Drude component.

The conductivity $\sigma(\omega)$ at different energies is shown in Fig. 2(c). (c) Transmission through a ~5 µm thick sample. (d) The pressure dependence of $\sigma(\omega)$ at different energies. (e) and (f) The loss function, $-\text{Im}(1/\varepsilon(\omega))$. Inset shows a sketch of the sample environment within the diamond anvil pressure cell. In all panels, the data taken between 0.22 and 0.33 eV are not shown due to strong diamond absorption.
Critique

• Nice use of color – a few curves highlighted; rainbow shading
• Composite figure – this info has to all be one place.
• Dense but not cluttered
• Points are “x”; joined by lines
• Axes clear; font sans serif
• Caption succinct, but informative
Critique:

Figure 8. (Left) A ground-state absorption spectrum of a Pc-TIPS thin film sample illustrating the adequate absorbance at 400nm and transparency at 800nm. This verifies that a 400nm pump and 800nm probe should function well to produce transient absorption data for Pc-TIPS. (Right) Transient absorption data for Pc-TIPS, both thin-film and toluene solution forms are shown. This illustrates an ultra-fast formation of excited states in Pc-TIPS that persist for at least several hundreds of picoseconds.
Graphs

Critique:

Figure 1: Absorption spectrum for a thin film of BaCuTeF. The bandgap for this material is at 2.9 eV. The thickness of this sample is 150 nm.
Graphs

Critique:

Figure 8: Typical optical measurement of a thin film of BaCuSF, thickness 460 nm, showing interference fringes in both the transmittance and reflectance. Also plotted is the interference free transmission $\frac{T}{1-R}$. 
Graphs - Do Not Trust the Defaults

• NEVER in default MS Excel format!
  Find at least 10 serious problems with a graph so-generated (and this version of Excel doesn’t even generate the horrible gray background by default!)
Photographs

• In focus
• Uncluttered background
• Is the photo more informative than a schematic?
• OK to use non-copyright material from web (with attribution), but NEVER imply that it represents your system. Generally avoid using others’ photos to represent your system.
Photographs

A photograph of a drive mass attached to a rotor and installed in the gas bearing. The drive mass in the photo has not yet been planarized, so the mass trenches are still visible. Also visible is the gold pattern used by the spin-speed detector.

David M. Weld, Jing Xia, Blas Cabrera, and Aharon Kapitulnik
Phys. Rev. D 77, 062006 – Published 27 March 2008
Photographs used in conjunction with schematics

Good photo, but needs a schematic to help (next page)

Figure 2
A photograph of the assembled probe. The gold-coated cantilever wafer is visible between the lid and housing of the gas bearing. The stainless steel structure protruding from the lid is the fiber holder that maintains the alignment of the interferometer. The optical fiber is barely visible emerging from the top of that structure. The fiber bundle for the encoder and two of the gas bearing inlets are also visible here.

David M. Weld, Jing Xia, Blas Cabrera, and Aharon Kapitulnik
Phys. Rev. D 77, 062006 – Published 27 March 2008
Photographs used in conjunction with schematics

Figure 1
A schematic side view (not to scale) of the heart of the experimental apparatus.

Figure 3
A schematic drawing of the helium gas bearing, showing the six gas inlet ports. Left diagram: Side view. Right diagram: Top view. The ports labeled “TOP” and “BOT” provide the gas that the rotor floats on. The clockwise and counterclockwise spin-up ports are labeled “CW” and “CCW,” respectively. Exhaust ports are also indicated.

David M. Weld, Jing Xia, Blas Cabrera, and Aharon Kapitulnik
Phys. Rev. D 77, 062006 – Published 27 March 2008
Tables

• Columns and/or rows labeled
• Units as appropriate
• Only as many significant figures as you measured
• Pay attention to right/left/center justification
• Information easily interpreted
• Is tabulation is the correct format? A long, two-column may be better presented graphically
• Good for a moderate number of numbers
• Keep it clean and simple
• Acknowledge other data sources in caption if appropriate
### Good Table

**Table 1.** Constant volume heat capacity and Thermal conductivity of used gases

<table>
<thead>
<tr>
<th>Gas</th>
<th>$C_{v_i}$ (J/mol K)</th>
<th>$k_{gi}$ (W/m K) x $10^{-2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argon</td>
<td>12.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Oxygen</td>
<td>19.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>20.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Methane</td>
<td>32.5</td>
<td>3.8</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>26.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Ethylene</td>
<td>38.5</td>
<td>2.5</td>
</tr>
<tr>
<td>C$_4$/Ar$^a$</td>
<td>32.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Propylene</td>
<td>46.0</td>
<td>1.7</td>
</tr>
<tr>
<td>i-butylene</td>
<td>75.5</td>
<td>1.6</td>
</tr>
</tbody>
</table>

$^a$ C$_4$/Ar is a gas mixture of 66% argon and 34% i-butylene.
Bad Table - Do Not Trust the Defaults

*NEVER in MS Excel default format!*

Find at least 5 serious problems with this table

<table>
<thead>
<tr>
<th>$V_{x\text{L}}$ (mV)</th>
<th>$V_{x\text{=2L}}$ (mV)</th>
<th>$R_{\text{term}}$ (Ohms)</th>
<th>$V_{x=L}/V_{x=0}$ (exp.)</th>
<th>$V_{x=2L}/V_{x=0}$ (exp.)</th>
<th>$V_{x=L}/V_{x=0}$ (th. w/ out atten.)</th>
<th>$V_{x=2L}/V_{x=0}$ (th. w/ out atten.)</th>
<th>$V_{x=L}/V_{x=0}$ (th. w/ atten.)</th>
<th>$V_{x=2L}/V_{x=0}$ (th. w/ atten.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>182.5</td>
<td>65</td>
<td>371</td>
<td>1.3272727</td>
<td>0.4727273</td>
<td>1.6825397</td>
<td>0.6825397</td>
<td>1.386431166</td>
<td>0.4634404</td>
</tr>
<tr>
<td>172.5</td>
<td>55</td>
<td>278</td>
<td>1.2545455</td>
<td>0.4</td>
<td>1.5977011</td>
<td>0.5977011</td>
<td>1.316523284</td>
<td>0.4058355</td>
</tr>
<tr>
<td>162.5</td>
<td>47.5</td>
<td>224</td>
<td>1.1818182</td>
<td>0.3454545</td>
<td>1.5238095</td>
<td>0.5238095</td>
<td>1.255635773</td>
<td>0.3556636</td>
</tr>
<tr>
<td>152.5</td>
<td>40</td>
<td>186</td>
<td>1.1090909</td>
<td>0.2909091</td>
<td>1.453125</td>
<td>0.453125</td>
<td>1.19739095</td>
<td>0.3076692</td>
</tr>
<tr>
<td>142.5</td>
<td>32.5</td>
<td>149</td>
<td>1.0363636</td>
<td>0.2363636</td>
<td>1.3607306</td>
<td>0.3607306</td>
<td>1.121256945</td>
<td>0.2449339</td>
</tr>
<tr>
<td>132.5</td>
<td>25</td>
<td>124</td>
<td>0.9636364</td>
<td>0.1818182</td>
<td>1.2783505</td>
<td>0.2783505</td>
<td>1.053374856</td>
<td>0.1889984</td>
</tr>
<tr>
<td>122.5</td>
<td>15</td>
<td>102</td>
<td>0.8909091</td>
<td>0.1090909</td>
<td>1.1860465</td>
<td>0.1860465</td>
<td>0.977315344</td>
<td>0.1263245</td>
</tr>
<tr>
<td>112.5</td>
<td>7.5</td>
<td>86</td>
<td>0.8181818</td>
<td>0.0545455</td>
<td>1.1025641</td>
<td>0.1025641</td>
<td>0.908524922</td>
<td>0.0696404</td>
</tr>
<tr>
<td>102.5</td>
<td>0</td>
<td>70</td>
<td>0.7454545</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0.824010976</td>
<td>0</td>
</tr>
<tr>
<td>92.5</td>
<td>-10</td>
<td>58.5</td>
<td>0.6727273</td>
<td>-0.072727</td>
<td>0.9105058</td>
<td>-0.0894942</td>
<td>0.750266803</td>
<td>-0.060766</td>
</tr>
<tr>
<td>82.5</td>
<td>-17.5</td>
<td>48.8</td>
<td>0.5272727</td>
<td>-0.127273</td>
<td>0.8215488</td>
<td>-0.1784512</td>
<td>0.676965246</td>
<td>-0.121167</td>
</tr>
<tr>
<td>72.5</td>
<td>-25</td>
<td>41.3</td>
<td>0.4545455</td>
<td>-0.236364</td>
<td>0.6394558</td>
<td>-0.3605442</td>
<td>0.526918583</td>
<td>-0.244807</td>
</tr>
<tr>
<td>62.5</td>
<td>-32.5</td>
<td>32.9</td>
<td>0.3818182</td>
<td>-0.290909</td>
<td>0.540146</td>
<td>-0.459854</td>
<td>0.445086221</td>
<td>-0.312238</td>
</tr>
<tr>
<td>52.5</td>
<td>-40</td>
<td>25.9</td>
<td>0.3090909</td>
<td>-0.363636</td>
<td>0.44098</td>
<td>-0.55902</td>
<td>0.363372324</td>
<td>-0.379571</td>
</tr>
<tr>
<td>42.5</td>
<td>-50</td>
<td>19.8</td>
<td>0.2363636</td>
<td>-0.418182</td>
<td>0.3606557</td>
<td>-0.6393443</td>
<td>0.297184286</td>
<td>-0.434111</td>
</tr>
<tr>
<td>32.5</td>
<td>-57.5</td>
<td>15.4</td>
<td>0.1636364</td>
<td>-0.472727</td>
<td>0.2694685</td>
<td>-0.7305315</td>
<td>0.222044985</td>
<td>-0.496027</td>
</tr>
<tr>
<td>22.5</td>
<td>-65</td>
<td>10.9</td>
<td>0.0909091</td>
<td>-0.527273</td>
<td>0.1770833</td>
<td>-0.8229167</td>
<td>0.14591861</td>
<td>-0.558756</td>
</tr>
<tr>
<td>12.5</td>
<td>-72.5</td>
<td>6.8</td>
<td>0.0</td>
<td>0.6</td>
<td>0.0716253</td>
<td>-0.9283747</td>
<td>0.05902007</td>
<td>-0.630361</td>
</tr>
<tr>
<td>0</td>
<td>-82.5</td>
<td>2.6</td>
<td>0</td>
<td>0.0</td>
<td>0.0716253</td>
<td>-0.9283747</td>
<td>0.05902007</td>
<td>-0.630361</td>
</tr>
</tbody>
</table>

1/15/18 PH 403, Winter 2018, OSU PH; JT
Diagrams

• Find a good drawing program
• Usually left-to-right flow is best for electronics, optics information
• Clear schematics
• Label carefully
• OK to use non-copyright material from web (with proper attribution), but NEVER imply that it represents your system.
Figure 9. The autocorrelation technique is achieved by overlapping two pulses in time through a non-linear optical crystal (BBO). A third pulse is produced in the crystal whose intensity is dependant on how close in time the two incident pulses are, and whose direction is the vector sum of the two incident pulses. Varying Δt with the delay stage from negative to positive values while monitoring the intensity of the third beam form autocorrelation data. From this data an accurate pulse width can be extracted with software.
Diagrams

Critique:

Figure 3.1: The Ocean Optics spectrometers' layout.
Flowcharts

• Top-to-bottom or left-to-right
• Use conventional shapes for decision trees
Flowcharts

Figure 6
A diagram of the feedback loop that controls the spin frequency of the rotor. The system is described in the text.

David M. Weld, Jing Xia, Blas Cabrera, and Aharon Kapitulnik
Phys. Rev. D 77, 062006 – Published 27 March 2008