Orbitals in the CuO$_2$ Plane

Courtesy A. Yazdani
The importance of figures

“Graphic excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest place” - Edward R. Tufte -

“Figures play a significant role in the expression of scientific ideas” - APS Style Guide -

Imagine presentations without figures...
Figures can be used to do many things in a talk or paper:

- Illustrate a physical process
- Show data
- Illustrate how something works
- Provide an illustration of how something might look
- Provide a picture of equipment, device, collaborator, etc.
Figures that show physics processes

[Diagram of physics processes: Energy levels, transitions, and spectra.]
Figures that display data

\[ \Delta \frac{G}{G} (\%) \]

\[ \begin{align*}
0 & \quad 0.04 \\
0.04 & \quad 0.08 \\
-0.04 & \quad -0.08
\end{align*} \]

\[ \begin{align*}
0 & \quad 100 \\
100 & \quad 200 \\
300 & \quad 400
\end{align*} \]

\[ \text{time (μs)} \]

Labels and Units
Figures that display data

- Excess loss rate
- Constant loss rate
- Uncertainty, mostly due to protons
- Muon decay
Figures that display data
Figures that display data
Illustrations

When presenting images, you choose between photographs, drawings, and diagrams.

Source: The Craft of Scientific Presentations, Michael Alley
and http://www.writing.eng.vt.edu/handbook/visuals.html
The main advantage of photographs is realism

Figure 2. Space Shuttle Challenger, from about 59 seconds to 60 seconds into launch (January 28, 1986). On the right rocket, flame first becomes visible and then impinges on tank.

Source: The Craft of Scientific Presentations, Michael Alley
and http://www.writing.eng.vt.edu/handbook/visuals.html
Illustrations

One advantage of drawings is control of detail

Figure 5. Wind tunnel experiment at Virginia Tech for evaluating film-cooling designs for the blades of gas turbine engines [Thole and others, 2000].

Figures that illustrate the microscale

STM

100 Å
The main advantage of a diagram is the ability to show flow of a variable through a system.

Figure 8. Schematic of test stand for evaluating components of an air conditioner design.

Illustrations

Scientists and engineers often use illustrations that are too complex for the text.

The thermal storage system stores heat in a huge, steel-walled tank. Steam from the solar receiver passes through heat exchangers to heat the thermal oil, which is pumped into the tank. The tank then provides energy to run a steam generator to produce electricity. A schematic of this system is shown in Figure 5.

Figure 5. Schematic of thermal storage system.

Source: The Craft of Scientific Presentations, Michael Alley
and http://www-writing.eng.vt.edu/handbook/visuals.html
The thermal storage system, shown in Figure 6, stores heat in a huge, steel-walled tank. Steam from the solar receiver heats a thermal oil, which is pumped into the tank. The tank then provides energy to run a steam generator to produce electricity.

Figure 6. Schematic of thermal storage system for the solar power plant.

Illustrations

For clarity, you should introduce and explain illustrations in the text

..., as shown in Figure 7.

Figure 7. Title of figure. Some formats allow you extra sentences to explain unusual details.

Source: The Craft of Scientific Presentations, Michael Alley
and http://www.writing.eng.vt.edu/handbook/visuals.html
The testing hardware of the rocket shown in Figure 8 has five main components: camera, digitizer, computer, I/O interface, and mechanical interface. Commands are generated by the computer, then passed through the I/O interface to the mechanized interface where the keyboard of the ICU is operated. The display of the ICU is read with a television camera and then digitized. This information is then manipulated by the computer to direct the next command.

Figure 8. Testing hardware.

Source: The Craft of Scientific Presentations, Michael Alley
and http://www.writing.eng.vt.edu/handbook/visuals.html
Figures that show how something works
Figures that show how something works
Figures that show how something works

\[ \theta_{1/2} = \frac{m_\pi}{E} \]

- Deflected ep
- RCS
- \( \pi^0 \)
Figures that show scale

- 2039 m to surface
- $10^{11}$ m to Sun

- 12 m diameter acrylic vessel
- Support structure for 9500 PMTs, concentrators

- 5300 tonnes light water
- 1000 tonnes heavy water
- 1700 tonnes light water

CERN - LHC
Figures that show equipment

- Cryostat
- Storage area
- Vacuum chamber
- Superconducting coil
Figures that “peer inside”
Figures that persuade

New $e^+e^-$ Data
New $\tau$-only Data

Theory Experiment

August 2002
Figures that have a problem

The most famous figure I know that just can’t be read, ever ...
An attempt to clean this up (courtesy, Dave Hertzog)
Figures that confuse
Same physics, different figures: The SAMPLE Expt.
Different figures for different purposes

Less Detail: appropriate for colloquium-type talk

More Detail: appropriate for more specialized audience
Some final tips

• Use figures to add interest to your papers & talks
• Make them clear, simple and memorable
• Remove the words you don’t need
• Label all your data plots !!