Communicating Scientific Results in LaTeX

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I'll be addressing several ways in which LaTeX can make clear and concise communication in science easier.

- Beamer: Presentations in LaTeX, like this one!
- BibTeX: Automating bibliography generation
- Additional packages: tikz, pgfplots, chemfig

Beamer

Presentations in LaTeX

What is Beamer, and why should I use it?

- Beamer is a **document class**, just like **article** and **book**.
- All the normal LaTeX commands work, you can paste your material directly from your article.
- The output is a **.pdf** file. Your presentation will look exactly the same on every computer, and almost every device can open pdf files.

How do I use Beamer?

- Add `\documentclass{beamer}` at the top of the file.
- The `\usetheme{theme_name}` command sets the theme. The themes are named after cities. I'm using Berkeley for this presentation.
- Each slide is defined by a frame environment, e.g. `\begin{frame}` $\cdots$ `\end{frame}`

Beamer: Final notes

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Example of a block environment - The Navier-Stokes Equation

$$\overbrace{\rho\left(\underbrace{\frac{\partial \mathbf{v}}{\partial t}}_{\text{Unsteady acceleration}} + \underbrace{\mathbf{v}\cdot\nabla\mathbf{v}}_{\text{Convective acceleration}}\right)}^{\text{Inertia (per volume)}} = \overbrace{\underbrace{-\nabla p}_{\text{Pressure gradient}} + \underbrace{\mu\nabla^2\mathbf{v}}_{\text{Viscosity}}}^{\text{Divergence of stress}} + \underbrace{\mathbf{f}}_{\text{Other body forces}}$$

BibTeX

Managing citations and bibliography generation

What it is and how it helps

BibTeX is:

- A system for organizing, formatting, and citing references.
- An enormous time saver.
- Supported by many journals through .bst style files.[2]
- Supported by most citation management programs (Mendelay, Papers, BibDesk, Endnote, etc.)

It helps you by:

- Automatically numbering and sorting references.[3]
- Applying and switching style files with minimal effort.
- Only rendering cited references (though this can be disabled).

How to use BibTeX

1. Create an empty .bib file in the same directory as your document, here `example.tex`.
2. Populate it with entries like:

```
@Book{abramowitz,
 author    = "Milton {Abramowitz} and Irene A. {Stegun}",
 title     = "Handbook of Mathematical Functions",
 publisher = "Dover",
 year      =  1964,
 address   = "New York",
 edition   = "ninth Dover printing, tenth GPO printing"
}
```

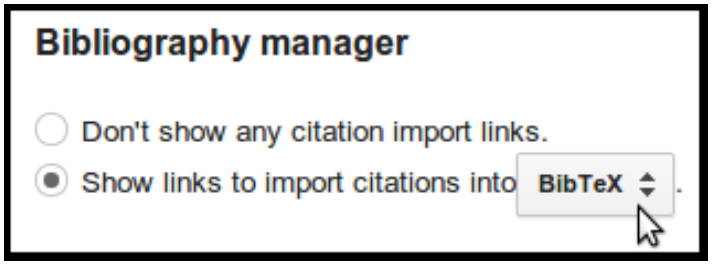
3. Use `\cite{}` in your main document file (e.g. `\cite{abramowitz}`.) and include the commands to generate the bibliography:

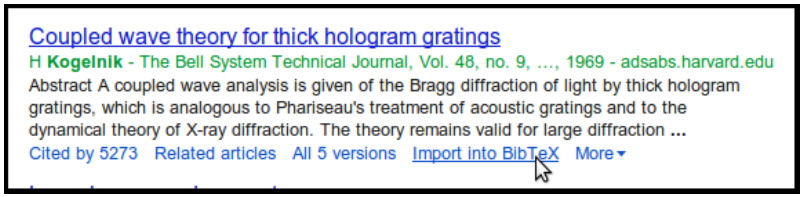
```
\bibliographystyle{plain}
\bibliography{bib_file_name}
```

4. Run `latex example.tex`, then `bibtex example`, and finally `latex example.tex` again.

Example: Inserting a new reference via Google Scholar

1. Set it to show BibTeX links.
2. Find your paper, click the link.
3. Copy the citation block to your .bib file.
4. You can now `\cite{kogelnik1969coupled}`





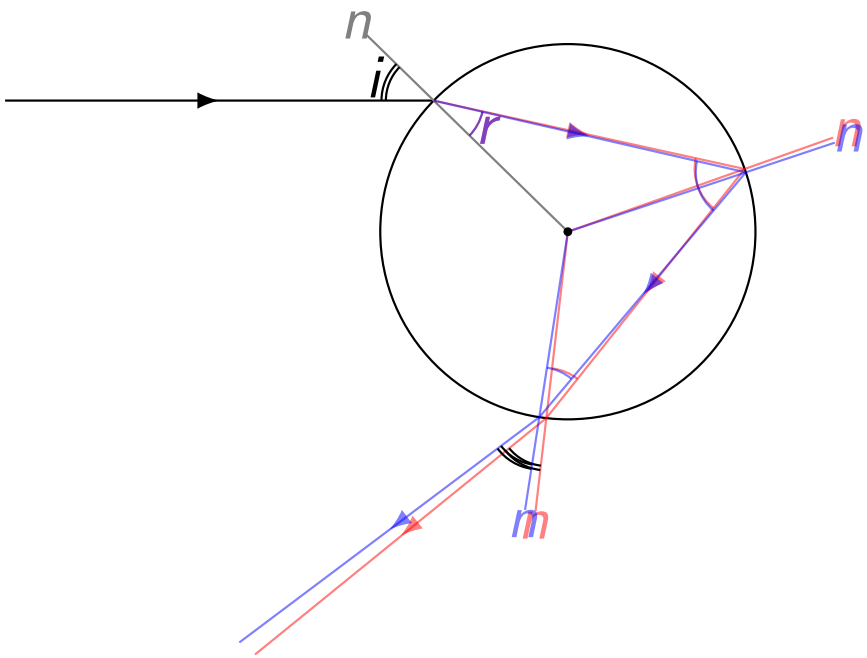

```
@inproceedings{kogelnik1969coupled,
  title={Coupled wave theory for thick hologram gratings},
  author={Kogelnik, Herwig},
  booktitle={The Bell System Technical Journal, Vol. 48, no. 9, November 1969, pp. 2909-2947},
  volume={48},
  pages={2909--2947},
  year={1969}
}
```

Data and Diagrams

In-LaTeX Figure Generation

Tikz

Tikz is a programmable graphics framework that many other packages (such as pgfplots and chemfig) use as their backbone. It's capable of drawing just about anything, but the learning curve is fairly harsh.



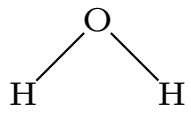
Example: Rainbow Formation Diagram

Chemfig: Chemical diagrams in LaTeX

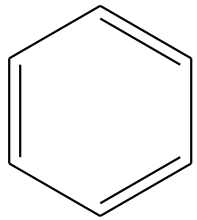
The code below:

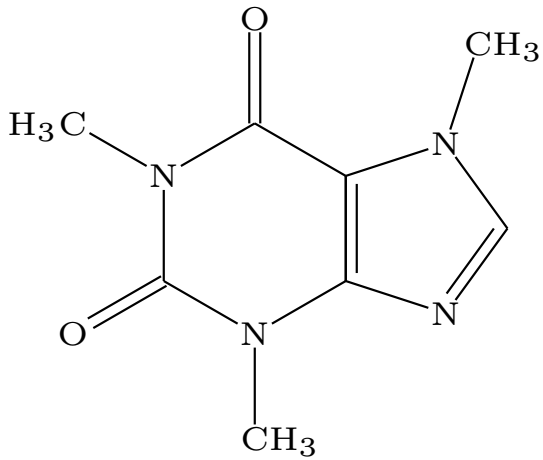
```
\usepackage{chemfig}
\tiny
\chemfig[scale=0.25]{H-[1]O-[7]H}
\\ Water

\vspace{0.5cm}
\chemfig{*6(-=-=-=)}
\\ Benzene ring

\vspace{0.5cm}
\chemfig[scale=0.25]{*6((=O)-N(-CH_3)
-*5(-N=-N(-CH_3)-=)--(=O)-N(-H_3C)-)}
\\ Caffeine
```

Produces these figures:



Water


Benzene ring



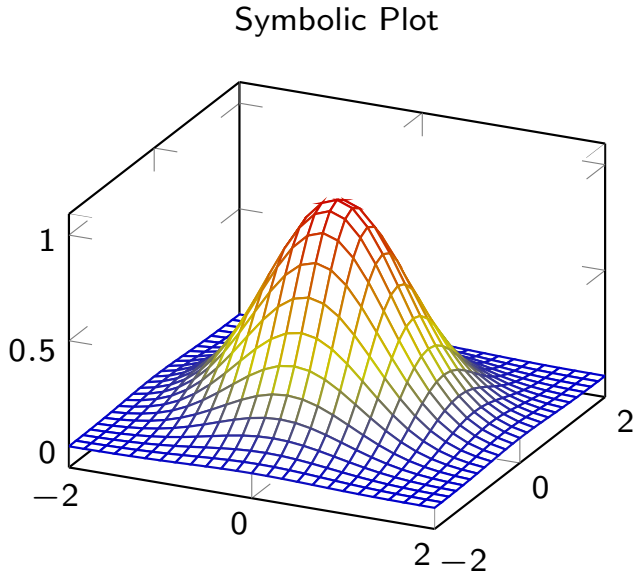
Caffeine

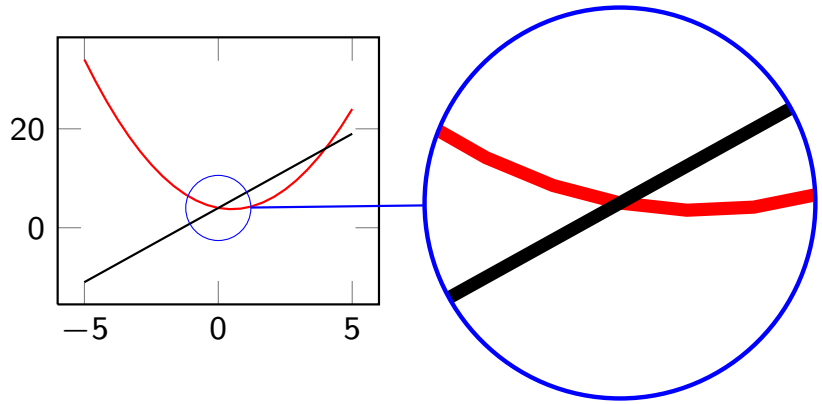
pgfplots[1]: Plotting in LaTeX

The code below:

```
\usepackage{pgfplots}
\begin{tikzpicture}
 \begin{axis}[title=Symbolic Plot]
  \addplot3[surf,fill=white,
  domain=-2:2] {exp(-x^2-y^2)};
 \end{axis}
\end{tikzpicture}

\usetikzlibrary{spy}
\begin{tikzpicture}[spy using outlines=
{circle, magnification=6, connect spies}]
\begin{axis}[scale=0.3]
\addplot[mark=none, red] {x^2 - x +4};
        \addplot[mark=none] {3*x+4};
        \coordinate (spypoint) at (axis cs:0,4);
        \coordinate (magnifyglass) at
        (axis cs:15,5);
\end{axis}
\spy [blue, size=2.5cm] on (spypoint)
   in node[fill=white] at (magnifyglass);
\end{tikzpicture}
```

Produces these figures:



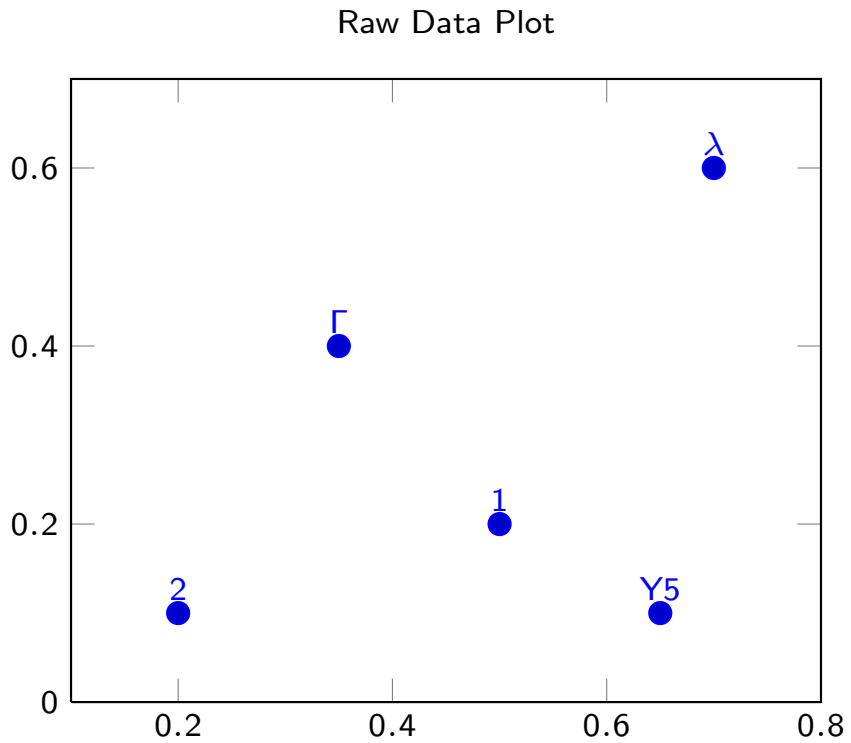


pgfplots: Plotting in LaTeX

The code below:

```
\usepackage{pgfplots}
\begin{tikzpicture}
\begin{axis}[enlargelimits=0.2,
scale=0.7, title=Raw Data Plot]
\addplot+[nodes near coords,only marks,
point meta=explicit symbolic]
table[meta=label] {
x y label
0.5 0.2 1
0.2 0.1 2
0.7 0.6 $\lambda$
0.35 0.4 $\Gamma$
0.65 0.1 Y5
};
\end{axis}
\end{tikzpicture}
```

Produces this figure:



Note: You can also point it directly at a comma or tab-delimited data file!

Questions?

Is there any interest in a follow-up talk or continuation as a series of talks?

References

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URL http://www. ctan. org/tex-archive/help/Catalogue/entries/pgfplots. html. Probablement installé dans votre système sous le nom pgfplots. pdf, 17, 2011.

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