Figures

N. Mason, B. DeMarco and J. Shelton
PHYS496 Fall 2020

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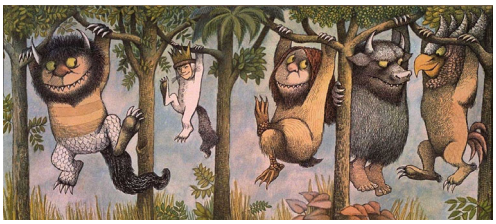
Figures are part of the narrative

…and made him king of all wild things.



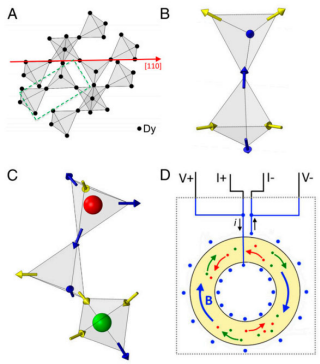
And now, cried Max, let the wild rumpus start!

- Each figure should have a single point (or closely related points)
- Caption (in a paper) should explain every part of figure

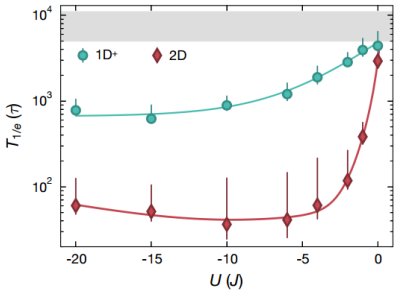
2

Different types of figures

Explanatory



Results (Data) Figure



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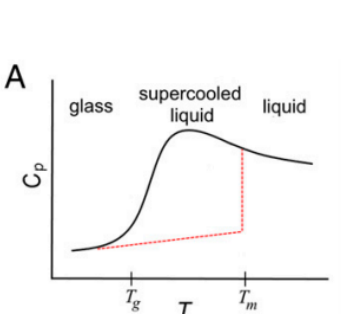
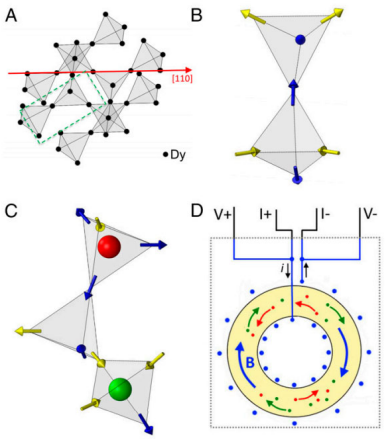
Explanatory Figure





Supercooled spin liquid state in the frustrated pyrochlore $Dy_2Ti_2O_7$

Ethan R. Kassner[a], Azar B. Eyvazov[a], Benjamin Pichler[a,b], Timothy J. S. Munsie[c,d], Hanna A. Dabkowska[c], Graeme M. Luke[c,d,e], and J. C. Séamus Davis[a,f,g,h,1]

PNAS | July 14, 2015 | vol. 112 | no. 28 | 8549–8554

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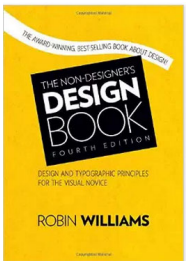
Explanatory Figure

- Gives overview, summary, or big picture
- Often schematic
- Not data or results
- Important to (over-) simplify without introducing errors
- Important to be visually attractive

A great resource:



Learn a software platform:
Illustrator, CorelDraw, Powerpoint…

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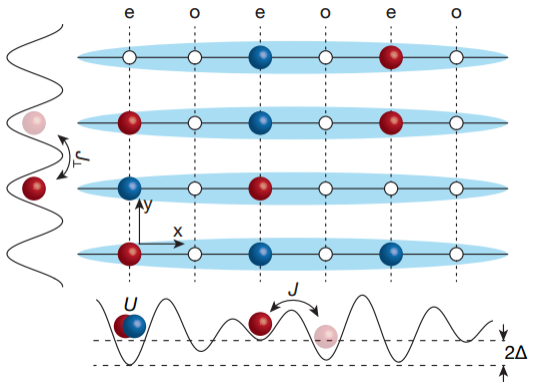
Example: Explanatory Figure



Coupling Identical 1D Many-Body Localized Systems

Pranjal Bordia,[1,2] Henrik P. Lüschen,[1,2] Sean S. Hodgman,[1,2]
Michael Schreiber,[1,2] Immanuel Bloch,[1,2] and Ulrich Schneider[1,2,3]

arXiv:1509.00478v1

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Example: Explanatory Figure

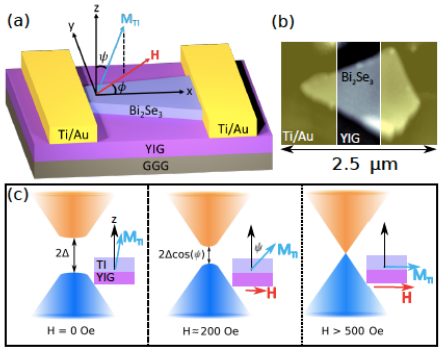

FIG. 1. (a) An illustration of a 30 nm Bi_2Se_3 flake exfoliated on YIG and contacted by Ti/Au electrodes. The coordinate system depicts that the current flows in the x-direction and an external magnetic field is applied in the xy plane at an angle ϕ. The magnetization of the TI cants towards the in-plane direction of the external field as described by the polar angle ψ. (b) Atomic force microscope image of a TI flake. False shaded yellow rectangles represent the patterned Ti/Au electrodes. (c) Illustration of the theoretical mechanism behind AMR in a proximity magnetized TI. Perpendicular magnetization induced in the TI by the YIG will open a gap (2Δ) between the surface states. Applying an in-plane field (H) rotates the magnetization (M_{TI}) which closes the gap.

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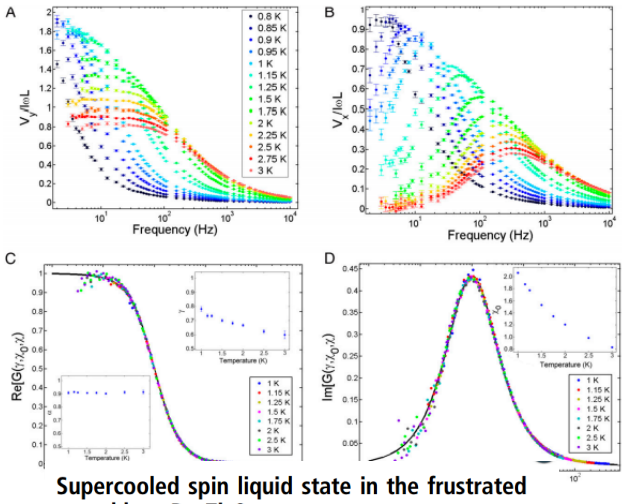
Results (data) Figure



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PNAS | July 14, 2015 | vol. 112 | no. 28 | 8549–8554

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Results (data) Figure

- Presents data, numerical results, theory curve
- Usually a graph
- Can encode a lot of information

  Be careful! Too much is deadly
- Important to label axes clearly and correctly
- Make sure points, lines, and error bars are **visible** and *distinct*

  Make sure distinctions can be seen even if printed in B/W

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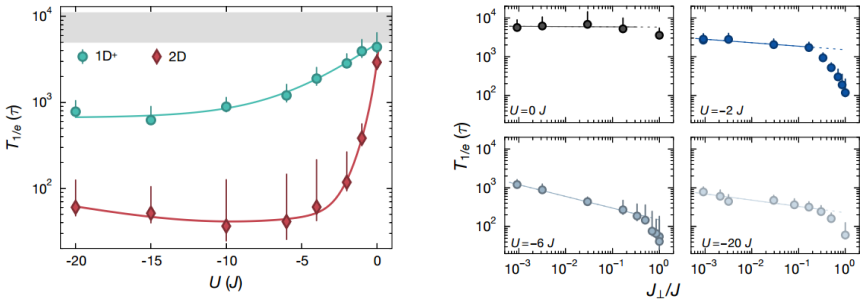
Another example: results figure



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Another example: results figure

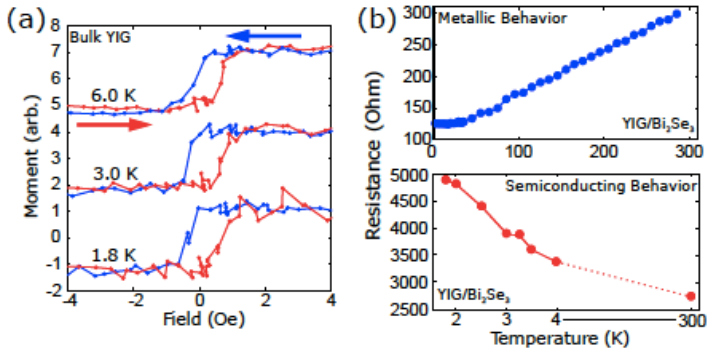

FIG. 2. (a) SQUID magnetometry of the bare YIG film shown over the temperature range where we observed ferromagnetic effects in the magnetoresistance. Note that the coercive field of the YIG is less than 2 Oe over the relevant temperature range. (b) Resistance versus temperature for a resistive Bi_2Se_3 flake (red) compared with a conductive flake (blue), that are exfoliated on the same YIG substrate.

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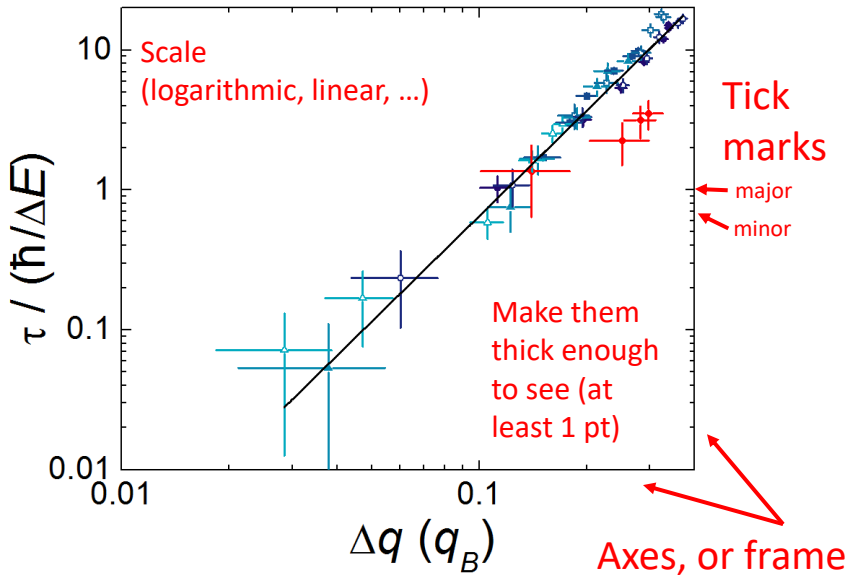
Essential elements of a plot



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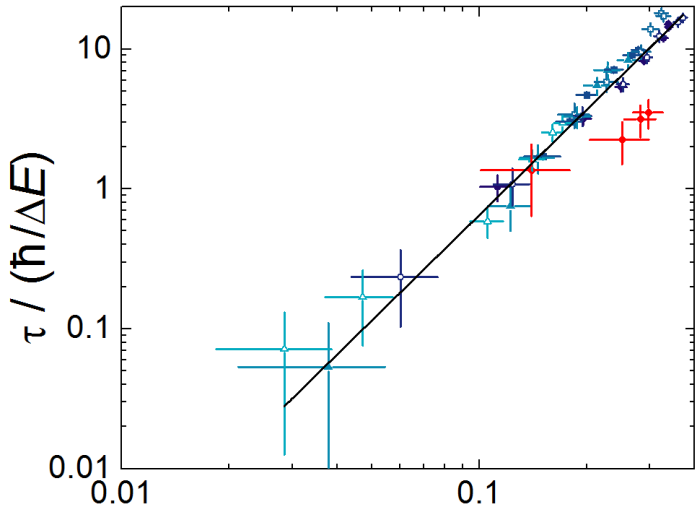
Essential elements of a plot



Axis labels

units

Big enough to read!

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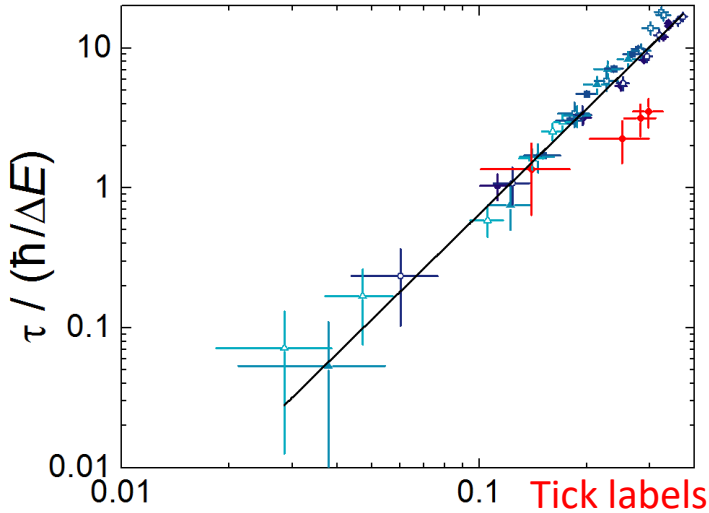
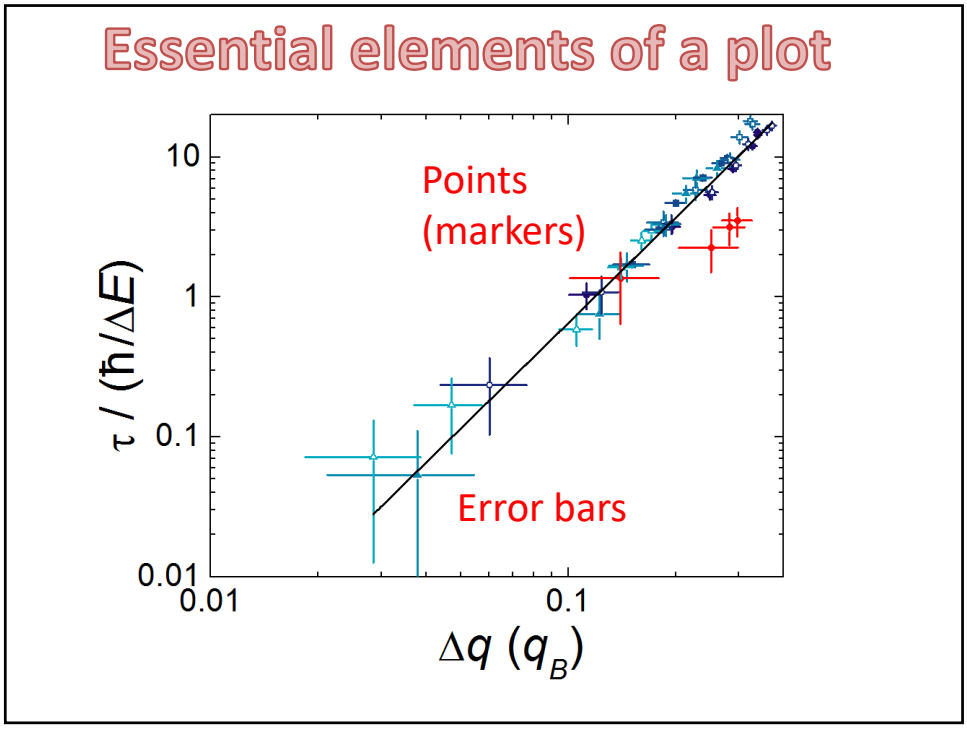
Essential elements of a plot



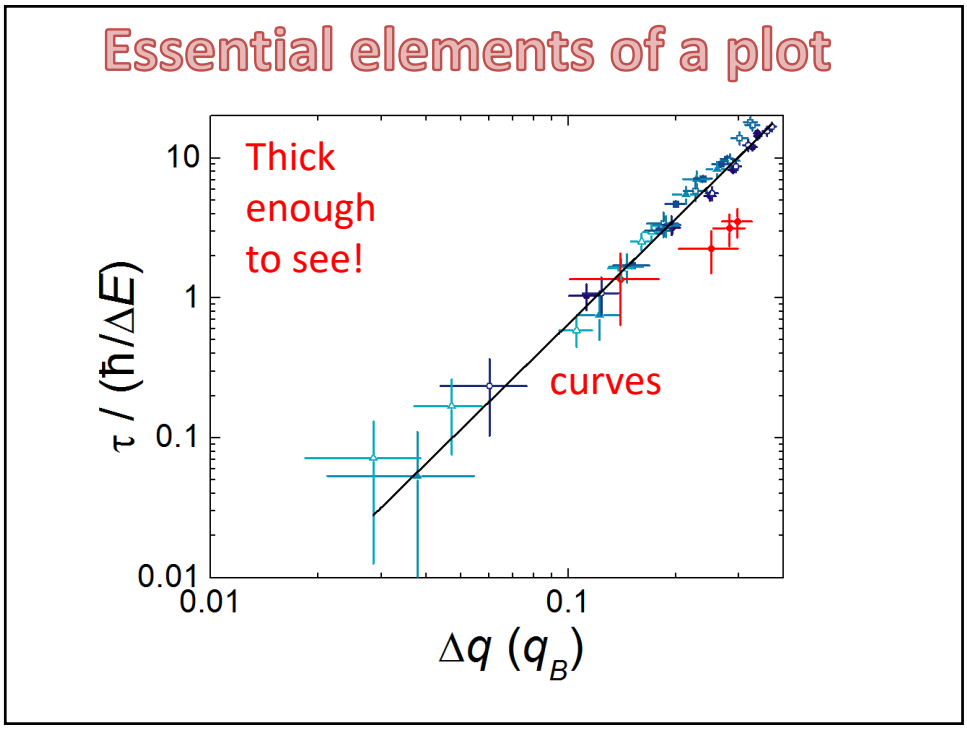
Big enough to read!

Tick labels

14



15



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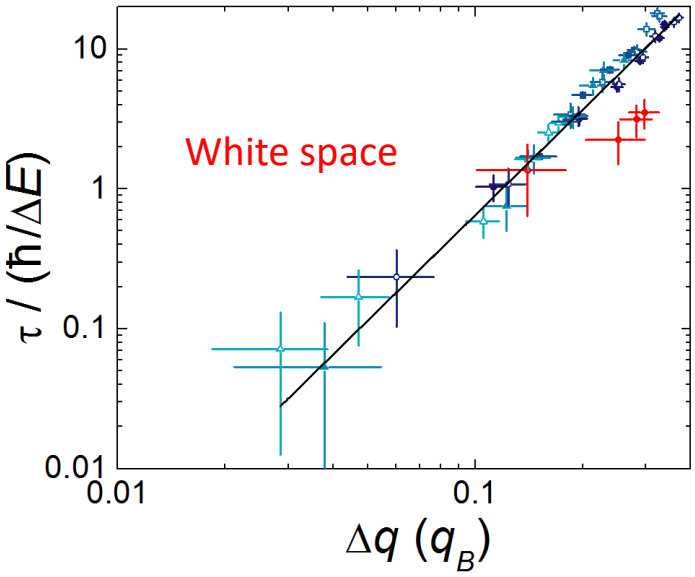
Essential elements of a plot



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General Advice

- Legible fonts
  Print the figure at 100% (reproduction scale)
- Avoid similar colors, yellow, orange; red/green
- Avoid arbitrary units
- Explain every part of the figure in the caption
  - symbols, insets, what each part is about
- Include scale bars & color bars
- Use high resolution, high contrast images
- Use vector graphics when possible

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Problems

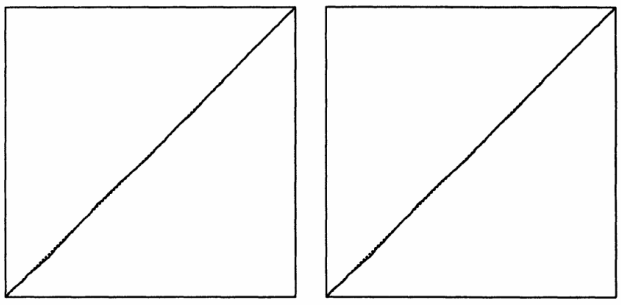

Figure 1. SRQ Plots of T_i/T_n (Vertical Axes) Against i/n (Horizontal Axes) for the Gibbs Sampler (a) and an Alternating Gibbs/Independence Sampler (b) for the Pump Failure Data Based on Runs of Length 5,000. Lines through the origin with unit slope are shown dashed; axis ranges are from 0 to 1 for all axes.

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Problems

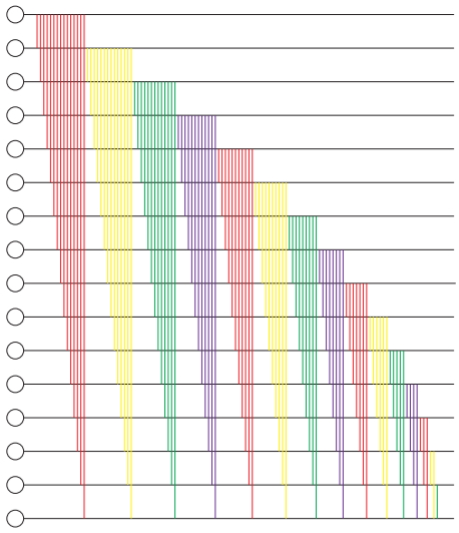

FIG. 2. (Color online) Possible layout for the 16-qubit chip.

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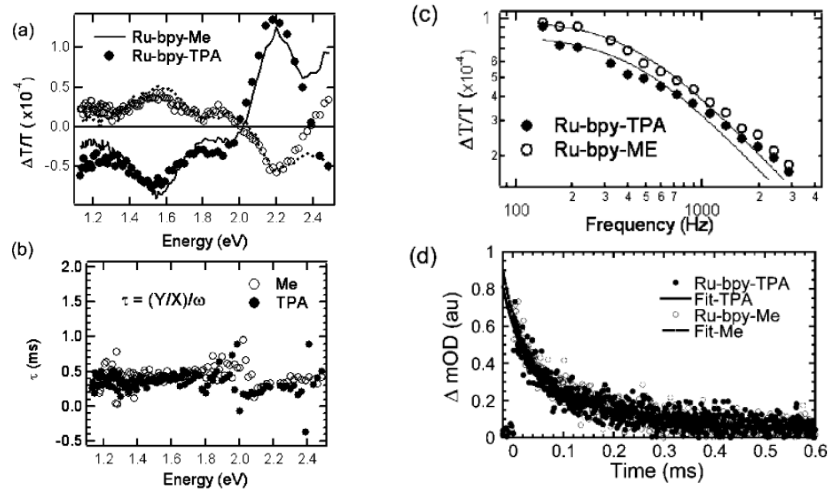
Problems



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Common issues from last year:

- Make axis labels large enough to be seen easily when figure is printed on ¼ page

- Plot markers should be large enough to be seen at ¼ scale

- Plot markers should be visually distinct in color, but also distinguishable when printed in black and white (hint: use different shapes)

- Legend should clearly indicate which curves are which

- Caption should explain all aspects of the figure

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Dark personal history

- Count the problems:

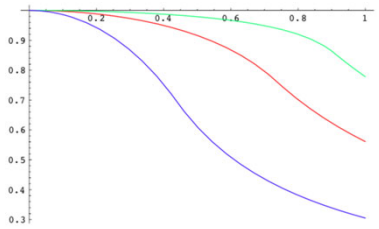

FIG. 4: Polarization reduction factor $\cos\omega$ for three different sets of new particle masses, as a function of parent top partner boost β. The phase space integral over $d\cos\theta$ has been performed. The red (central) curve is for a top partner with mass 500 GeV and boson partner 150 GeV. The green (upper) curve is for a top partner with mass 900 GeV and boson partner 300 GeV. The blue (lower) curve is for a top partner with mass 900 GeV and boson partner 700 GeV.

PHYSICAL REVIEW D **79,** 014032 (2009)

Polarized top quarks from new physics: Signals and observables

Jessie Shelton*

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Dark personal history

- Better use of Mathematica options:

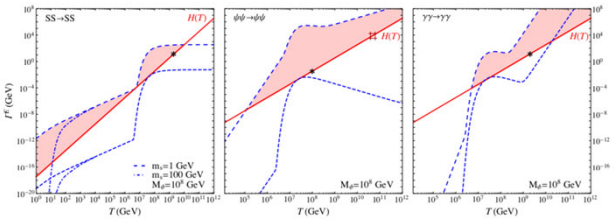

Figure 3. Comparison of the energy transfer rate (blue, dashed) to the Hubble rate (red, solid) for the scalar-scalar model (left panel), the Dirac fermion-Dirac fermion model (middle panel) and the gauge-gauge boson model (right panel). In each case the energy transfer rate is shown for a value of $k = 0.5$ and for $M_\phi = 10^8$ GeV. The lower curve in each case is the lowest value of the width for which thermalization occurs (for $k = 0.5$), while the upper curve is the upper allowed value. The black star indicates the reheat temperature and corresponding Hubble rate for the lower width, while the red # (visible only in the fermion case) indicates the maximum value of the reheat temperature.

JHEP

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Chilly dark sectors and asymmetric reheating

Peter Adshead,[a] Yanou Cui[b,c] and Jessie Shelton[a]

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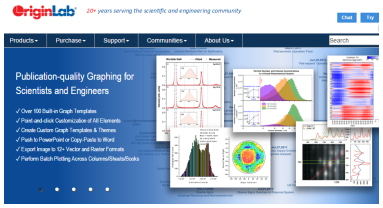
Resources

Software for making professional-quality plots

Origin (Webstore)



Matplotlib (Python)

MATLAB, Mathematica…caution

Excel

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Resources

Software for making professional-quality figures

Line / vector art

Illustrator, CorelDraw, Inkscape (free)

Mathematica

3D Illustration

SketchUp (free), VPython (free), Blender (free)
Autodesk products (free for students)

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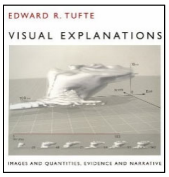
More resources (Celia)



Edward R. Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative* (Cheshire, CT, Graphics Press, 1997).

"Graphing Resources" (http://www.ncsu.edu/labwrite/res/res-homepage.htm), particularly their "Revising your Visuals" section.

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