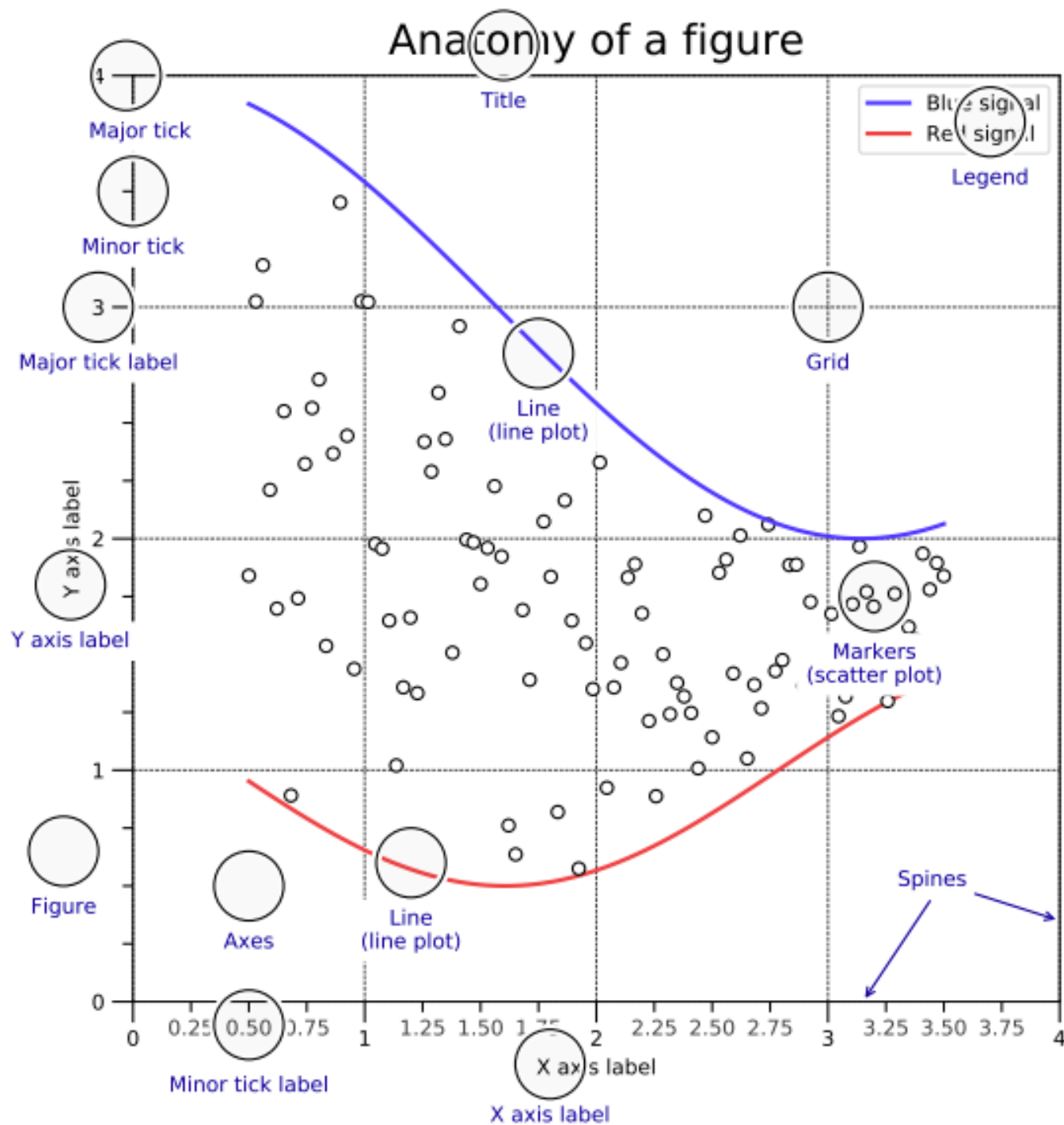


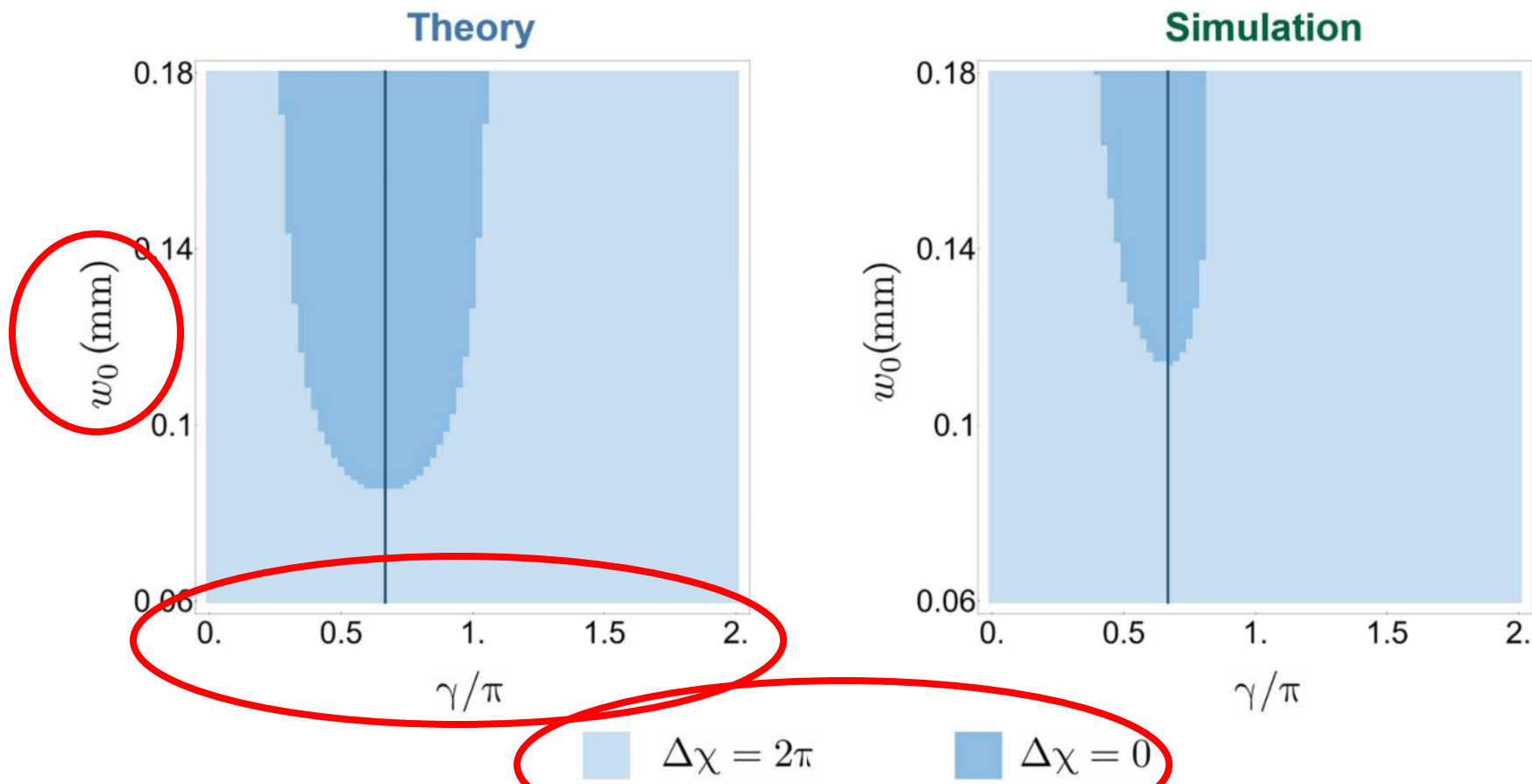
Figures that your postdoc won't hate

by Manuel Ferrer

Anatomy of a plot

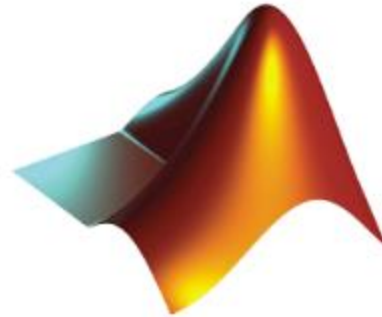
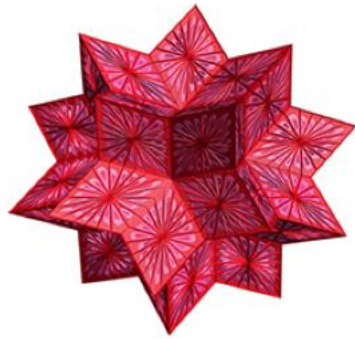


Must of a plot



How to plot?

Wolfram *Mathematica*



MATLAB



julia



How to plot?



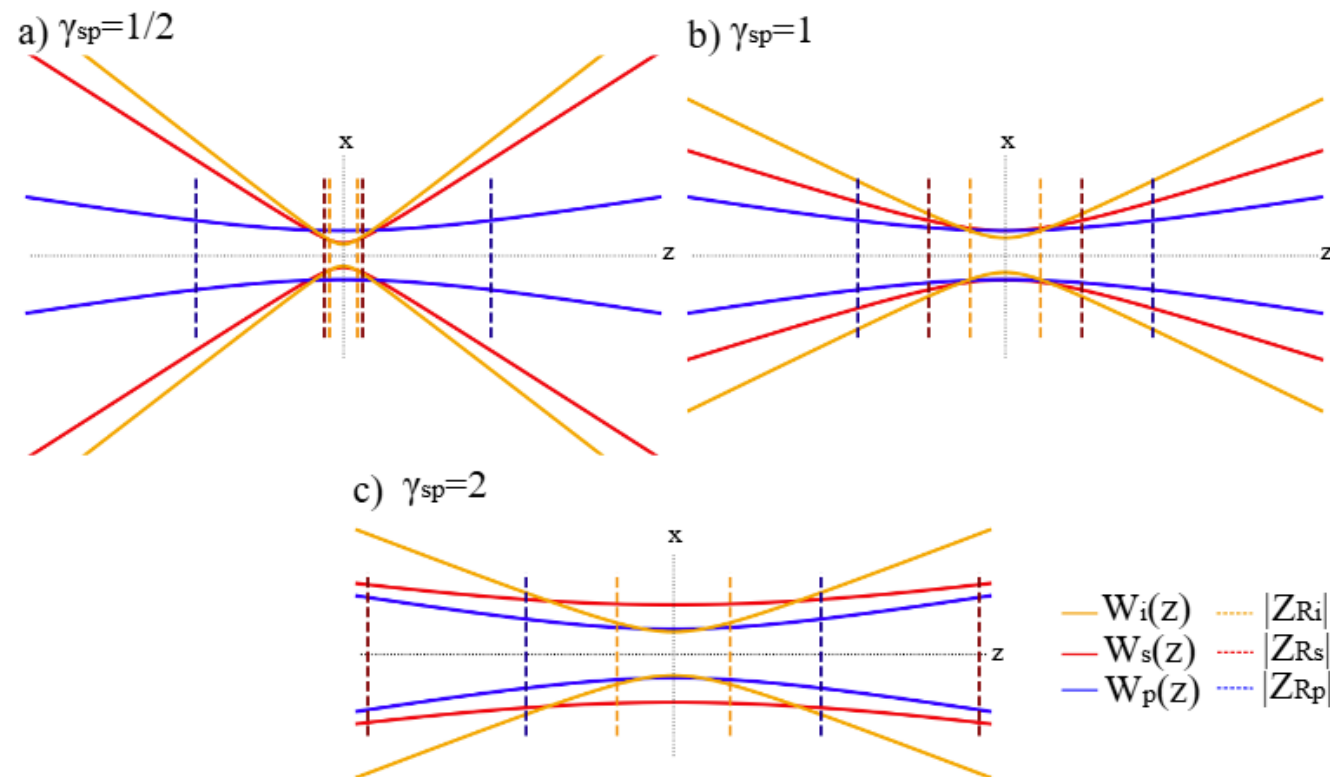
Important things to consider

1. Know your audience



Important things to consider

2. Identify your message



Important things to consider

3. Adapt the figure to the Support medium

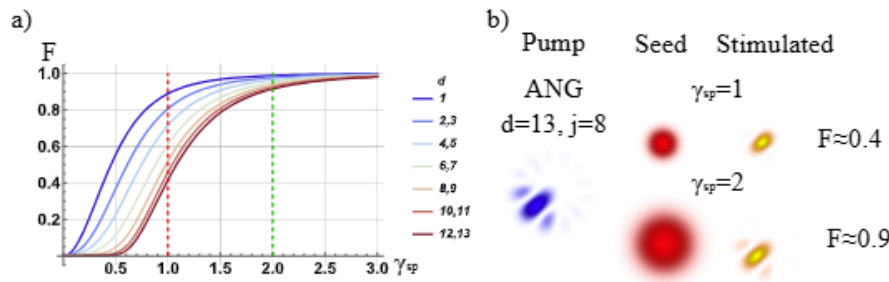


Fig. 5. (a) Fidelity plots of stimulated beams calculated using Equation 14 for ANG beams with $d \in [1, 13]$ as function of γ_{sp} . Notice that the fidelity decrease for higher dimensions. The red and green dashed lines indicate $\gamma_{sp} = 1$ and $\gamma_{sp} = 2$ respectively, corresponding to the experimental measurements taken (See Fig. 8d.) (b) Intensity of pump beam with ANG structure with dimension $d = 13$ and modal number $j = 8$, Gaussian seed beam, and the resulting stimulated beam for $\gamma_{sp} = 1$ and $\gamma_{sp} = 2$.

Figure 5 shows the fidelity values for transferring ANG modes with different dimensions and modal numbers. Here, fidelity does not depend on the modal number j , but rather solely on the dimensionality of the basis d . The fidelity decreases as the dimensionality of the basis increases. This is because a larger dimensionality would require higher values of l in Equation 13, which increases the size of the transverse spatial distribution for each basis element, thus decreasing the overlap between the seed beam and the pump ANG modes. However, for a fixed dimension, all the basis elements are composed of the same OAM modes, while what changes is the intermodal complex phase of the superposition. Therefore, the size of the transverse spatial distribution remains the same for different modal numbers. As a result, every element within the same basis will have homogenized fidelity as a function of γ_{sp} .

This analysis was carried out assuming that the spatial mode intended for transfer is embedded in the pump beam. This remains applicable in the scenario where the seed beam has a non-trivial complex amplitude profile while the pump beam is Gaussian beam. In this specific case, the stimulated beam corresponds to the complex conjugate of the seed beam's spatial profile as seen in Eq. 1.

Encoding prime number in low-dimensional topological elements

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² Research Laboratory of Electronics, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, USA
³ Center for Quantum Information Science and Technology, Faculty of Engineering Sciences, Ben-Gurion University of the Negev, Beersheba, Israel
⁴ Faculty of Engineering, Institute of Nanotechnology and Advanced Materials, Bar Ilan University, Ramat Gan, Israel

Braids and Knots

A braid in s strands is a set of s non-intersecting smooth lines joining two parallel planes. Following Alexander's braiding theorem, the closing of a braid yields a knotted curve K .

We can extend these concepts by equipping each strand with a non-vanishing continuous vector field V called *framing*. Therefore, we obtain the framed knot (K, V) by closing our framed braid.

However, it must be noted that the braid representation of a framed knot is not unique: it depends on the way the twists are distributed on the strands.

Here, we exploit the ambiguity of the braid representation for a framed knot as a platform for secure communication. We propose the encoding of prime numbers using the braid representation and the half-twists per strand.

Encoding prime numbers

Our general problem is that Alice wants to send a message to Bob in the form of a framed knot

Example

Encoding

$\alpha = 2$
 $d_0 = 3$
 $p = 2$
 $j = 1-22526$

α, β

The message

Decoding

$M = 6$
 $N_{\alpha, \beta} = 518400$

References

1. Ebrahimi, M., Karimi, E., and Kishinev, "Framed knots," The Mathematical Intelligencer 42, no. 4 (2020).
2. Alexander, J.W., "A lemma on systems of knotted curves," Proceedings of the National Academy of Sciences of the United States of America 10(1), 53 (1923).
3. Larocque, H., Ferrer-García, M.F., Carmi, A., Cohen, E., D'Errico, A., and Karimi, E., "Optical framed knots as information carriers," Nature communications 11, no. 1 (2020).
4. Kauffman, L.H., "Lorenz, S.J., Quantum entanglement and topological entanglement," New Journal of Physics 4(1), 73 (2002).

Important things to consider

4. Captions are not optional

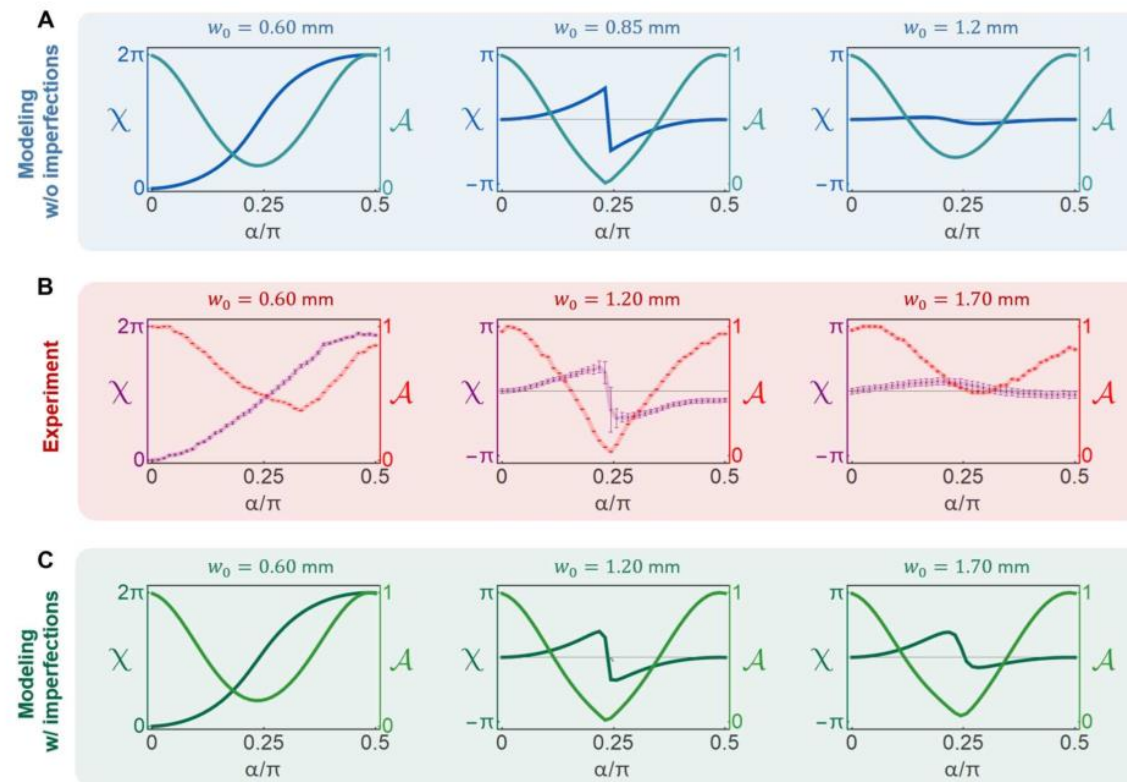
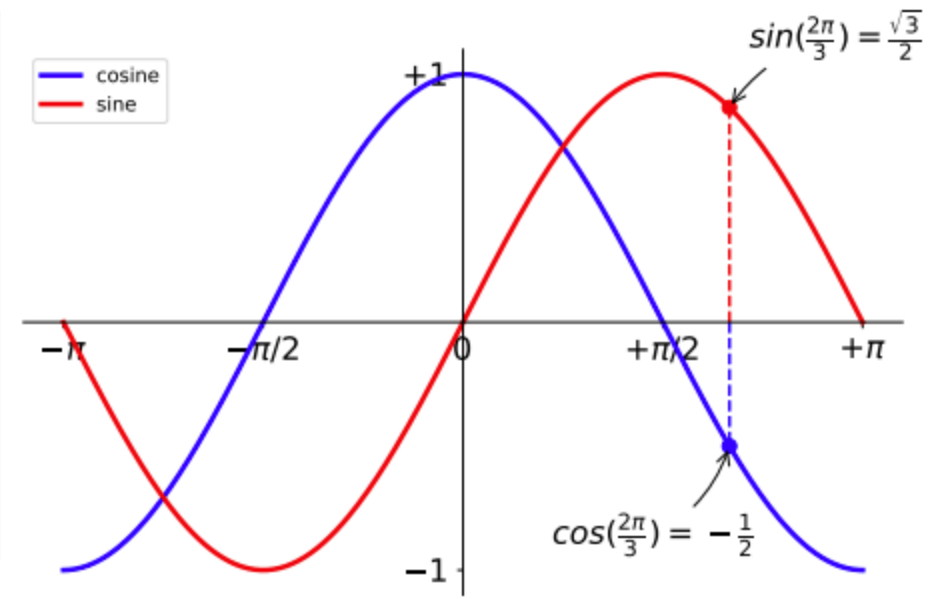
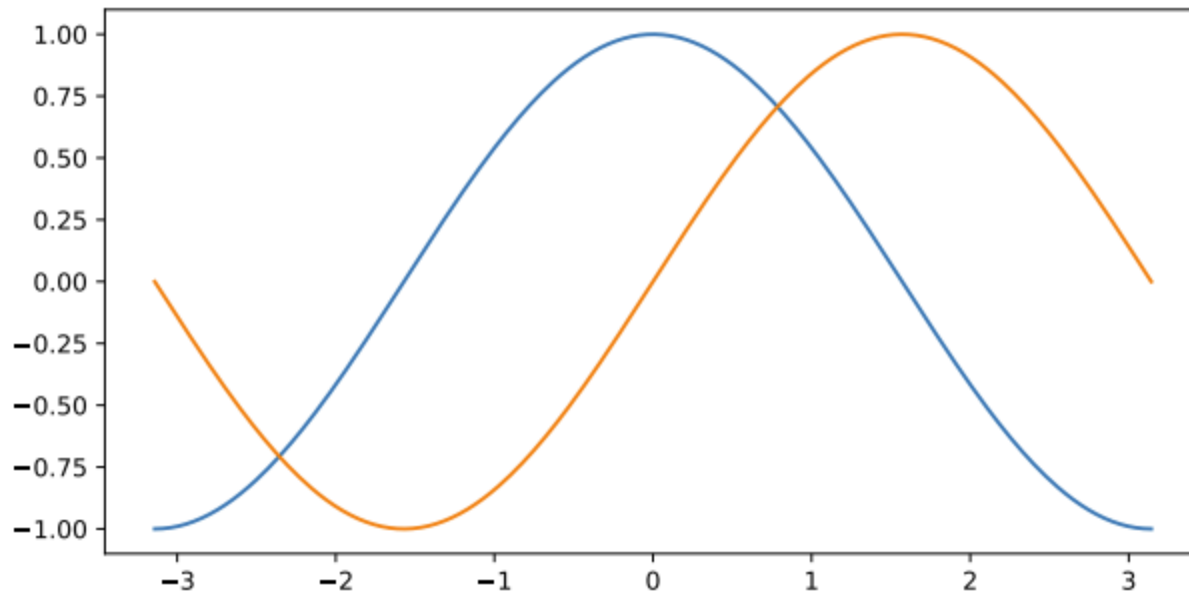


Fig. 3. Experimentally measured and theoretically simulated geometric phase. Topological transition in the measurement-induced geometric phase $\chi(\alpha = \theta/2)$: (A) theoretical modeling, (B) experimental results, and (C) modeling incorporating the imperfection of the birefringent crystals. The plots show the phase $\chi(\alpha)$ and the interference contrast \mathcal{A} . The left column corresponds to a narrow beam (small w_0 , strong measurement) and features $\Delta\chi = 2\pi$. The right column corresponds to a large beam width (weak measurement) and exhibits $\Delta\chi = 0$. The middle column represents a point close to the transition: The phase $\chi(\alpha)$ exhibits a sharp change near $\alpha = \pi/4$. The sharp change of the phase coincides with the vanishing of the interference contrast, which renders $\chi(\alpha)$ ill-defined and enables the topological transition.

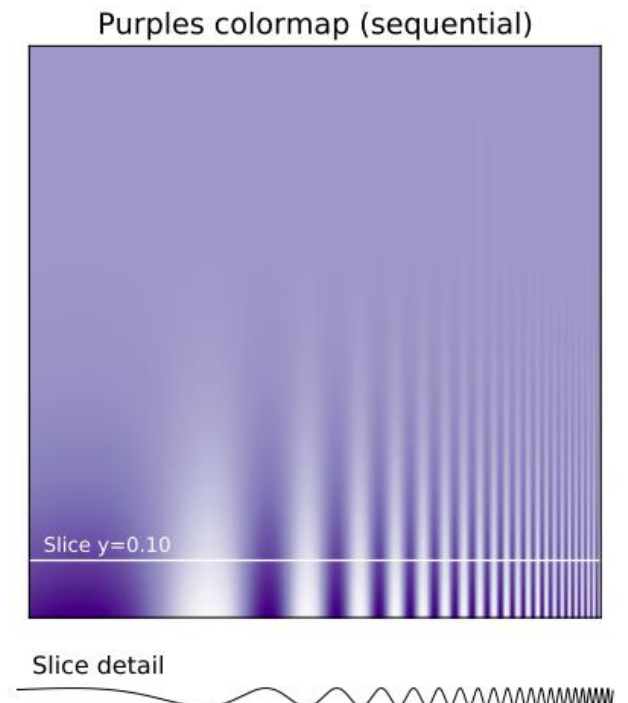
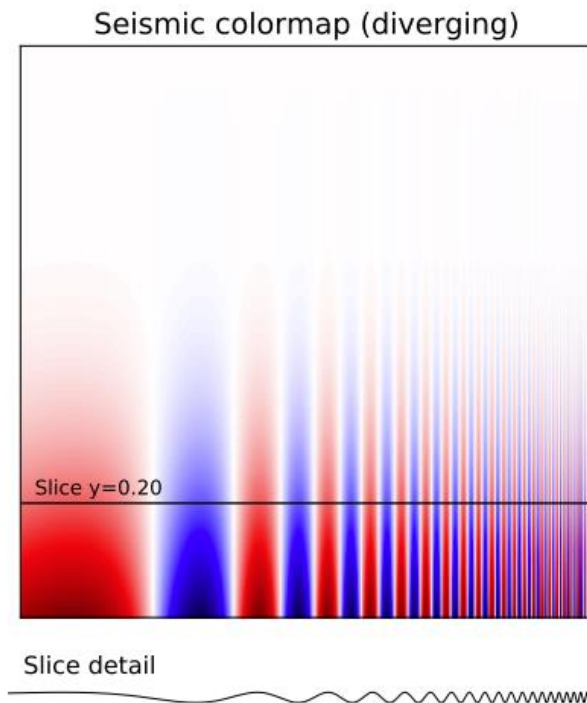
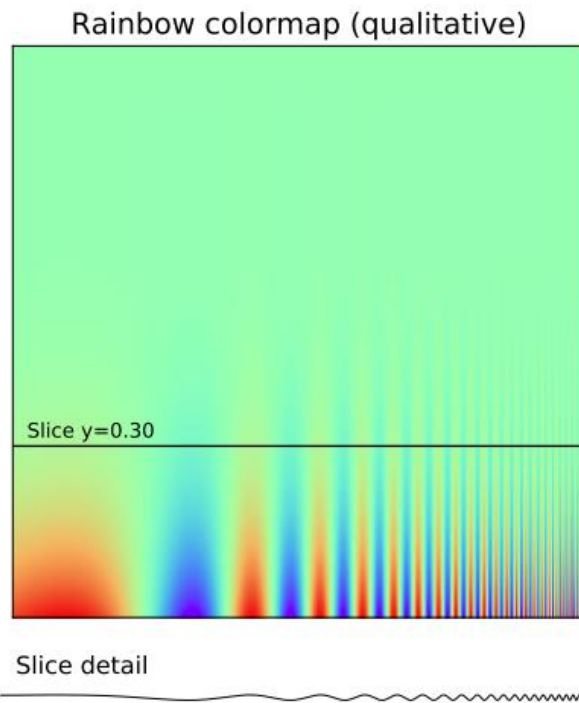
Important things to consider

5. Don't trust the defaults



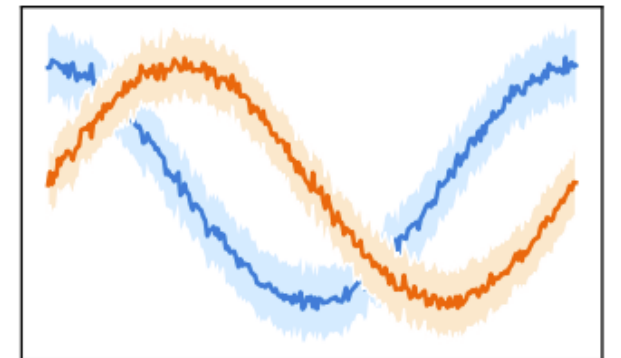
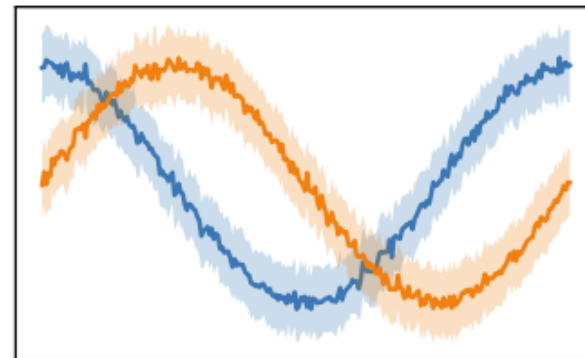
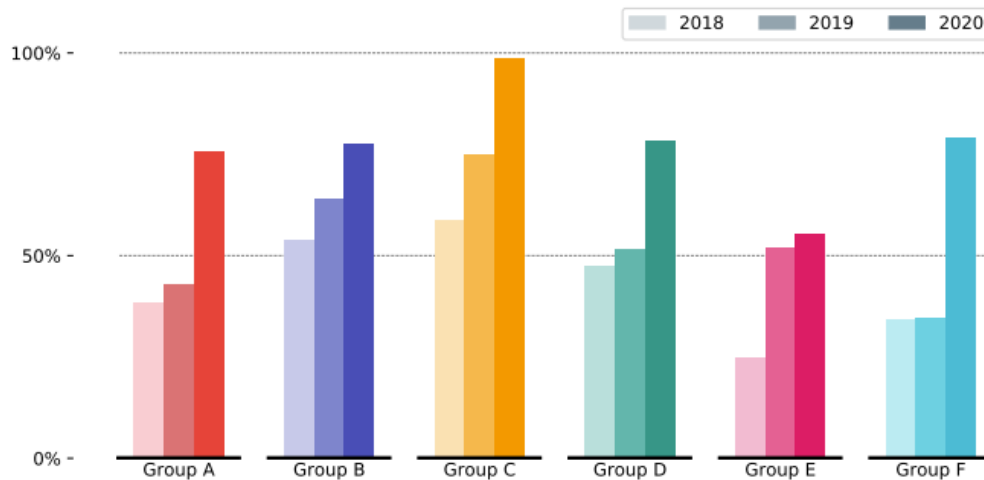
Important things to consider

6. Use color effectively



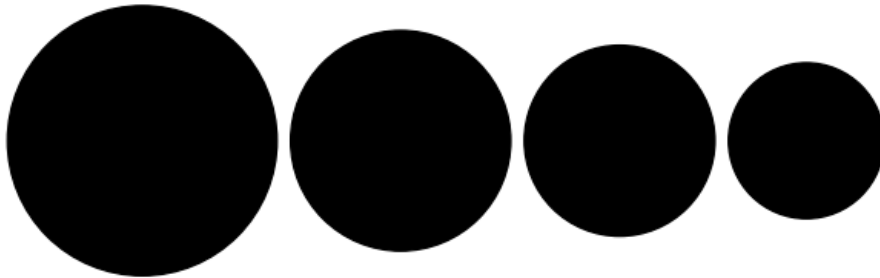
Important things to consider

6. Use color effectively



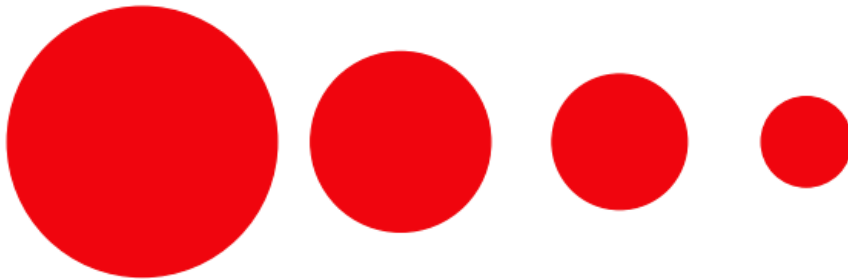
Important things to consider

7. Do not mislead the reader



Relative size using disc area

Relative size using disc radius



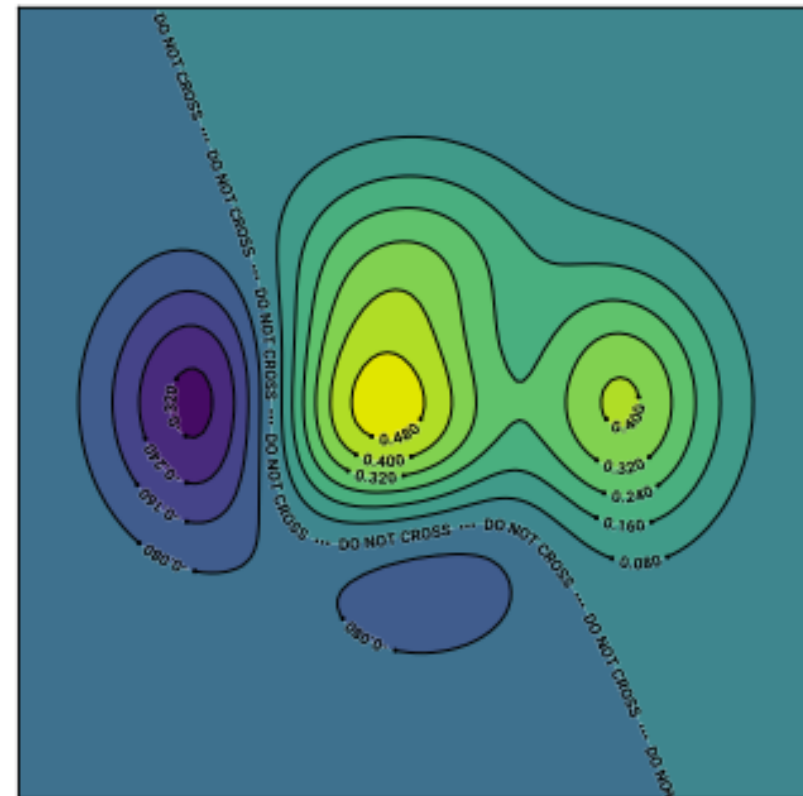
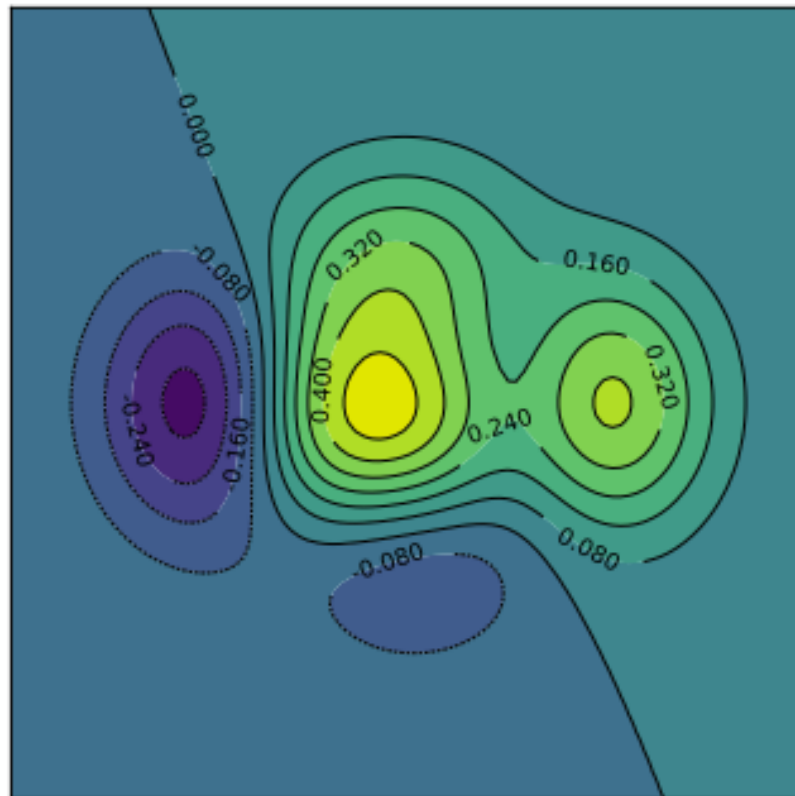
Relative size using full range

Relative size using partial range



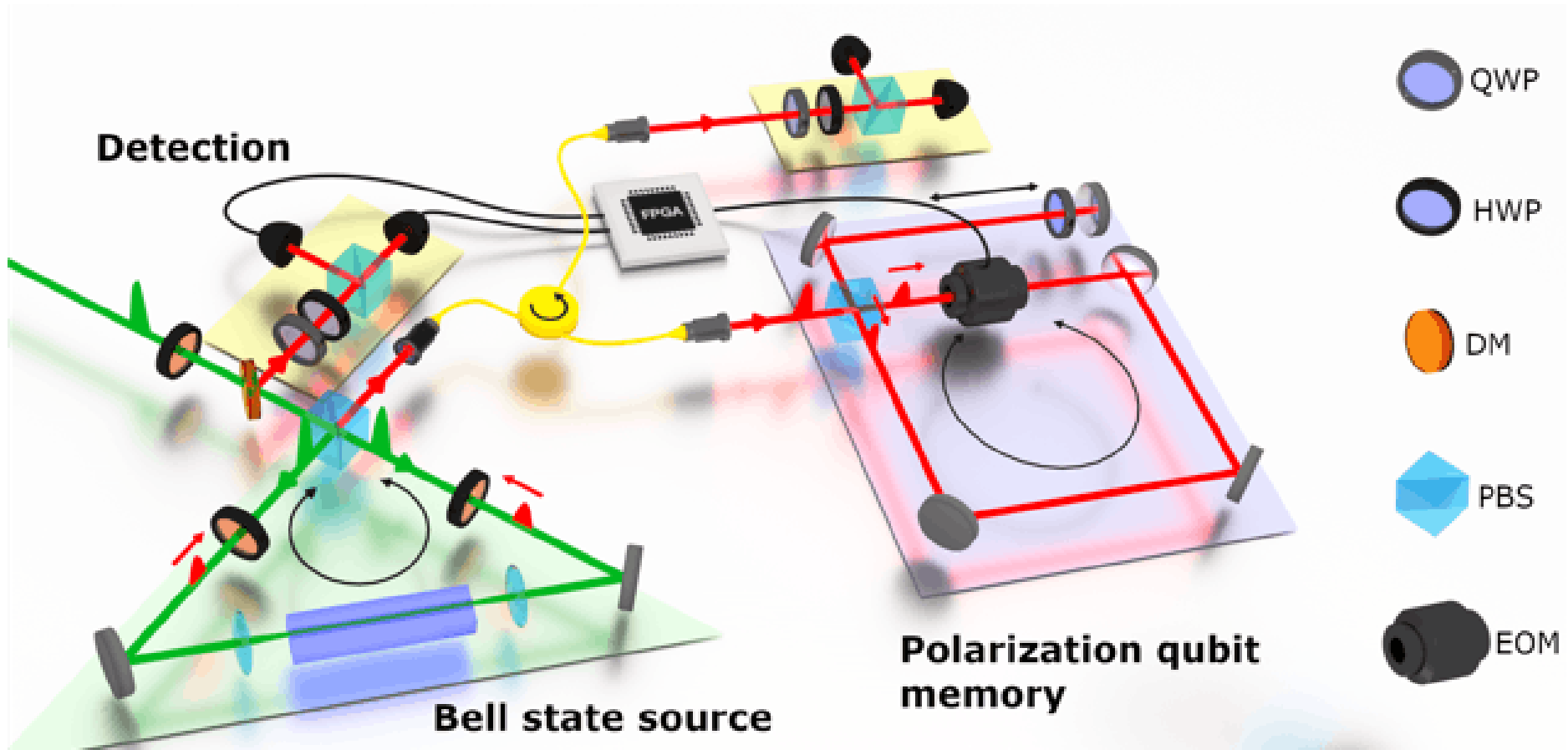
Important things to consider

8. Avoid Chartjunk



Important things to consider

9. Message trumps beauty



Important things to consider

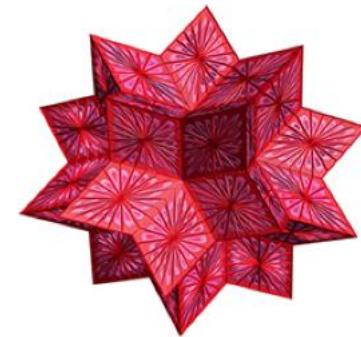
10. Get the right tool



L^AT_EX

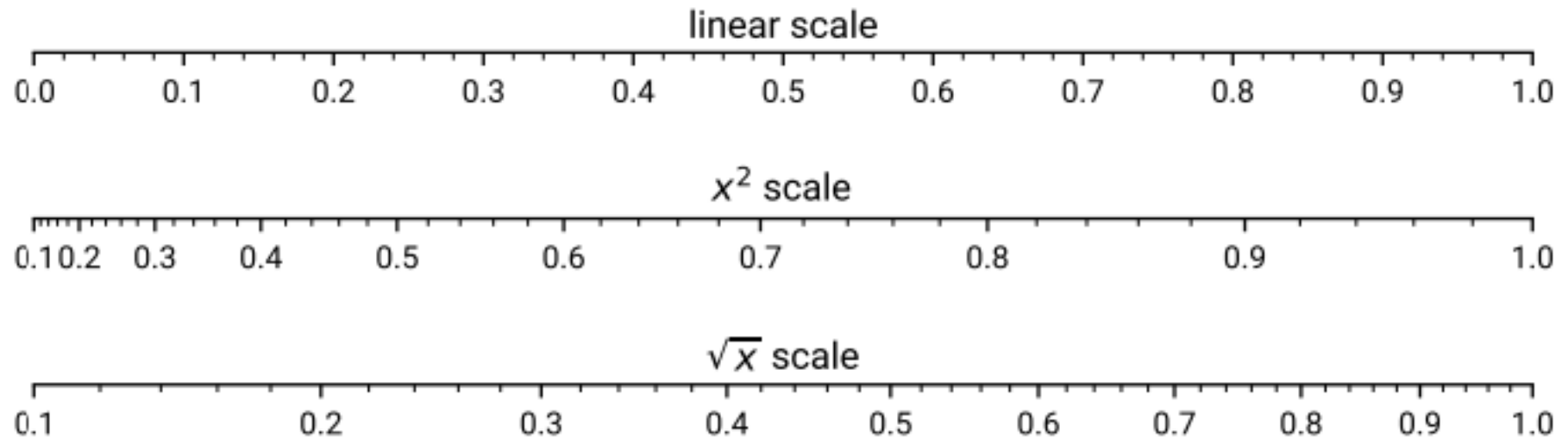


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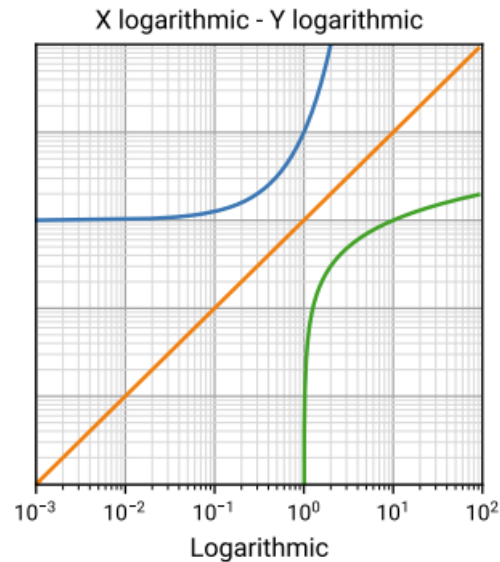
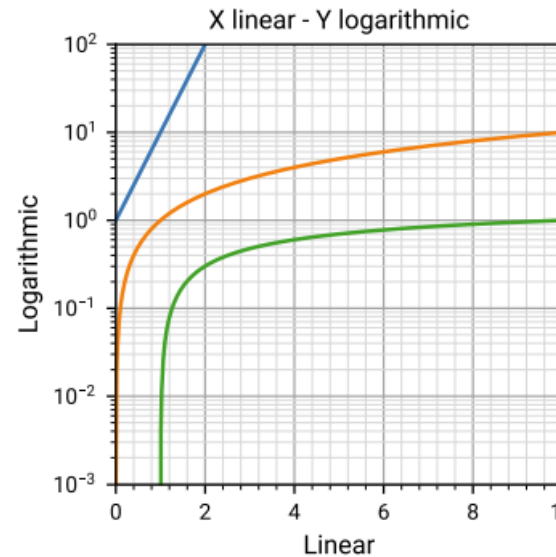
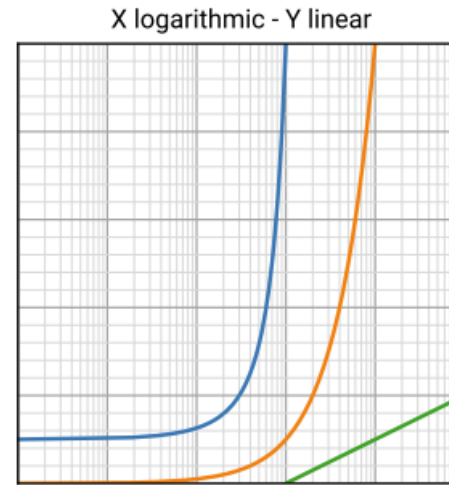
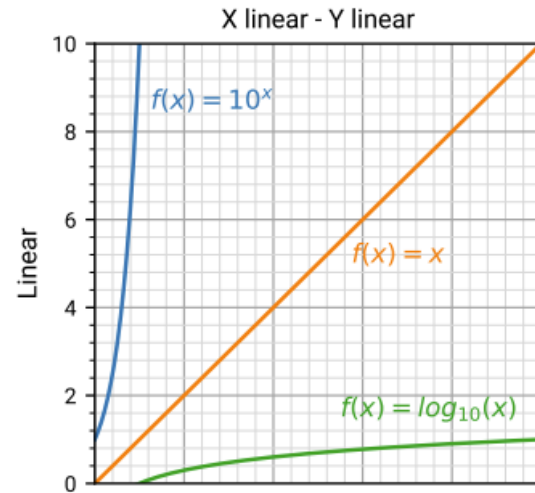
Important things to consider

Scales



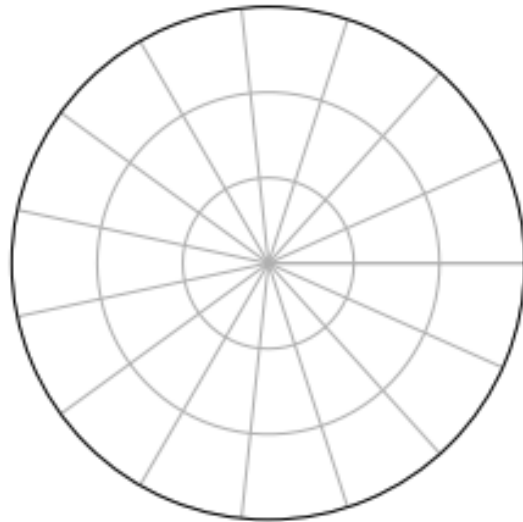
Important things to consider

Scales

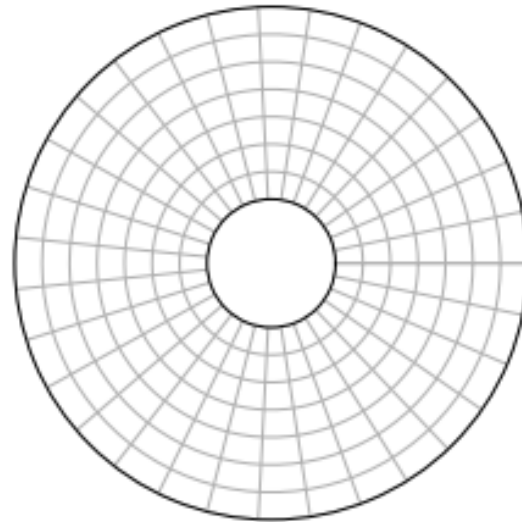


Important things to consider

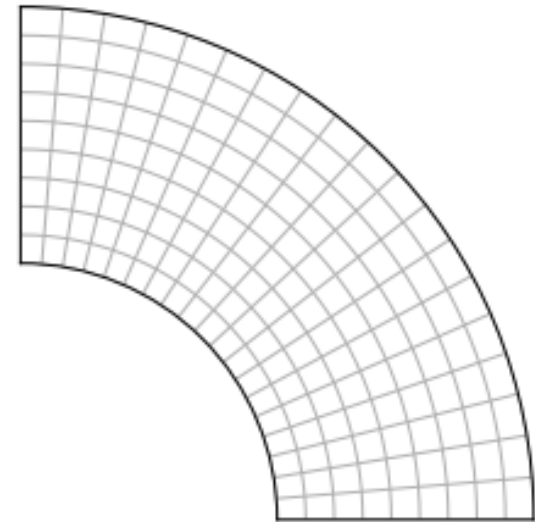
Symmetries



$r_0 = 0.00, r_{min} = 0.00, r_{max} = 1.00$
 $t_{min} = 0.00, t_{max} = 360.00$



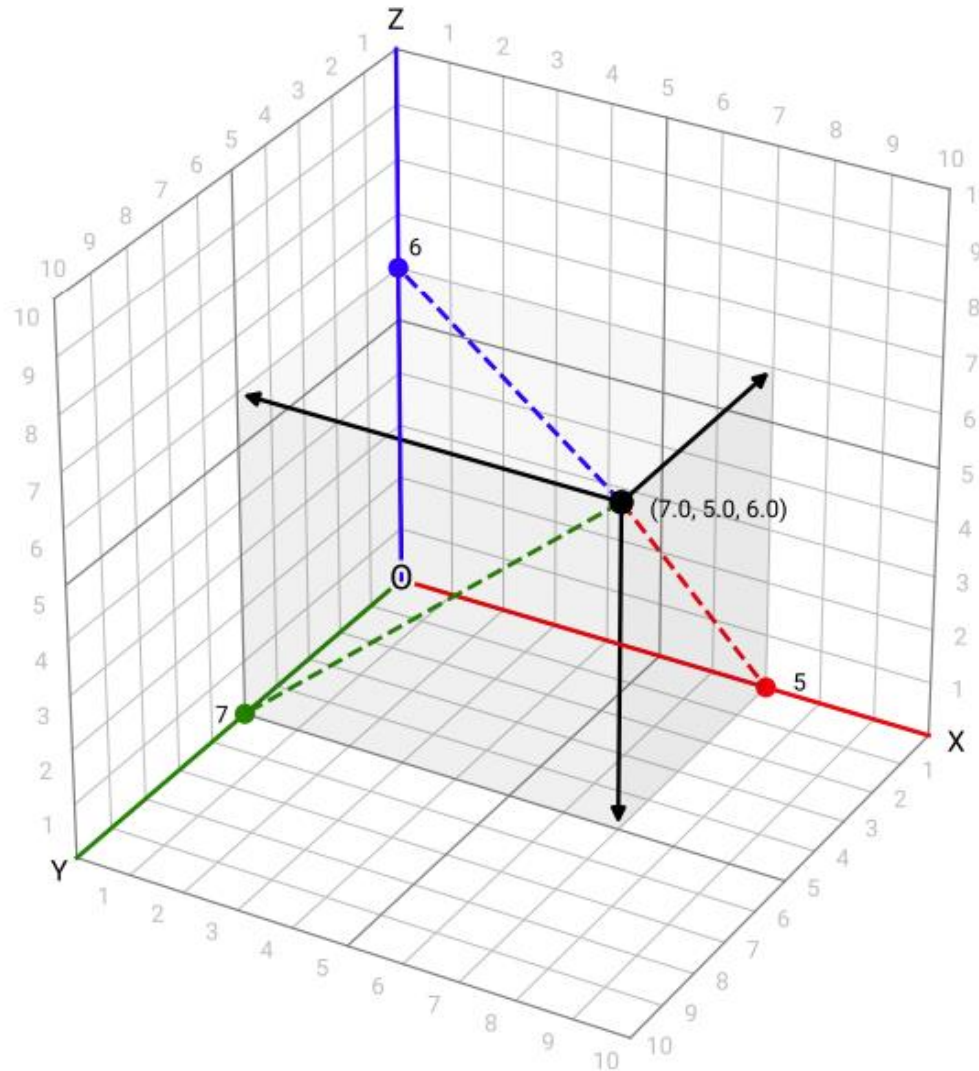
$r_0 = 0.00, r_{min} = 0.25, r_{max} = 1.00$
 $t_{min} = 0.00, t_{max} = 360.00$



$r_0 = 0.00, r_{min} = 0.50, r_{max} = 1.00$
 $t_{min} = 0.00, t_{max} = 90.00$

Important things to consider

Symmetries



Important things to consider

Font

Serif

DejaVuSerif.ttf

Serif

RobotoSlab-Regular.ttf

Serif

SourceSerifPro-Regular.otf

Sans

DejaVuSans.ttf

Sans

RobotoCondensed-Regular.ttf

Sans

SourceSansPro-Regular.ttf

Monospace

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Cursive

Apple Chancery.ttf

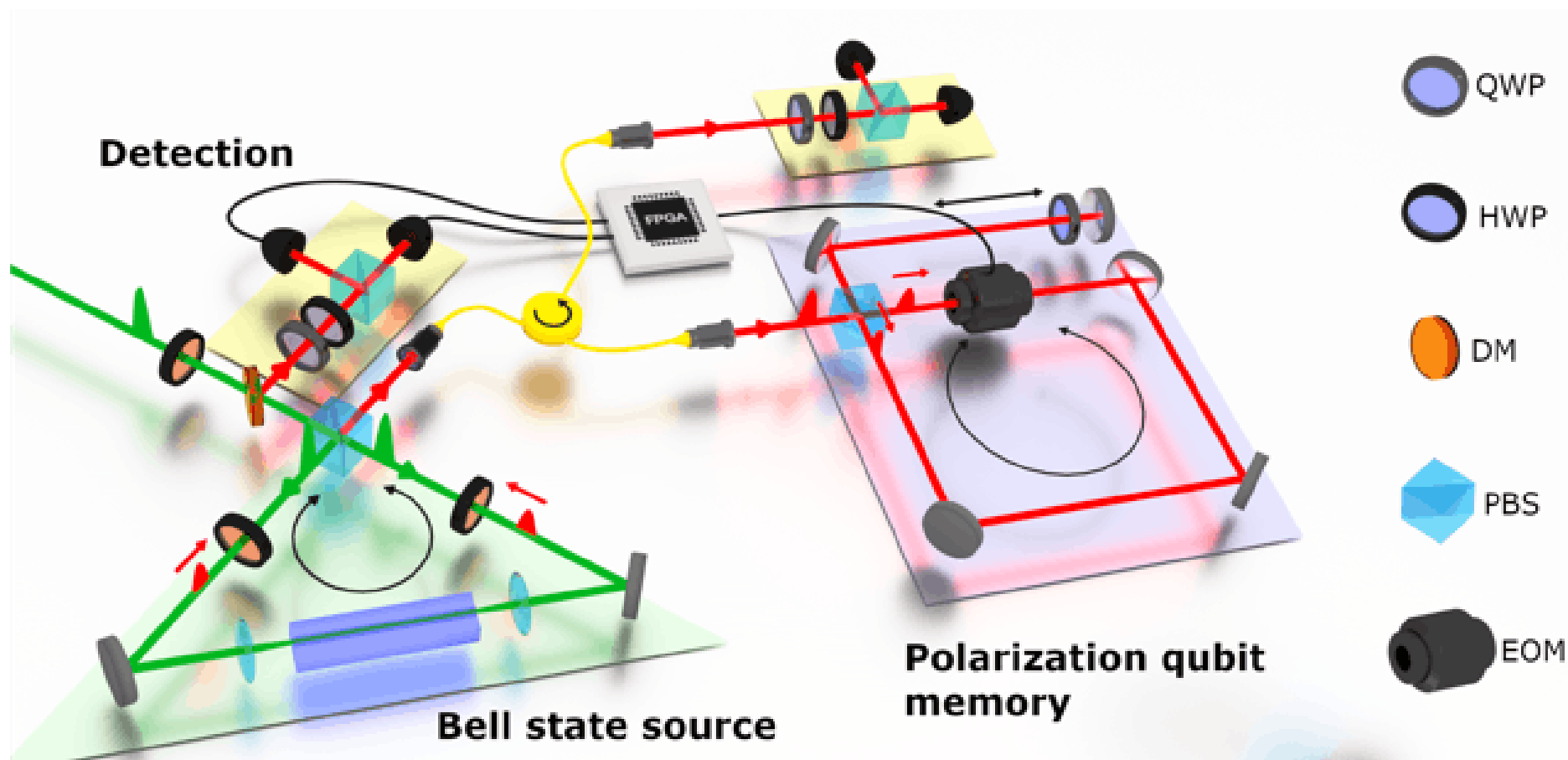
Cursive

Merienda-Regular.ttf

Cursive

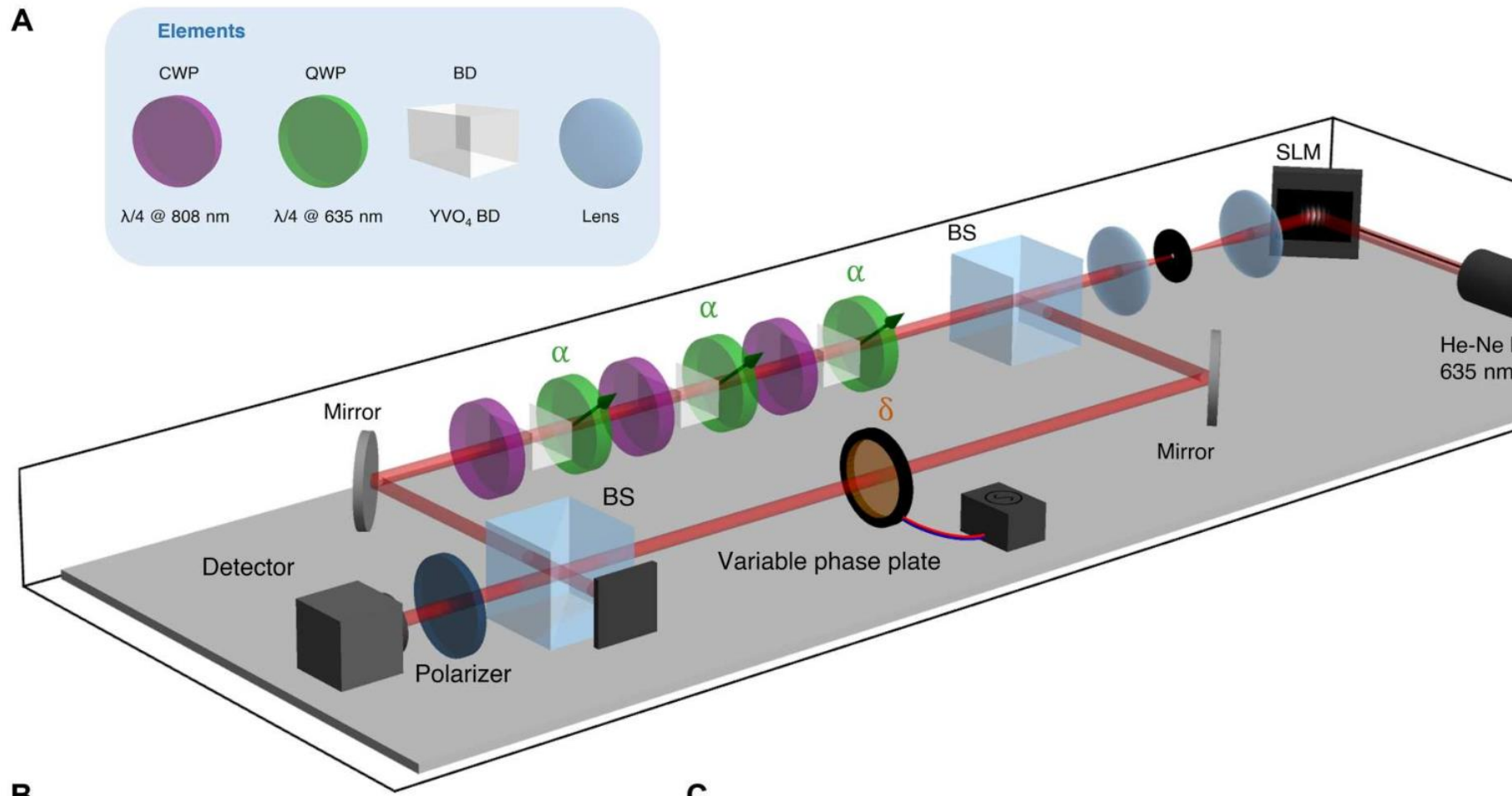
ITC Zapf Chancery.ttf

Experimental setups



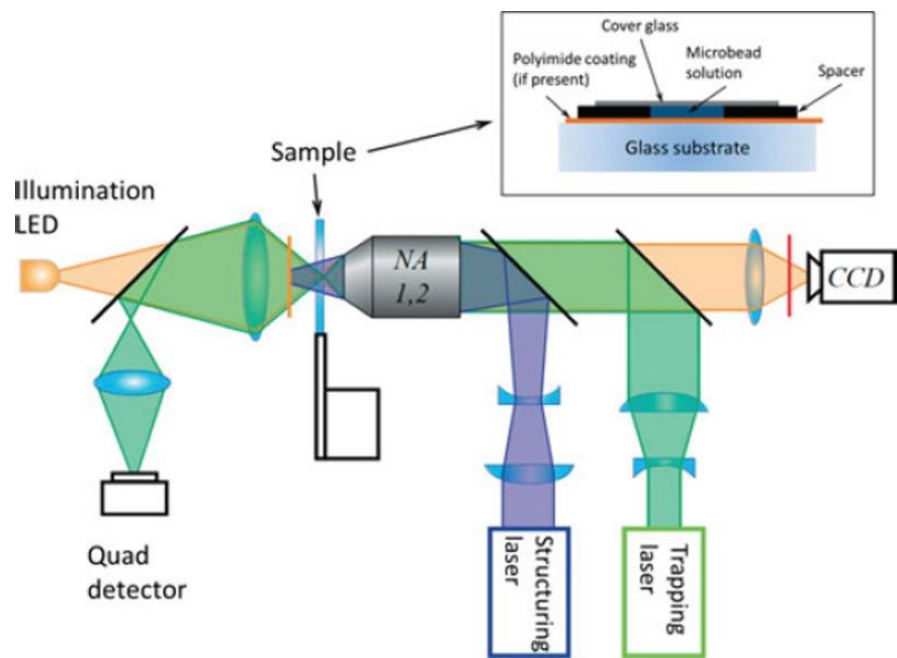
- **ALWAYS** indicate elements!!!
- Properties of the beam!
- Use a box if it A

Experimental setups

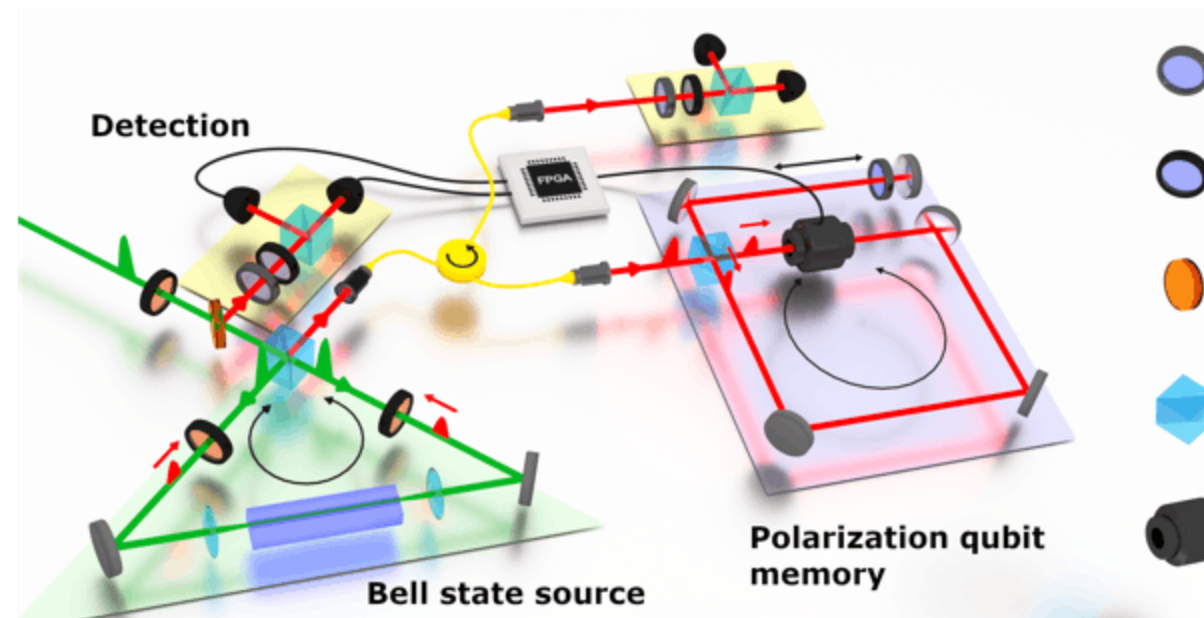


Experimental setups

2D?



3D?



Experimental setups

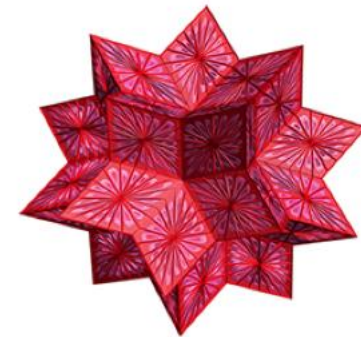
Which software?



L^AT_EX



Wolfram *Mathematica*[®]





Experimental setups

Resources

1. <https://www.gwoptics.org/ComponentLibrary/>
2. <https://github.com/amv213/ComponentLibrary>
3. <https://github.com/fruchart/tikz-optics>
4. <https://github.com/mffg1993/OpticsSetupsDictionary>