The design of a Master Thesis

Andrea Donini
(curso organizado y supervisado con Pilar Hernández)

Outline of the lectures

1. **STARTING**
    1. Choosing a language
    2. Choosing an editing language
    3. Choosing an editor

2. **ORGANIZATION OF THE THESIS**
    1. Understanding your subject
    2. What is “old”
    3. Appendices
    4. What is “new”
    5. Introduction and conclusions

1.

3. **GRAPHICS AND EQUATIONS**
    1. Drawing and inserting plots
    2. Explaining plots (captions!)
    3. Equations

4. **REFERENCING**

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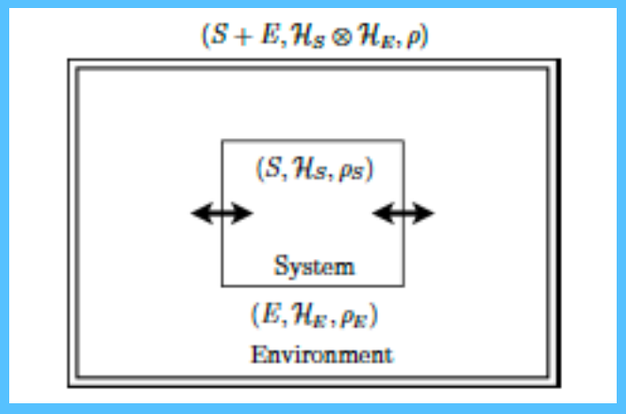
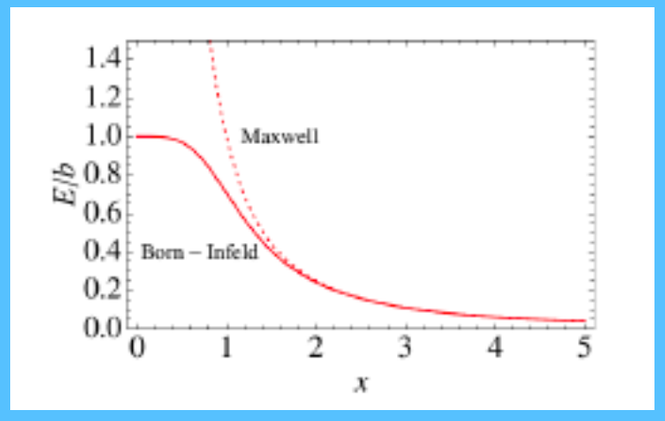
1.

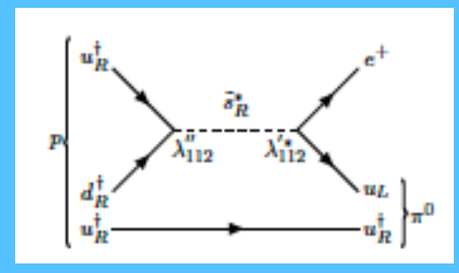
Class Number Two

Part III: Graphics

Pictures are an important tool to present physics results







Graphics are easily imported into Latex in any format. Having them in .pdf is usually better….

Part III: Graphics

You should produce your figures with the software you prefer

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They may be of two kinds:

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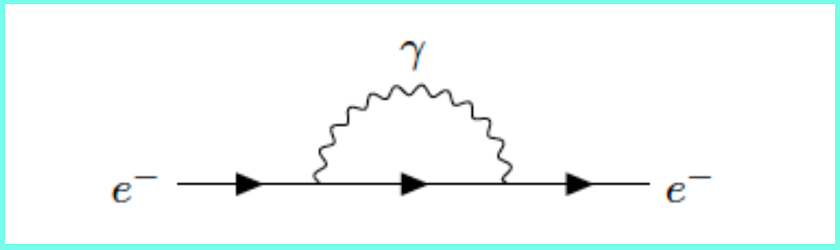
Theory



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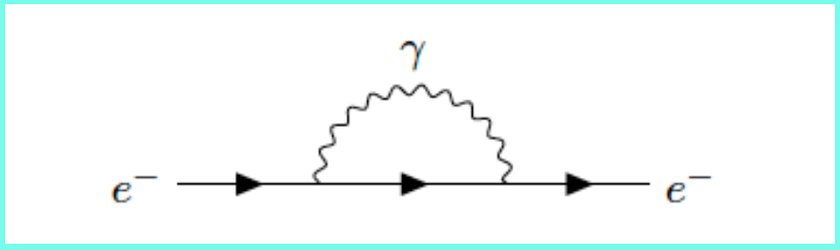

Clean, simple

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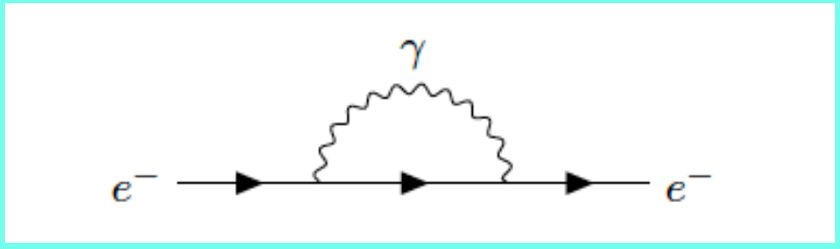
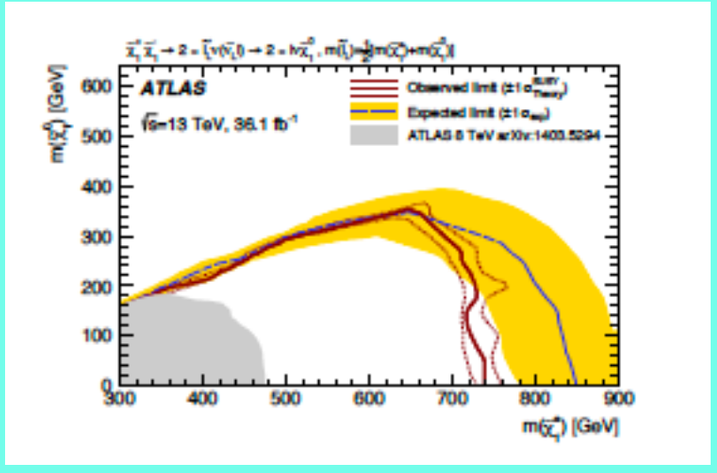


Clean, simple

Pheno/Exp



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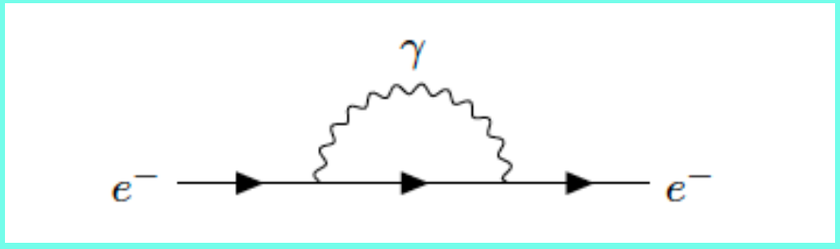

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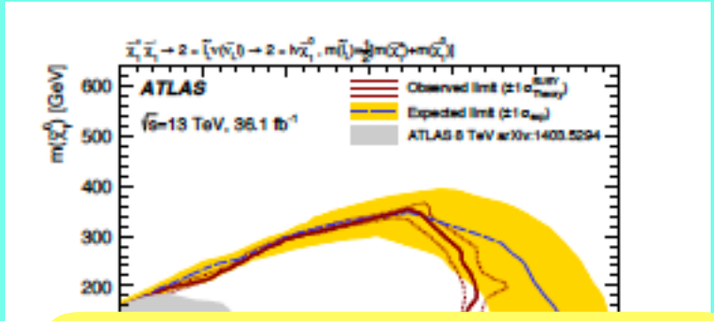


Messy, filled

Part III: Graphics

A Figure is made out of two pieces:

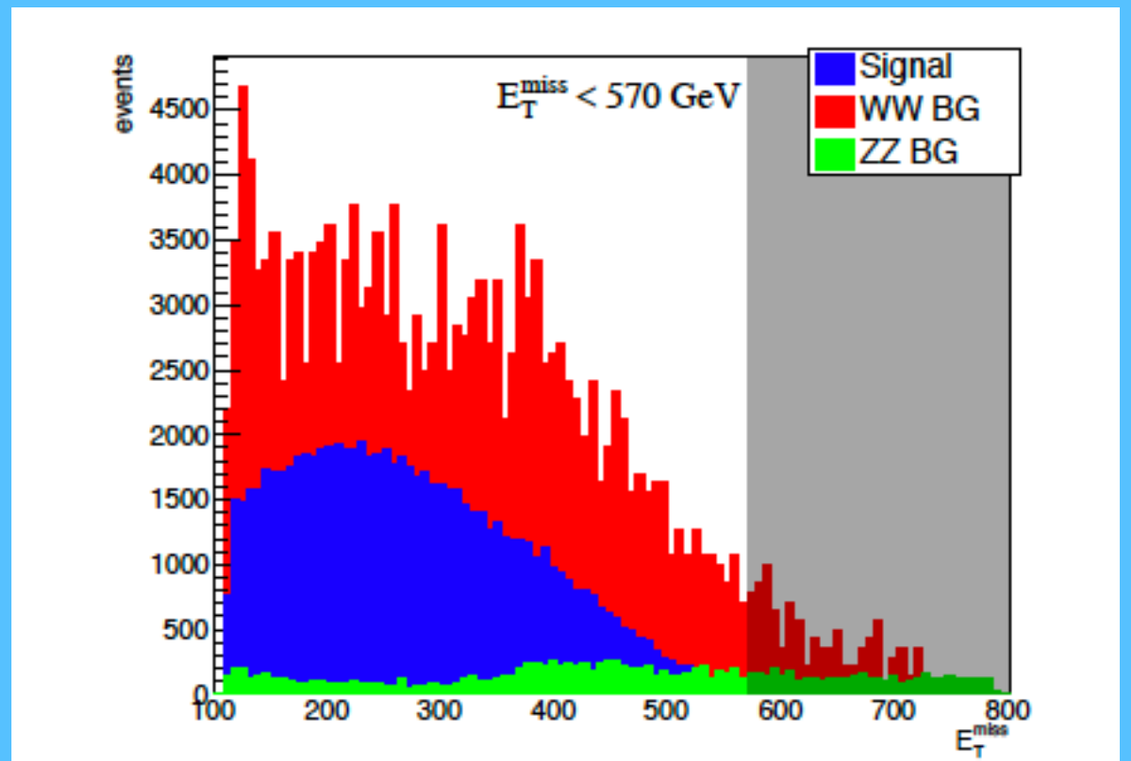
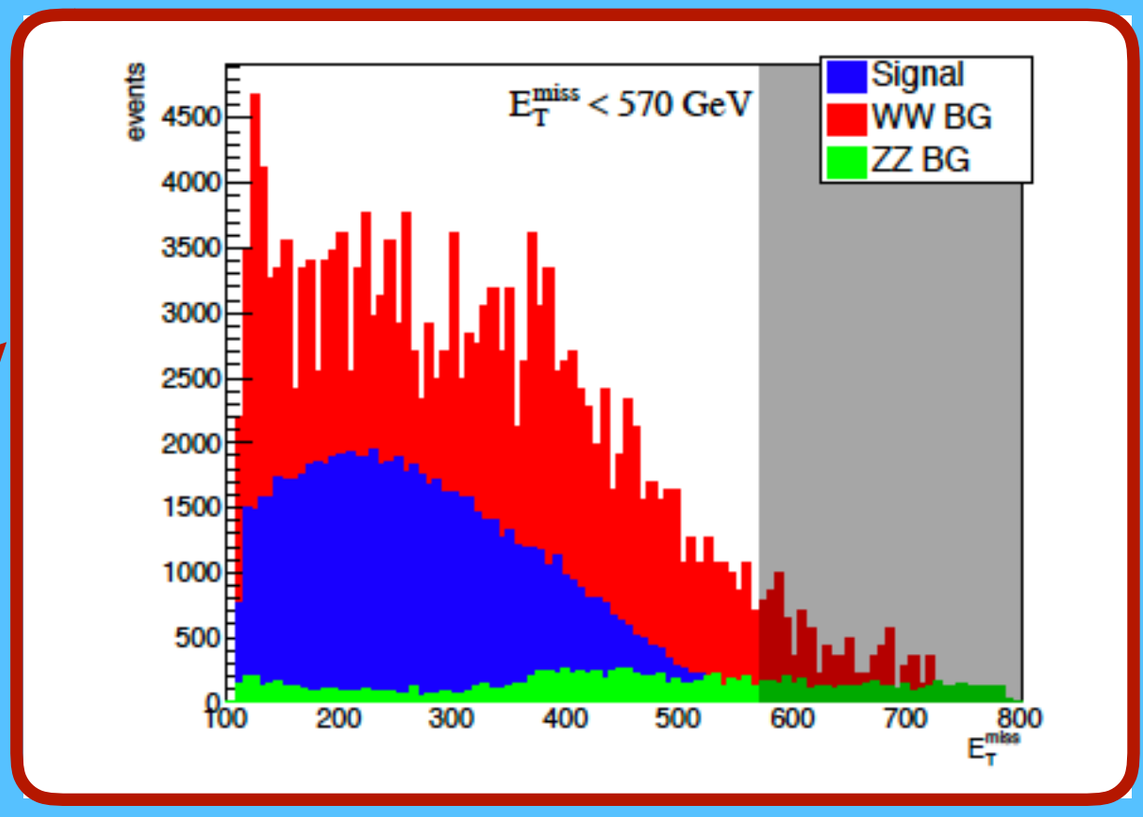


Figure 5.6: Histogram showing all the cuts being applied for the E_T^{miss}. Here we have scaled the number of events in accordance with equation 5.3.29.

Part III: Graphics

A Figure is made out of two pieces:

1. The graphic object



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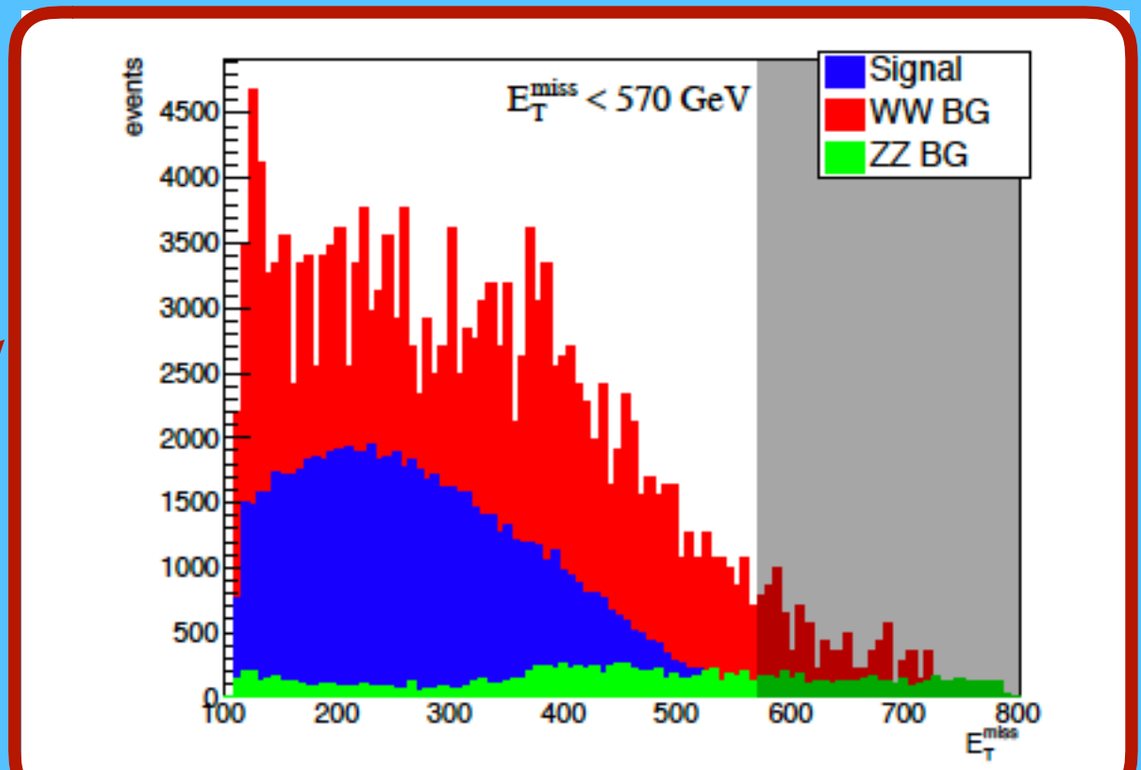

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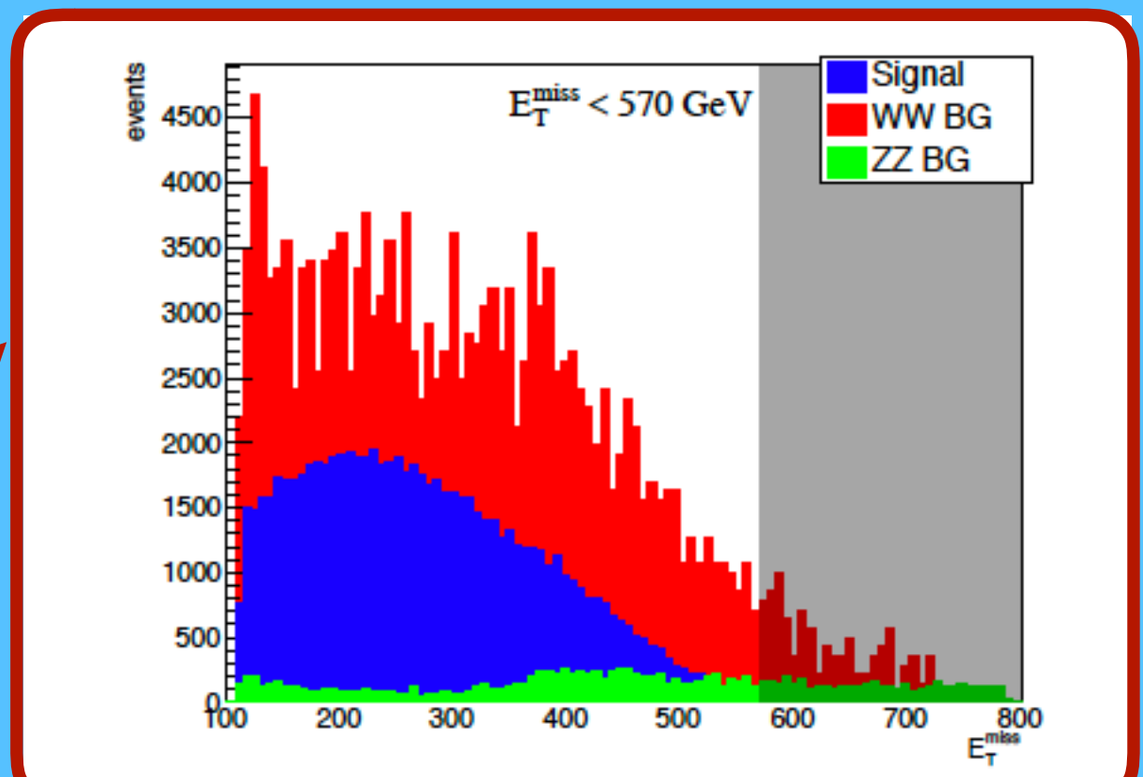

Captions are not an optional!

Figure 5.6: Histogram showing all the cuts being applied for the E_T^{miss}. Here we have scaled the number of events in accordance with equation 5.3.29.

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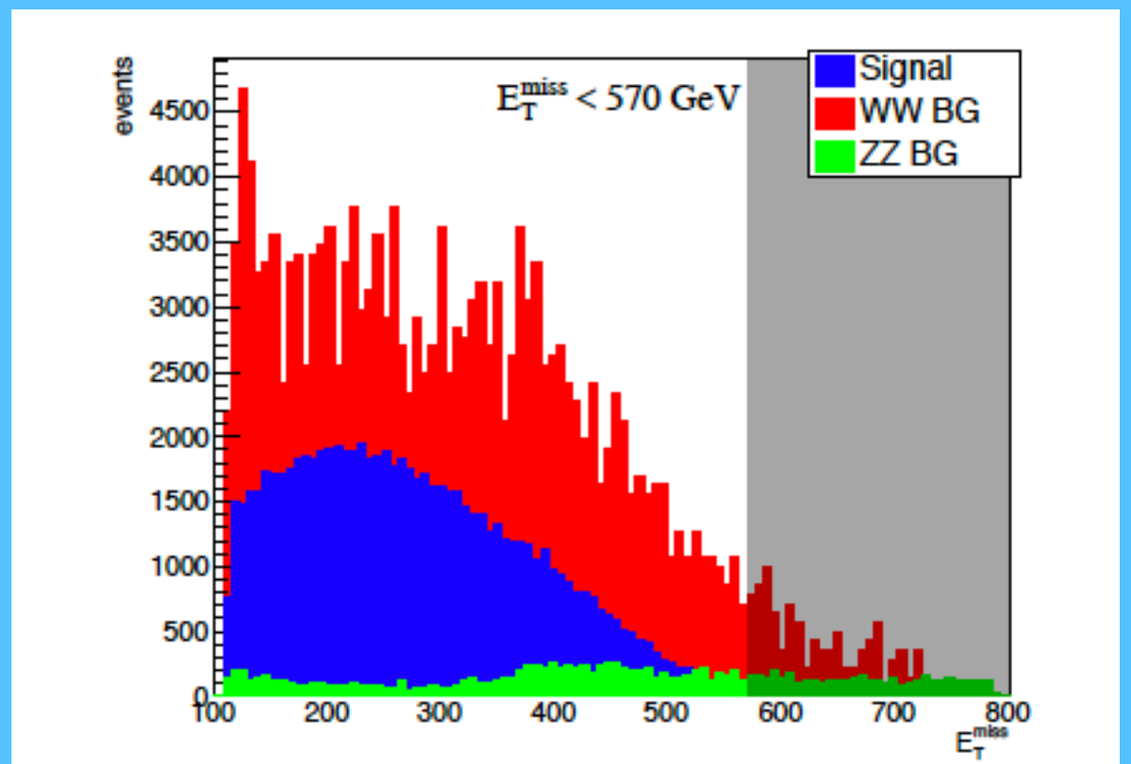
Graphic objects:

legends should be simple and clear (not too many Items)



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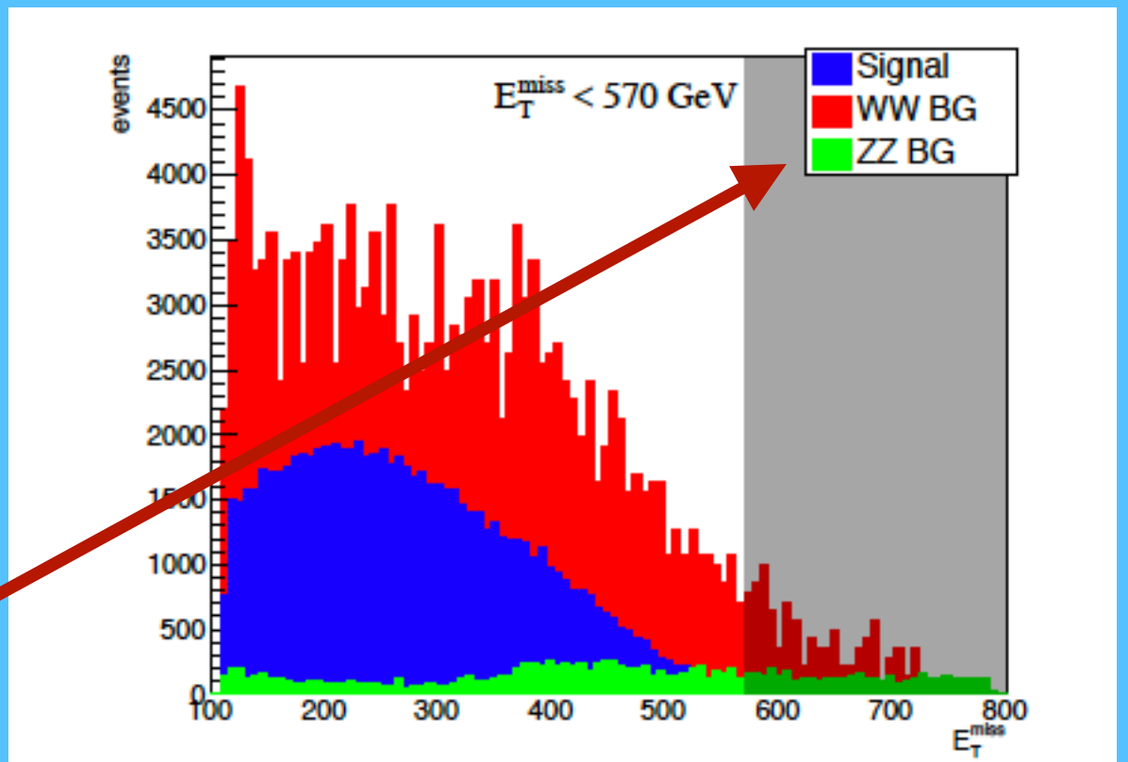

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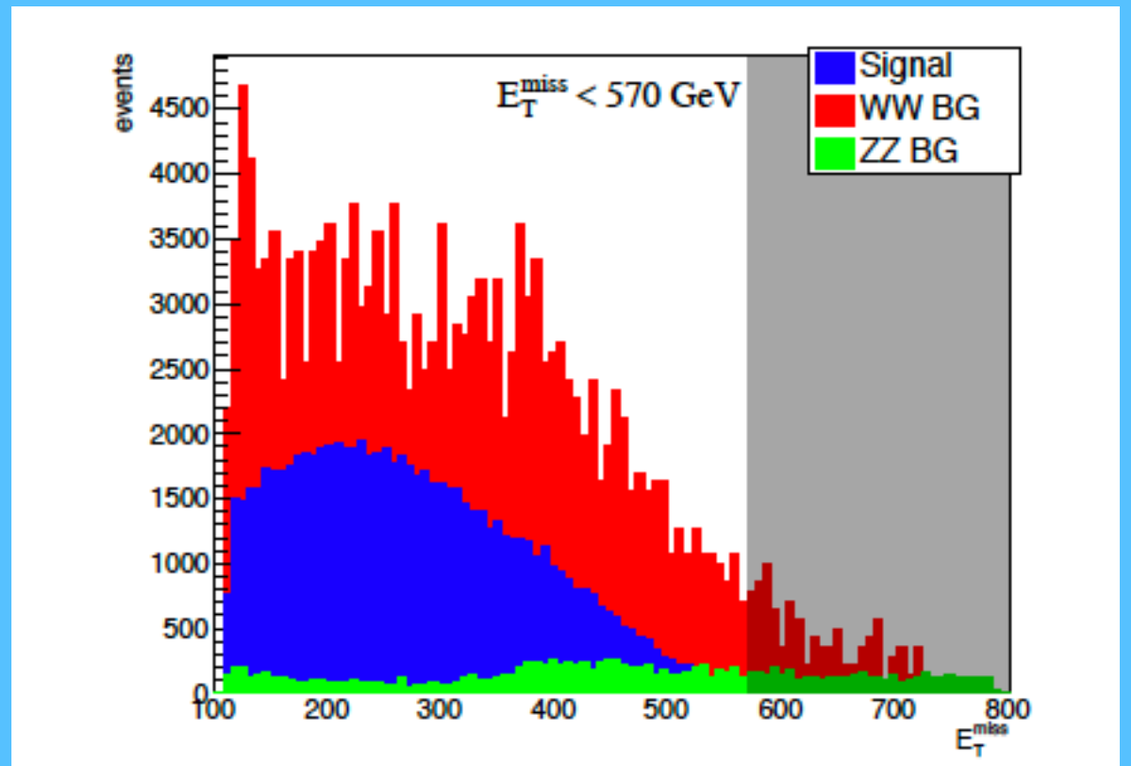
Captions: you have two choices

Put all the information needed to understand the picture



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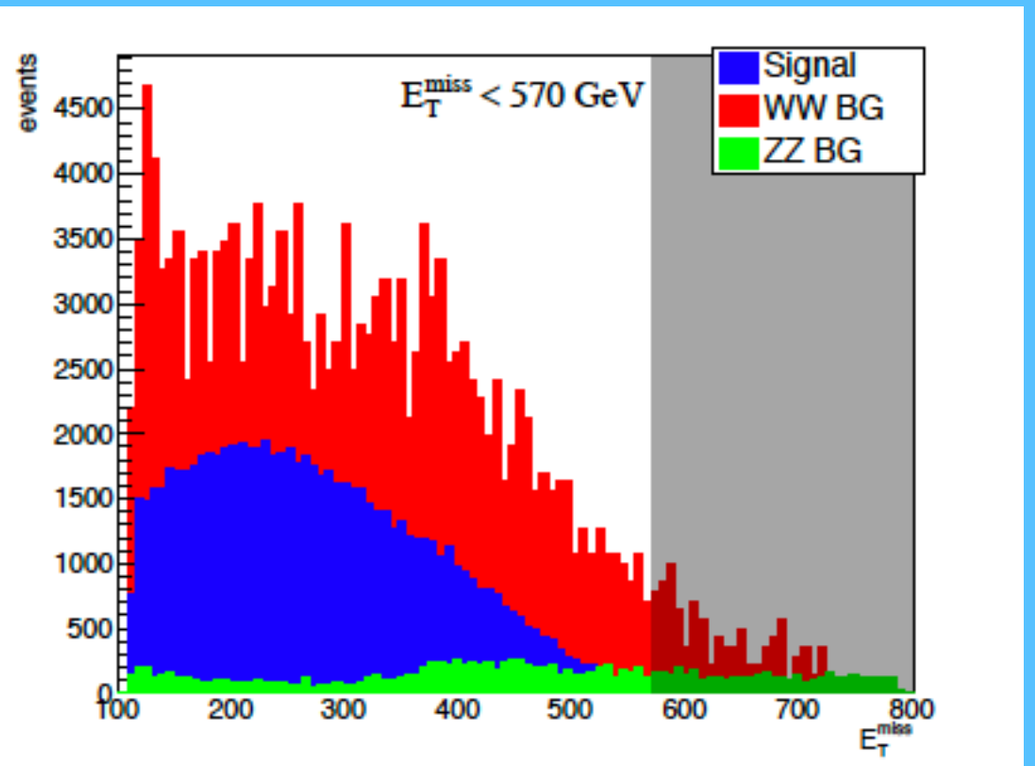
Put only basic information and refer to the main text



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In a thesis, much better the first option. Remember that you should help the reader!

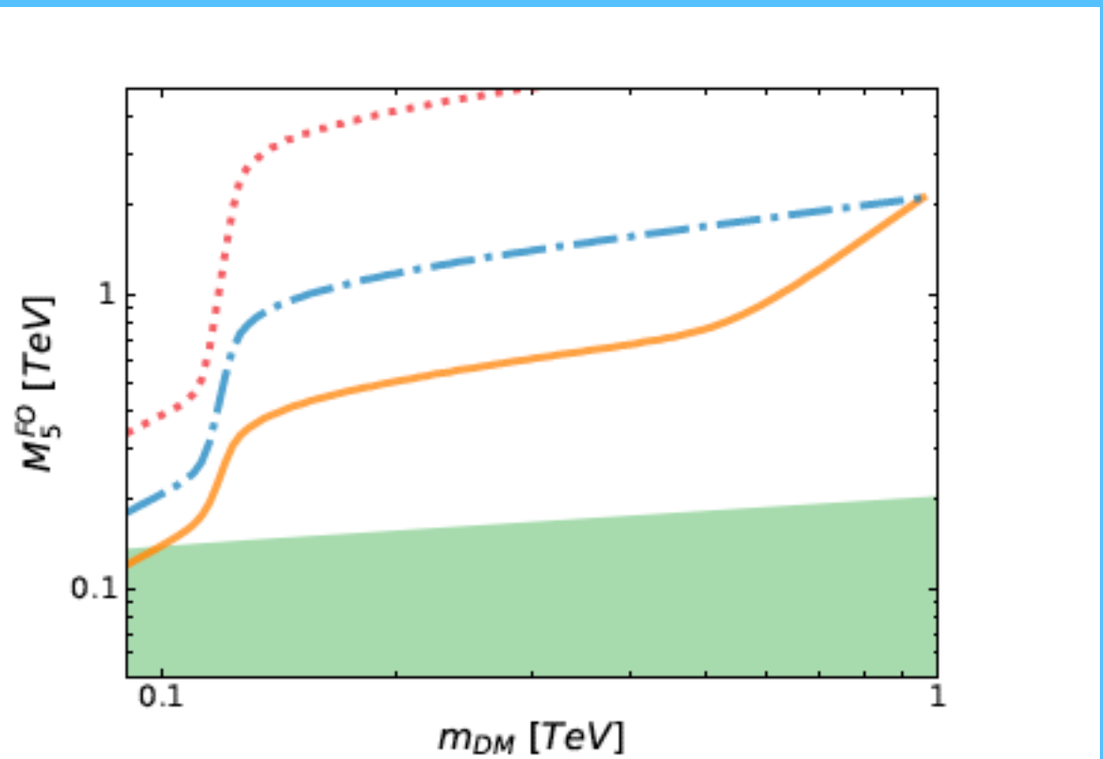


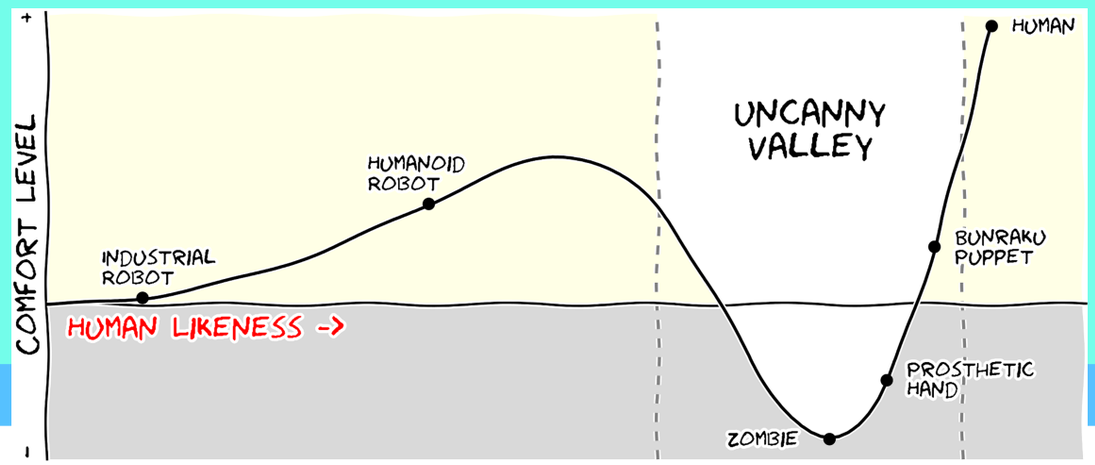
Figure 5. The scale needed to achieve the freeze-out relic abundance, $M_5^{\rm FO}$, as a function of the DM mass $m_{\rm DM}$, for $k = 250$ GeV. Solid orange, dot-dashed blue and dotted red lines correspond to scalar, fermion and vector DM, respectively. The green-shaded area, on the other hand, is the experimental bound in the $(m_{\rm DM}, M_5)$ plane from XENON1T [56].

Recipes for a good figure

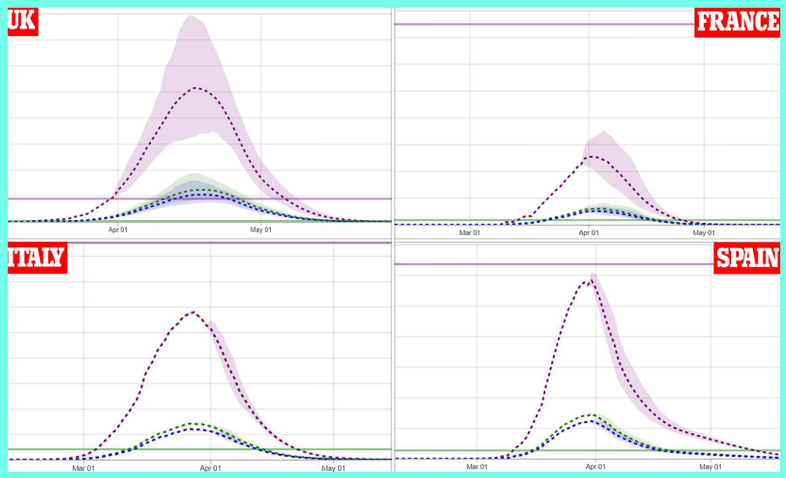
You may find interesting tips here:

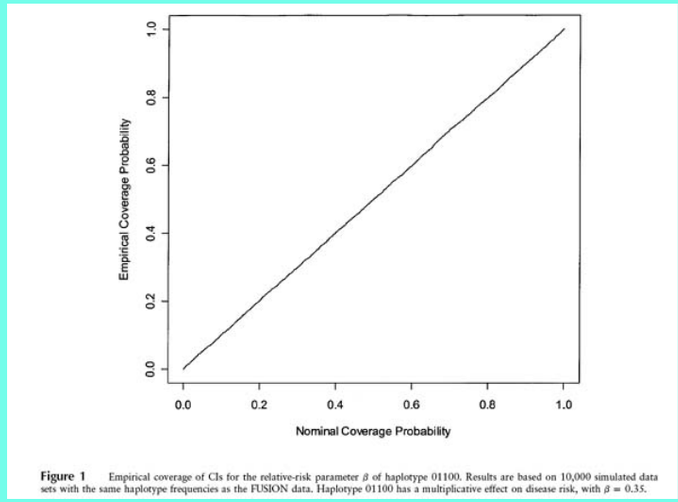
https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833#s7

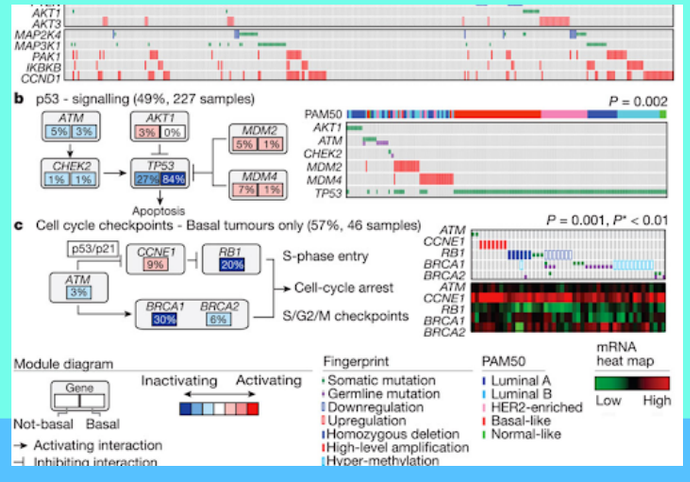
message and readability of the figure is the most important aspect while beauty is only an option,



Recipes for a bad figure







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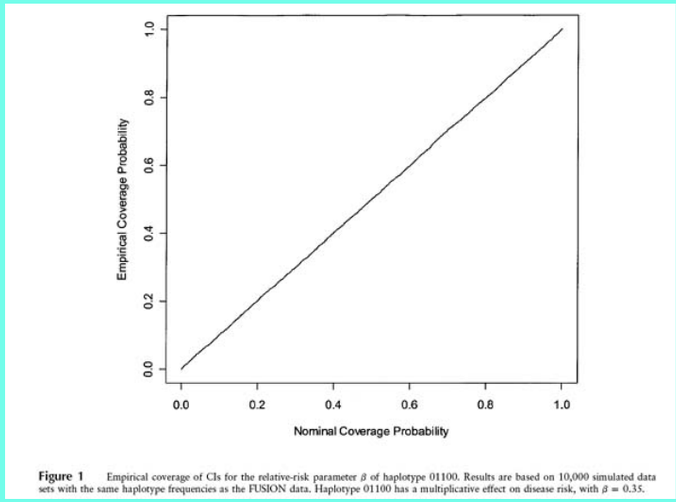
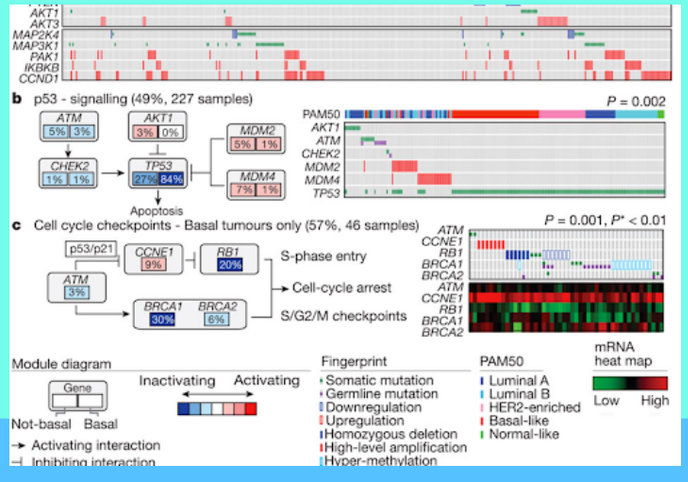


Figure 1 Empirical coverage of CIs for the relative-risk parameter β of haplotype 01100. Results are based on 10,000 simulated data sets with the same haplotype frequencies as the FUSION data. Haplotype 01100 has a multiplicative effect on disease risk, with $\beta = 0.35$.



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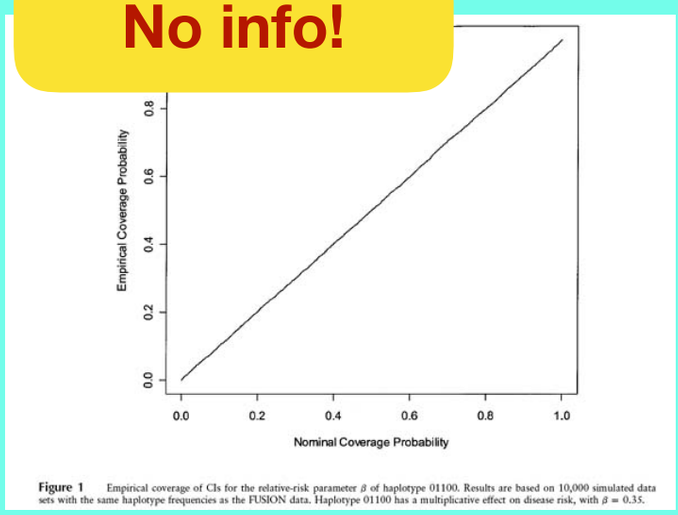
No scales!

No info!



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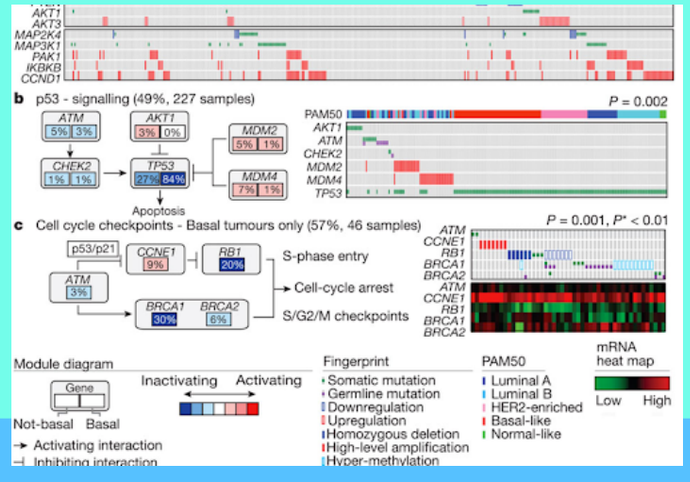

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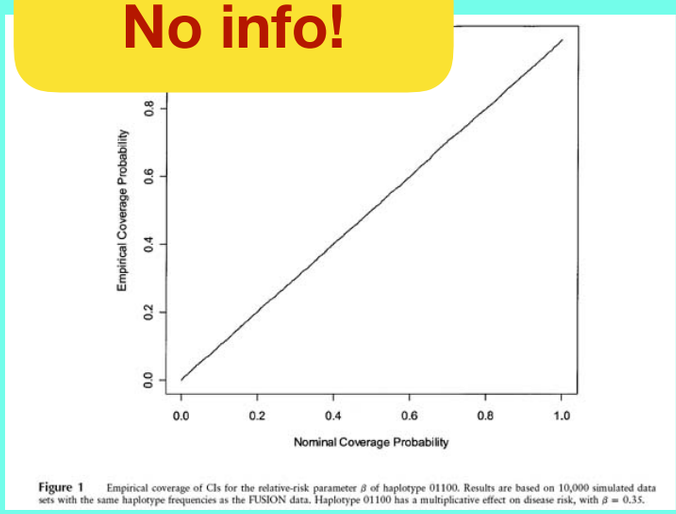

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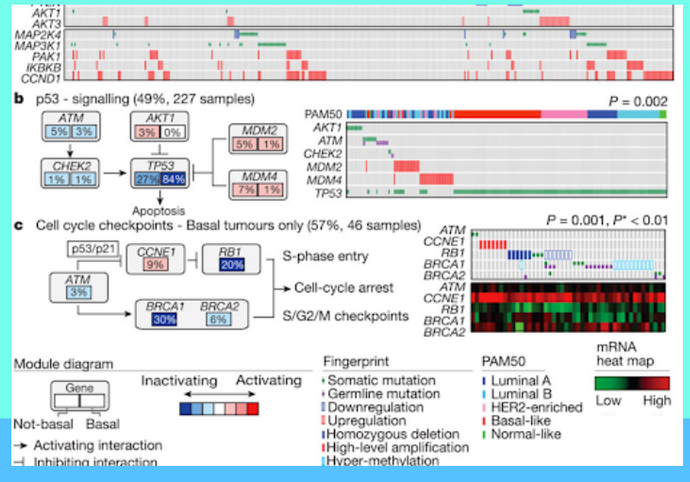


Too much info!

Part III: Equations

An equation is not just an aesthetic tool!

It should be written ONLY if is necessary to explain something

If you feel like writing equations to proof you are a real theorist, use the appendices!

Part III: Equations

An equation is not just an aesthetic tool!

You should define ALL of the elements in an equation

$$\delta\phi = \epsilon\psi, \qquad \delta\phi^* = \epsilon^\dagger\psi^\dagger, \tag{3.1.3}$$

where ϵ^α is an infinitesimal, anti-commuting, two-component Weyl fermion object that parameterizes

The reader should be able to understand each one of the symbols appearing in an equation

Part III: Equations

An equation is not just an aesthetic tool!

It is not compulsory to be able to derive the equation

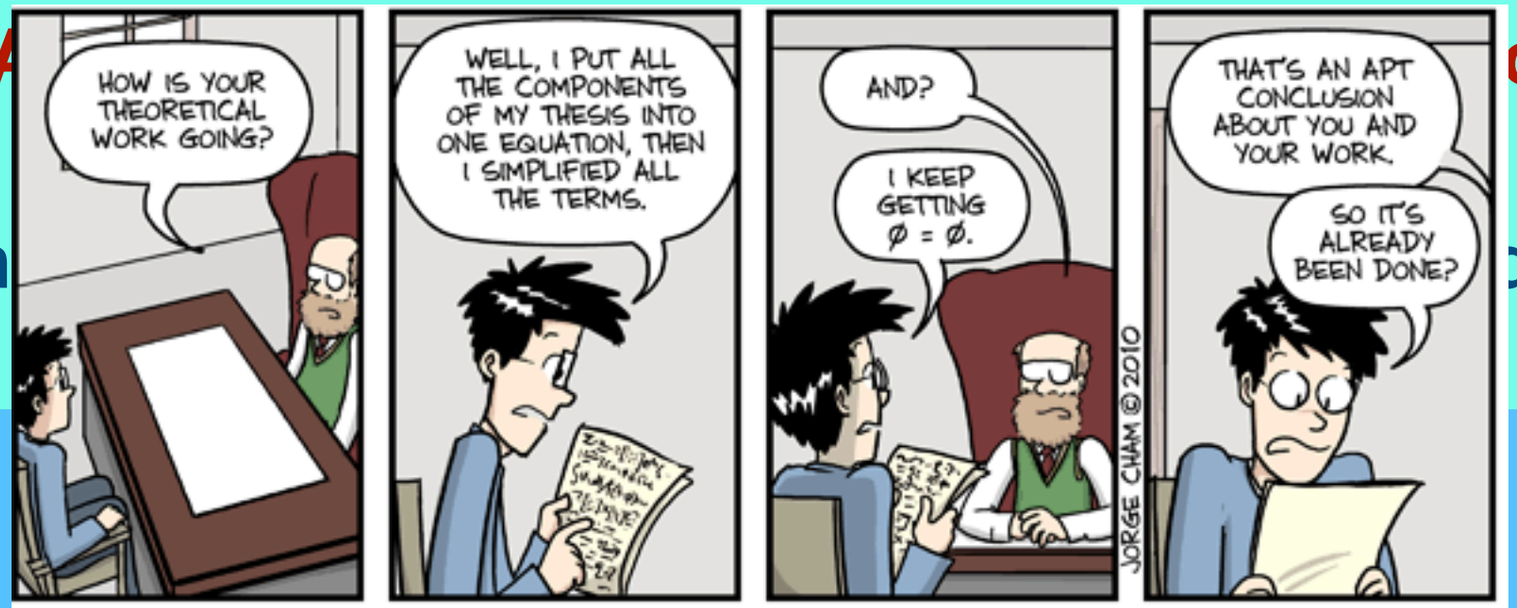
$$\frac{dn_{\rm DM}}{dt} = -3H(T)\, n_{\rm DM} - \langle \sigma v \rangle \left[n_{\rm DM}^2 - (n_{\rm DM}^{eq})^2 \right]$$

However, you should be able to explain what the equation means (what are left and right hand sides)

Part III: Equations

A ol!

It is n quation



However, you should be able to explain what the equation means (what are left and right hand sides)

Part III: Equations

NEVER EVER write an equation in the Introduction or the Conclusions

(if you are not Einstein and the equation is not $E = mc^2$)

Part III: Equations

An equation must be treated with the same punctuation as a standard sentence, as if you were reading it

$$\begin{cases} m_r^2 \equiv m_{\Phi_0}^2 = \frac{8}{9}k^2\left(1 - \frac{2\epsilon_{\rm UV}}{9}\right) + \mathcal{O}(\epsilon^2)\,, \\ \\ m_{\Phi_n}^2 = k^2 + \frac{n^2}{r_c^2}\left[1 - \frac{6(n^2+k^2r_c^2)(\epsilon_{\rm UV}+\epsilon_{\rm IR})}{9n^2\pi kr_c+\pi k^3r_c^3}\right] + \mathcal{O}(\epsilon^2)\,. \end{cases}$$

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Part IV: Referencing

It is extremely important to quote the relevant bibliography in a thesis!

You should quote the original source where something important for what you are telling was first published

Part IV: Referencing

What should you be quoting? **Better more than less!**

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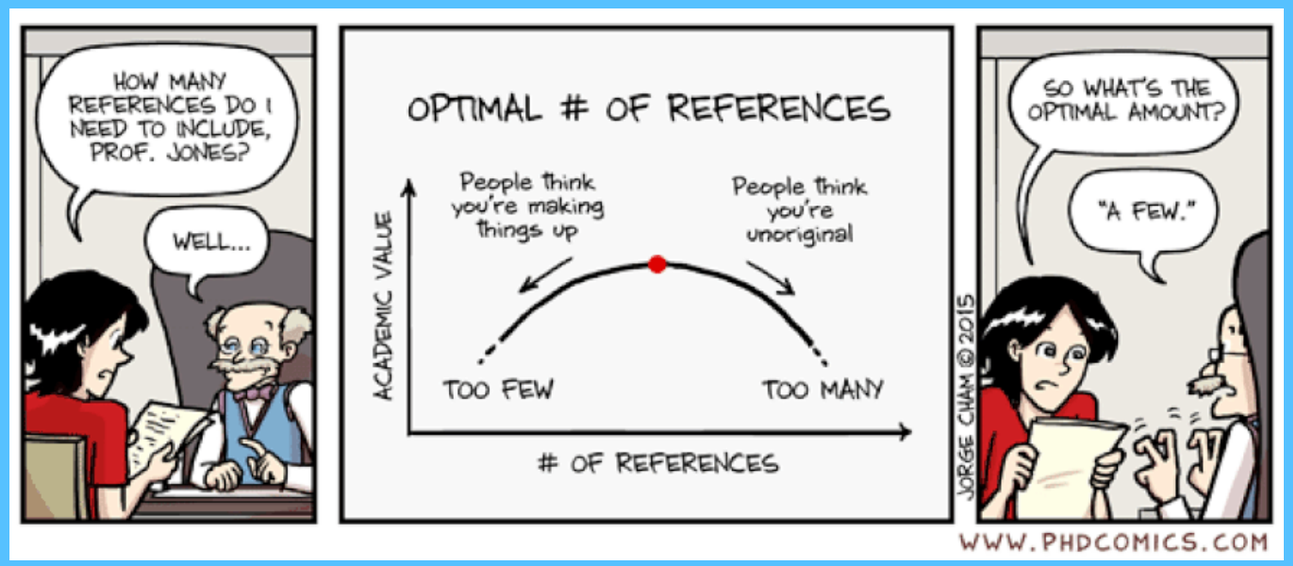

"A few" is explicitly ambiguous .
Better replace it by "Quite a few"

Part IV: Referencing

What should you be quoting? **Better more than less!**

"A few" is explicitly ambiguous .
Better replace it by "Quite a few"
Actually, cite it all!

Part IV: Referencing

Most of you have studied "classical" physics on textbooks or reviews

An example: A SUSY review

hep-ph/9709356
version 7, January 2016

A Supersymmetry Primer

Stephen P. Martin
Department of Physics, Northern Illinois University, DeKalb IL 60115

Part IV: Referencing

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An example: A SUSY review

A Supersymmetry primer

- Stephen P. Martin(Northern Illinois U. and Fermilab)

Sep 17, 1997
153 pages
Published in: *Adv.Ser.Direct.High Energy Phys.* 21 (2010) 1-153, *Adv.Ser.Direct.High Energy Phys.* 18 (1998) 1-98
e-Print: hep-ph/9709356 [hep-ph]
DOI: 10.1142/9789812839657_0001, 10.1142/9789814307505_0001
Report number: FERMILAB-PUB-97-425-T
View in: ADS Abstract Service

Part IV: Referencing

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You should quote first THE ORIGINALS:

[8] S. Coleman and J. Mandula, Phys. Rev. **159** (1967) 1251;

[9] P. Fayet, Phys. Lett. B **64**, 159 (1976).

[10] P. Fayet, Phys. Lett. B **69**, 489 (1977), Phys. Lett. B **84**, 416 (1979).

[11] G.R. Farrar and P. Fayet, Phys. Lett. B **76**, 575 (1978).

[12] P. Ramond, Phys. Rev. D **3**, 2415 (1971); A. Neveu and J.H. Schwarz, Nucl. Phys. B **31**, 86 (1971); J.L. Gervais and B. Sakita, Nucl. Phys. B **34**, 632 (1971).

[13] Yu. A. Gol'fand and E. P. Likhtman, JETP Lett. **13**, 323 (1971).

[14] J. Wess and B. Zumino, Nucl. Phys. B **70** (1974) 39.

Part IV: Referencing

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AND then the textbooks and reviews that you used…..

[16] J. Wess and J. Bagger, *Supersymmetry and Supergravity*, (Princeton Univ. Press, 1992).

[17] P.P. Srivastava, *Supersymmetry and Superfields and Supergravity; an Introduction*, (Adam-Hilger, 1986).

[18] P.C. West, *Introduction to Supersymmetry and Supergravity*, (World Scientific, 1990).

[19] R.N. Mohapatra, *Unification and Supersymmetry: The Frontiers of Quark-Lepton Physics*, Springer-Verlag, New York 1992.

[20] D. Bailin and A. Love, *Supersymmetric Gauge Field Theory and String Theory*, (Institute of Physics Publishing, 1994).

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If it is absolutely unavoidable to quote a sentence from someone else, you should quote it as:

“sentence from someone else”

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If it is absolutely unavoidable to quote a sentence from someone else, you should quote it as:

“sentence from someone else”

The same would happen if you were writing a sentence from the Quijote…
A piece of scientific writing is, above all, a particular form of literature (remember Cormac McCarthy… and Newton)

Part IV: Referencing

Strongly suggested: BibTeX

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First: go to iNSPIRE https://inspirehep.net/

Part IV: Referencing

Strongly suggested: BibTeX

First: go to iNSPIRE https://inspirehep.net/

Second: once found the paper, copy the bibtex entry into a file called filename.bib

Part IV: Referencing

A BibTeX entry from iNSPIRE

```
@article{tHooft:1972tcz,
    author         = "'t Hooft, Gerard and Veltman, M. J. G.",
    title          = "{Regularization and Renormalization
                      of Gauge Fields}",
    journal        = "Nucl. Phys.",
    volume         = "B44",
    year           = "1972",
    pages          = "189-213",
    doi            = "10.1016/0550-3213(72)90279-9",
    SLACcitation   = "%%CITATION = NUPHA,B44,189;%%"
}
```

Drop it in Filename.bib

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@article{tHooft:1972tcz,
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      SLACcitation   = "%%CITATION = NUPHA,B44,189;%%"
}
```

Drop it in Filename.bib

Add this line just before the end of your latex document

\bibliography{Filename}

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A BibTeX entry from iNSPIRE

```
@article{tHooft:1972tcz,
    author         = "'t Hooft, Gerard and Veltman, M. J. G.",
    title          = "{Regularization and Renormalization
                      of Gauge Fields}",
    journal        = "Nucl. Phys.",
    volume         = "B44",
    year           = "1972",
    pages          = "189-213",
    doi            = "10.1016/0550-3213(72)90279-9",
    SLACcitation   = "%%CITATION = NUPHA,B44,189;%%"
}
```

Drop it in Filename.bib

Add this line just before the end of your latex document

\bibliography{Filename}

Compile with BibTeX

Part IV: Referencing

A BibTeX entry from iNSPIRE

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@article{tHooft:1972tcz,
    author         = "'t Hooft, Gerard and Veltman, M. J. G.",
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}
```

Drop it in Filename.bib

Add this line just before the end of your latex document

\bibliography{Filename}

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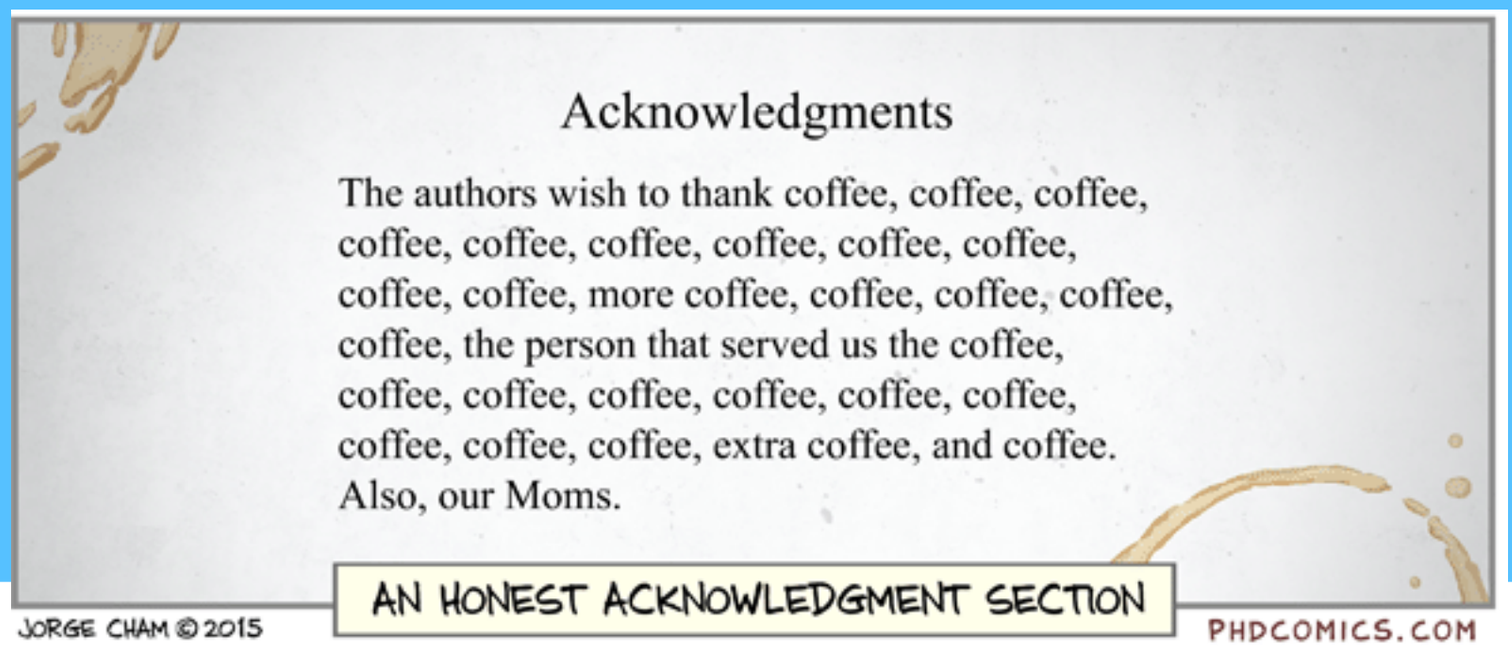
This is the result:

[1] G. 't Hooft and M.J.G. Veltman, Nucl. Phys. B44 (1972) 189,

Acknowledgements

You should acknowledge ANY help or useful discussions with anyone you talked to (but, really, this is up to you),
AND, MOST IMPORTANTLY,
all the grants that payed you to travel, attend workshops or schools, or anything else….
(this is not up to you, as the IFIC funding depends on this)



Thank you!

Thank you!

And remember……