

Getting started with L^AT_EX

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Abstract

1 Getting started

Labels are super important so you can easily reference things within your document, like this section, Section 1.

Some key examples are how to do speech marks or apostrophes, where we use two different marks ‘ and ’:

- “like this” for speech marks
- or ‘like this’ for single marks.

We should also clarify the difference between hyphens, en dashes and em dashes.

- Hyphens look like this -, are denoted using -, and are used to combine words, e.g. right-handed.
- en dashes look like this –, are denoted using --, and are used in number ranges, e.g. 10–12.
- em dashes look like this —, are denoted using ---, are used as grammatical tools like colons, e.g. they loved her a lot — at least when she wasn’t making mistakes in L^AT_EX.

Sometimes in British English en dashes are used in the place of em dashes, but never use hyphens in their place!

There are also several special characters in L^AT_EX:

- \, which is used for entering environments;
- %, which is used for comments;

- `$`, which can be used for inline equations or symbols;
- `&`, which is used in alignment environments, like Eq. (4) and Table 1;
- `;` which is used for force adding spaces where needed;
- `#`, which I don't know the special use for (extra points if you can find out why it's special).

You'll notice that in order to make these symbols appear in on the page, I have to prefix them with `\`, as that's the symbol that enters a new environment.

2 Packages

2.1 siunitx

`siunitx` is one of my favourite packages because it typesets units really nicely, and also makes it so you don't have to worry about typesetting powers of ten nicely, because it has a built in setting for it. Below are some examples of using it, and you can find full documentation at <https://ctan.org/pkg/siunitx?lang=en>.

- 12 eV.
- $10^{-18} \text{ kg s}^{-1}$.
- 0.5 km.
- 1×10^5 .
- A.

3 Equations

We can do inline equations using `\(\)` symbols or `$$`, like so: $E = mc^2$ or $E = mc^2$. I usually use `$` as that's what I started with, but `\(` is arguably better syntax.

We can also have standalone equations using the `equation` environment:

$$\Omega_{\text{DM}} h^2 = 0.1200 \pm 0.0012. \tag{1}$$

The `align` environment allows us to create multiline equations which all align at a point specified by the `&`:

$$\langle \sigma v \rangle = (n^{eq})^{-2} \prod_{i=1}^4 \frac{d^3 p_i}{(2\pi)^3 2E_i} \tag{2}$$

$$\times (2\pi)^4 \delta^{(3)}(p_1 + p_2 - p_3 - p_4) \delta(E_1 + E_2 - E_3 - E_4) \tag{3}$$

$$\times |\mathcal{M}|^2 \exp \left[-\frac{E_\nu - E_{\bar{\nu}}}{T} \right], \tag{4}$$

radiation:	$w = 1/3,$	$\Omega_r \propto a^{-4};$
matter:	$w = 0,$	$\Omega_m \propto a^{-3};$
cosmological constant, Λ :	$w = -1,$	$\Omega_\Lambda = \text{constant}.$

Table 1: A table of some values.

We can reference these using the regular `\ref` command, but that just gives the number: 4 or 1. If we use the `cleveref` package instead with the setting given it is more useful: Eq. (4) and Eq. (1).

Some key things to be aware of when it comes to formatting maths:

- We indicate a superscript by `^` and subscripts by `_`; for example E^2 or E_2 .
- There are a whole list of symbols in Overleaf that can be accessed by clicking the Ω symbol in the top toolbar.
- Next to that there is a button to insert inline and display maths, but I recommend *not* using the display maths option, as display math environments are not numbered, whereas equation environments are (and we want numbered equations in physics!).

4 Figures

You'll see that the ordering of the figure and the table are maybe not as you expect them — that's because \LaTeX places things where it is most appropriate for them to go, depending on the content of the page.

I've given two examples of figures here. Fig. 1 is a typical figure, with just a single image. I've also given an example using `subfigure`, Fig. 2, because I love subfigures. Subfigures are great if you want to have two diagrams you're comparing, or if you want to group related figures. You can reference the whole thing, or individual figures, by just choosing which label you want: Fig. 2 versus Fig. 2b. Subfigures are also a great way of saving space if you've got a page limit! I've done all my subfigures on one line (and have used `hfill` between them to space them nicely), but you can also spread them over multiple lines by inserting a `linebreak, \\`, where you want one.

5 Tables

You can use a website like <https://www.tablesgenerator.com/> to help you create tables to start out with. Once you've built a few you should be able to start noticing patterns! The key things:

- The opening line defines the number of columns, their alignment, and if there are lines.

```
\begin{tabular}{|r|l|l|}
```

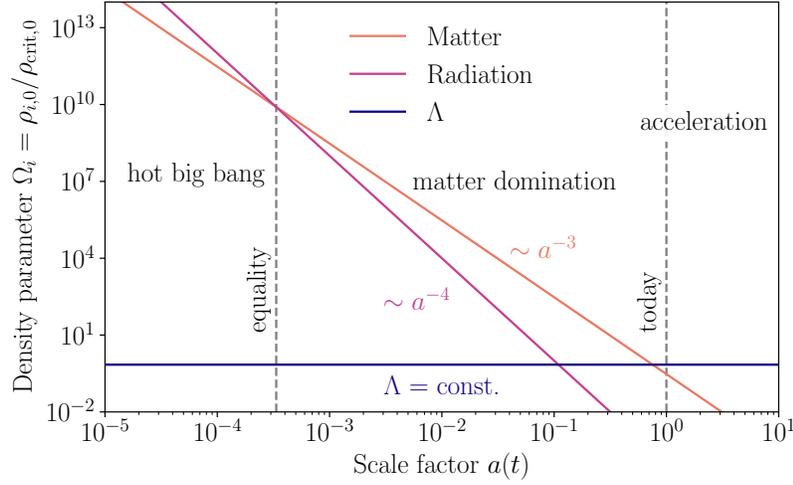
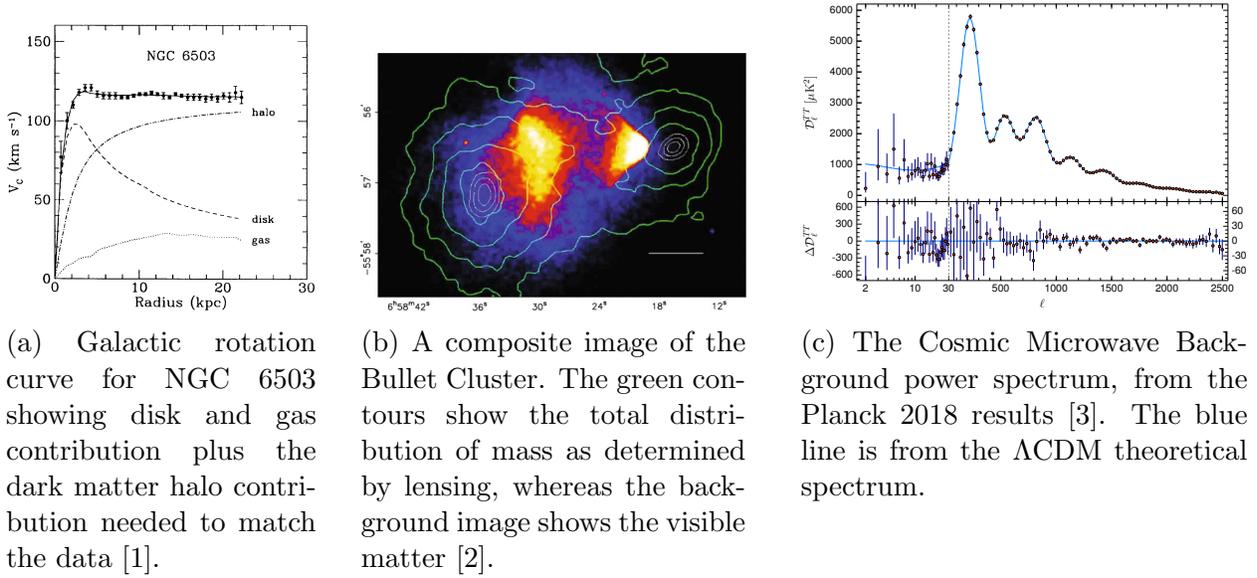


Figure 1: Evolution of the cosmic ingredients with scale factor, with $a_0 = 1$ today.



(a) Galactic rotation curve for NGC 6503 showing disk and gas contribution plus the dark matter halo contribution needed to match the data [1].

(b) A composite image of the Bullet Cluster. The green contours show the total distribution of mass as determined by lensing, whereas the background image shows the visible matter [2].

(c) The Cosmic Microwave Background power spectrum, from the Planck 2018 results [3]. The blue line is from the Λ CDM theoretical spectrum.

Figure 2: Various evidence for dark matter, and some citation examples.

- A — indicates a vertical line in the table
- r,l,c all indicate columns, with the respective alignment (right, left, centre).
- If you want horizontal lines in the table, you need to include them as table ‘rows’, by inserting a `\hrline`

References

- [1] A. G. Doroshkevich, V. N. Lukash, and E. V. Mikheeva. “A Solution to the Problems of Cusps and Rotation Curves in Dark Matter Halos in the Cosmological Standard Model”. In: *Uspekhi Fizicheskikh Nauk* 182.1 (2012), p. 3. ISSN: 0042-1294, 1996-6652. DOI: 10.3367/UFNr.0182.201201a.0003. arXiv: 1209.0388 [astro-ph].
- [2] D. Clowe et al. “A Direct Empirical Proof of the Existence of Dark Matter”. In: *The Astrophysical Journal* 648.2 (Aug. 30, 2006), p. L109. ISSN: 0004-637X. DOI: 10.1086/508162.
- [3] N. Aghanim et al. “Planck 2018 Results - VI. Cosmological Parameters”. In: *Astronomy & Astrophysics* 641 (Sept. 1, 2020), A6. ISSN: 0004-6361, 1432-0746. DOI: 10.1051/0004-6361/201833910.