A BEGINNERS GUIDE TO

LATEX

BACKGROUND

L^AT_EX WRAPS AROUND T_EX

> T, E, and X stand for tau, epsilon, and gamma (TeX is pronounced *tekh*)

> TeX is a style system created by Donald Knuth in 1978

LATEX WRAPS AROUND TEX

> **It allows you to type-set complex math**

> **Relies on "\" to start commands, parameters from "[ ]"**

> **And "{}" to group things**

> **A % comments out a line**

> **"$ $" lets you typeset math inline**

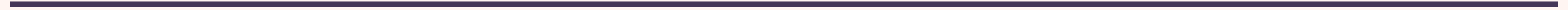| Markup	Renders as
The quadratic formula is `$$-b \pm \sqrt{b^2 - 4ac} \over 2a$$` `\bye`	The quadratic formula is $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

BREAKING IT DOWN

Markup	Renders as
The quadratic formula is $$-b \pm \sqrt{b^2 - 4ac} \over 2a$$ \bye	The quadratic formula is $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$ = Math Mode

BREAKING IT DOWN

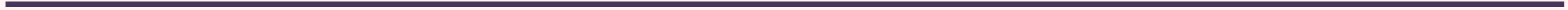| Markup	Renders as
The quadratic formula is `$$-b \pm \sqrt{b^2 - 4ac} \over 2a$$` `\bye`	The quadratic formula is $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

\pm = plus or minus command

BREAKING IT DOWN

Markup	Renders as
The quadratic formula is `$$-b \pm \sqrt{b^2 - 4ac} \over 2a$$` `\bye`	The quadratic formula is $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

\sqrt{} = a square root grouping

BREAKING IT DOWN

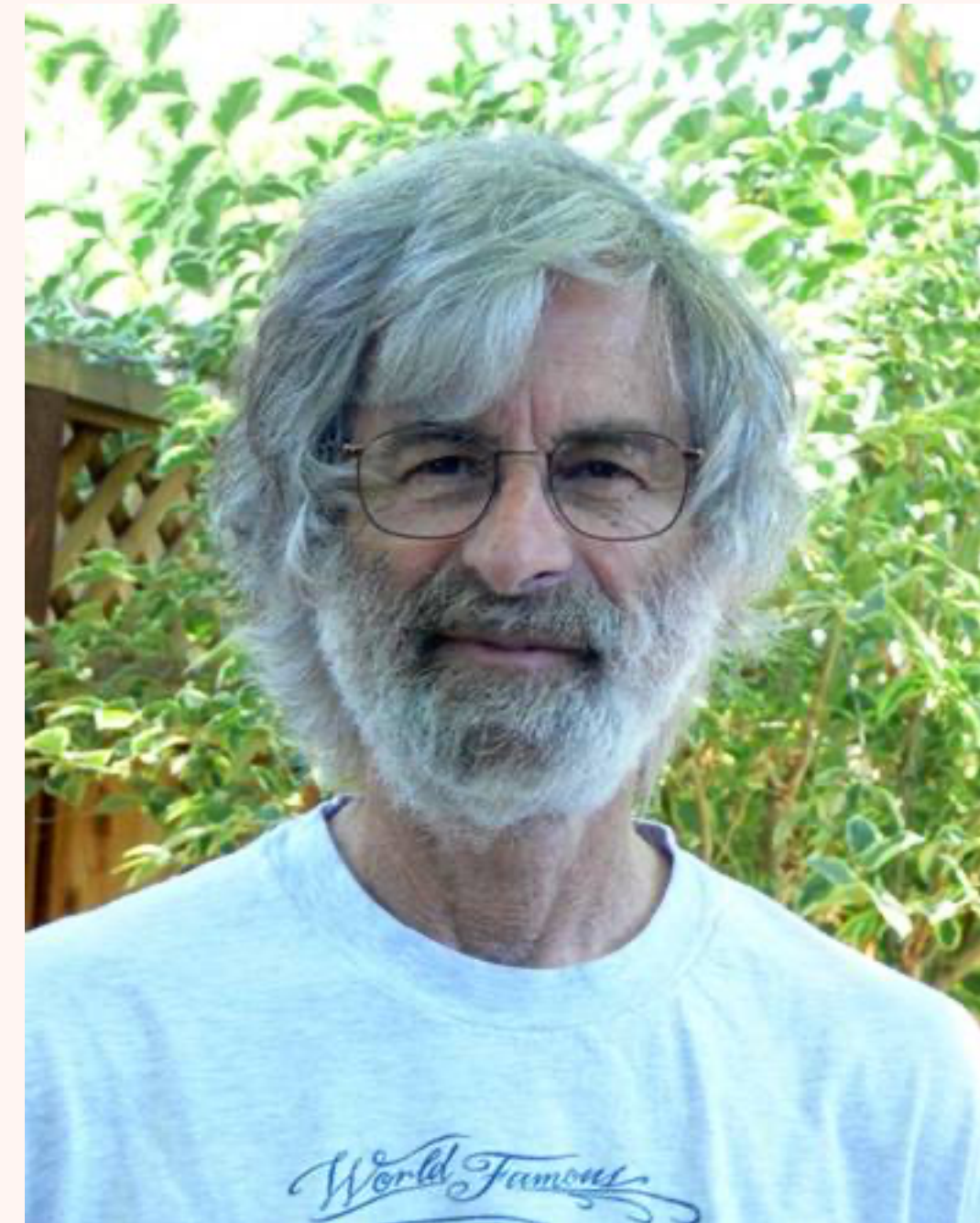| Markup	Renders as
The quadratic formula is `$$-b \pm \sqrt{b^2 - 4ac} \over 2a$$` `\bye`	The quadratic formula is $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

\over = fraction command

SO WHAT IS $\LaTeX$?

> **It wraps around TeX to format output**

> **It's a way to prepare documents (like Word, Pages, etc) but is *not* a word processor**

> **It is THE go to in academia**

> **Created in 1984 by Leslie Lamport**

> **Publicly licensed - so it's free!**

> **At its core the $\LaTeX$ system is a markup language**

CONTENT VS PRESENTATION

➤ **Latex operates on keeping these two separate unlike with word processors**

➤ **The creator defines a structure and lets LaTeX handle formatting**

➤ **The macros can also be modified**

```latex
\documentclass{article} % Starts a article
\usepackage{amsmath} % Imports amsmath
\title{\LaTeX} % Title

\begin{document} % Begins a document
  \maketitle
  \LaTeX{} is a document preparation system for
  the \TeX{} typesetting program. It offers
  programmable desktop publishing features and
  extensive facilities for automating most
  aspects of typesetting and desktop publishing,
  including numbering and  cross-referencing,
  tables and figures, page layout,
  bibliographies, and much more. \LaTeX{} was
  originally written in 1984 by Leslie Lamport
  and has become the  dominant method for using
  \TeX; few people write in plain \TeX{} anymore.
  The current version is \LaTeXe.

  % This is a comment, not shown in final output.
  % The following shows typesetting  power of
LaTeX:
  \begin{align}
    E_0 &= mc^2 \\
    E &= \frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}}
  \end{align}
\end{document}
```

CONTENT VS PRESENTATION

> **Latex operates on keeping these two separate unlike with word processors**

> **The creator defines a structure and lets LaTeX handle formatting**

> **The macros can also be modified**

LaTeX

LaTeX is a document preparation system for the TeX typesetting program. It offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout, bibliographies, and much more. LaTeX was originally written in 1984 by Leslie Lamport and has become the dominant method for using TeX; few people write in plain TeX anymore. The current version is LaTeX 2_ε.

$$E_0 = mc^2 \tag{1}$$

$$E = \frac{mc^2}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

LaTeX Mathematical Symbols

The more unusual symbols are not defined in base LaTeX (NFSS) and require `\usepackage{amssymb}`

1 Greek and Hebrew letters

α	\alpha	κ	\kappa	ψ	\psi	F	\digamma	Δ	\Delta	Θ	\Theta
β	\beta	λ	\lambda	ρ	\rho	ε	\varepsilon	Γ	\Gamma	Υ	\Upsilon
χ	\chi	μ	\mu	σ	\sigma	$\varkappa$	\varkappa	Λ	\Lambda	Ξ	\Xi
δ	\delta	ν	\nu	τ	\tau	φ	\varphi	Ω	\Omega		
ϵ	\epsilon	o	o	θ	\theta	ϖ	\varpi	Φ	\Phi	$\aleph$	\aleph
η	\eta	ω	\omega	υ	\upsilon	ϱ	\varrho	Π	\Pi	$\beth$	\beth
γ	\gamma	ϕ	\phi	ξ	\xi	ς	\varsigma	Ψ	\Psi	$\daleth$	\daleth
ι	\iota	π	\pi	ζ	\zeta	ϑ	\vartheta	Σ	\Sigma	$\gimel$	\gimel

2 LaTeX math constructs

$\frac{abc}{xyz}$	\frac{abc}{xyz}	$\overline{abc}$	\overline{abc}	$\overrightarrow{abc}$	\overrightarrow{abc}
f'	f'	$\underline{abc}$	\underline{abc}	$\overleftarrow{abc}$	\overleftarrow{abc}
$\sqrt{abc}$	\sqrt{abc}	$\widehat{abc}$	\widehat{abc}	$\overbrace{abc}$	\overbrace{abc}
$\sqrt[n]{abc}$	\sqrt[n]{abc}	$\widetilde{abc}$	\widetilde{abc}	$\underbrace{abc}$	\underbrace{abc}

https://www.caam.rice.edu/~heinken/latex/symbols.pdf

ACCESSING LaTeX
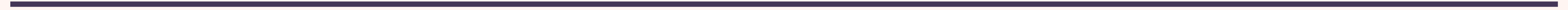
$\mathrm{L^AT_EX}$ IS EVERYWHERE

- **Many options for both on and off line writing**

- **In science we typically use Overleaf**

- **LaTeX exists inline in python notebooks, etc.**

- **There's applications for embedding latex generated images elsewhere:**

  - **e.g. LaTeX It**

Properties of TeX editors 1

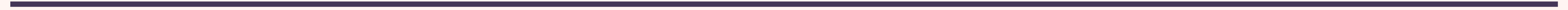| Name	Editing style[Note 1]	Native operating systems	Latest stable version	Costs	License	Configurable
AUCTeX	Source	Linux, macOS, Windows	(2017-12-10) 12.1	Free	GPL	Yes
Authorea	Source / partial-WYSIWYG	Online	N/A	Free	Proprietary	Yes
Auto-Latex Equations for Google Docs	Source[Note 2]	Online	(2020-04-06) 48	Free	Free	Yes
CoCalc	Source	Online	N/A	Free	AGPL	Yes
GNOME LaTeX	Source	Linux	(2019-03-10) 3.32	Free	GPL	Yes
Gummi	Source	Linux	(2020-01-26) 0.8.1	Free	MIT	Yes
Kile	Source	Linux (macOS, Windows)[Note 3]	(2012-09-23) 2.1.3	Free	GPL	Yes
LEd	Source	Windows	(2009-10-09) 0.53	Free	Proprietary	?
LyX	WYSIWYM	Linux, macOS, Windows	(2019-06-25) 2.3.3	Free	GPL	Yes
MeWa	Source	Windows	(2007-06-06) 1.4.0	Free	GPL	Yes
Notepad++	Source	Windows	(2019-10-29) 7.8.1	Free	GPL	Yes
Overleaf	Source	Online	N/A	Free	Unclear	Yes
Scientific WorkPlace	WYSIWYM	Windows	(2016-02-23) 6.0.12	Non-free	Proprietary	Yes
ShareLaTeX[Note 5]	Source	Online	N/A	Free	AGPL	Yes
TexLab	Source-WYSIWYG	Windows	(2019-04-30) 7.8	Free	Free	Yes
TeXmacs	WYSIWYG	Linux, macOS, Windows	(2017-12-21) 1.99.6	Free	GPL	Yes
Texmaker	Source	Linux, macOS, Windows	(2018-11-01) 5.0.3	Free	GPL2	Yes
TeXnicCenter	Source	Windows	2.02 Stable (September 29, 2013) [±]	Free	GPL	Yes
Texpad	Source	macOS, iOS	(2019-11-25) 1.8.14	Non-free	Proprietary	Yes
TeXShop	Source	macOS	(2019-10-23) 4.44	Free	GPL	Yes
TeXstudio	Source	Linux, Windows, macOS	(2020-01-18) 2.12.22	Free	GPL2	Yes
TeXworks	Source	Linux, macOS, Windows	(2019-03) 0.6.3	Free	GPL	No
Verbosus	Source	Online, Android, iOS	(2016-05-06) 4.1.3	Free	Proprietary	Yes
WinEdt	Source	Windows	(2017-04-13) 10.2	Non-free	Proprietary	Yes
WinShell	Source	Windows	(2013-02-10) 3.3.2.6	Free	Proprietary	Yes
Name	Editing Style	Native Operating Systems	Latest stable version	Costs	License	Configurable

LET'S GET STARTED

> **Step 1: Go to www.overleaf.com**

> **Make an account if you haven't (can be linked to Pitt)**

> **Sign in!**

LET'S GET STARTED

> Step 1: Go to www.overleaf.com

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> Step 2: Make a "New Project"

>> Note that there's tons of options

>> Let's look at the MNRAS template

WHAT DOES OUR DOCUMENT NEED?

> **A start and an end**

>> **\begin{document}**

>> **\end{document}**

> **Everything else is up to you!**

>> **\section{}**

>> **\begin{equation}**

>> **\begin{figure}**

>> **\begin{table}**

LET'S TRY IT OURSELVES

START A NEW DOCUMENT

> **Let's start our own blank document now**

> **Take a few minutes to set the title and**

> **Write out the NFW profile equation:**

$$\rho(r) = \frac{\rho_s}{\frac{r}{r_s}\left(1 + \frac{r}{r_s}\right)^2}$$

LOAD IN AN IMAGE

> **Now let's load in a new subsection**

>> **Step 1: Load in the graphicx package**

>> **Step 2: Download an image of M31**

>> **Step 3: Upload it using the "New File" option**

>> **Step 4: Add it into your document**

>> **Step 5: Give it a caption**
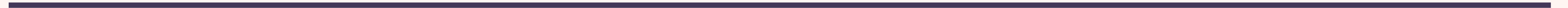
REFERENCES

> The \label{} command is used to label equations, tables, figures, sections, etc.

> They can then be reference in the text with the \ref{} command or \autoref{} command (autoref is in the hyperref package, load it in with options [colorlinks=true,linkcolor=blue]).

REFERENCES

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> In your document make a new subsection.

>> Make a \ref{} to your equation

>> Make an \autoref{} to your figure

>> Make a \ref{} to your first subsection

>> Make an \autoref{} to your second subsection

NEW COMMANDS

> \newcommand{} allows you to make new commands in your document

> \renewcommand{} changes an existing command
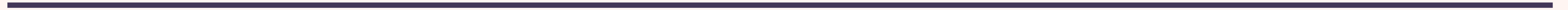
NEW COMMANDS

❯ **\newcommand{} allows you to make new commands in your document**

❯ **\renewcommand{} changes an existing command**

❯ **In your document:**

❯ **Make a new command for solar mass $\mathrm{M}_\odot$ and describe Andromeda's mass**

❯ **Use \renewcommand\subsectionautorefname{} to change the name to Section**

BIBLIOGRAPHIES

> When you look up a paper on ADS you can easily get the pre-formatted citation

> Keep your bibliography file separate!!!!

BIBLIOGRAPHIES

> When you look up a paper on ADS you can easily get the pre-formatted citation

> Keep your bibliography file separate!!!!

>> Make a new file called refs.bib

>> Add in the citation for Navarro et al. 1996 (The Structure of Cold Dark Matter Haloes)

> In your main document:

>> Load in the package natbib

BIBLIOGRAPHIES

> **Add the bibliography into your main document with:**

> > **\bibliographystyle{plainnat}**

> > **\bibliography{the name of your .bib documnet}**

> **Now in your document use the \citep{} and \citet{} commands to reference this paper**

NOW YOU KNOW LATEX!