

# Workshop on L<sup>A</sup>T<sub>E</sub>X: Basic level

**Skoltech**  
Materials

Center for  
Materials  
Technologies

The authors:

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September, 2024

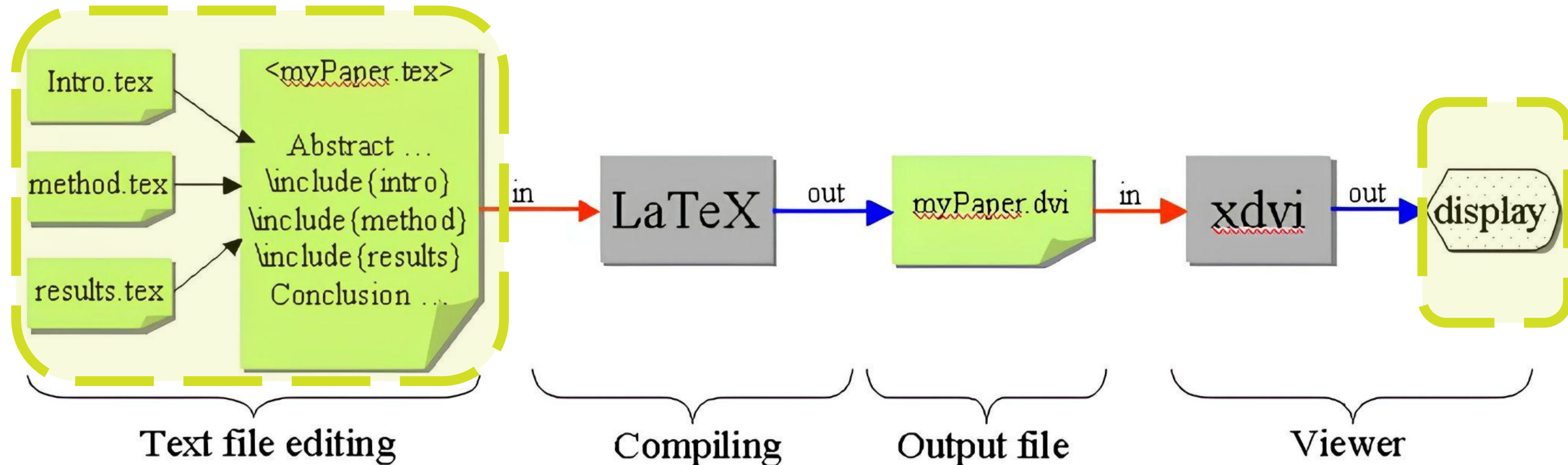
**Skoltech**

# Agenda

- What is LaTeX?
- Word vs LaTeX
- When to use LaTeX?
- Brief introduction to LaTeX
- Basic tutorial – **Interactive part**
- Advanced tutorial – **Not today**

# What is LaTeX?

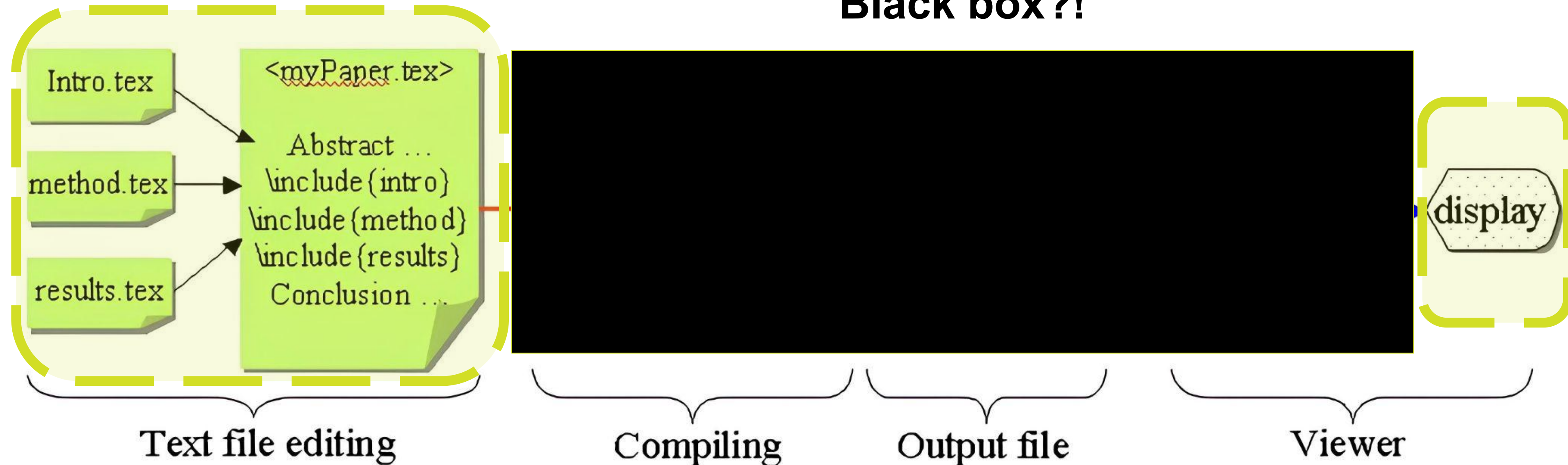
LaTeX (/ˈlɑːtɛx/, often pronounced lay-tech) is a writing software centered around document creation, allowing users to input commands and add unformatted text.



# What is LaTeX?

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## Black box?!



# Word vs LaTeX

The following formula describes a special case of the Schrödinger equation that admits a statement in those terms is the position-space Schrödinger equation for a single nonrelativistic particle in one dimension:

**Word:**

$$i\hbar \frac{\partial}{\partial t} \Psi(x, t) = \left[ -\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + V(x, t) \right] \Psi(x, t),$$

where  $\Psi(x, t)$  is the wave function,  $m$  is the mass of the particle, and  $V(x, t)$  is the potential that represents the environment in which the particle exists.

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where  $\Psi(x, t)$  is the wave function,  $m$  is the mass of the particle, and  $V(x, t)$  is the potential that represents the environment in which the particle exists.

# LateX biggest challenge

Edit your text using the **Code Editor** or **Visual Editor**.

Write and edit your document here.

Select **Recompile** to view the typeset result.

The typeset document is displayed here.

The screenshot displays the Overleaf LaTeX editor interface. The top navigation bar includes 'Menu', 'Home', 'Review', 'Share', 'Submit', 'History', 'Layout', and 'Chat'. Below this are tabs for 'Code Editor' and 'Visual Editor'. The left pane shows the source code editor with line numbers 23-34. The right pane shows the rendered PDF document. The rendered document includes the title 'Your Paper', author 'You', date 'June 19, 2023', and sections: 'Abstract', 'Introduction', 'Some examples to get started', and 'How to add Comments'. A 'Recompile' button is visible in the top right of the editor area.

# Word vs LaTeX: Comparison

**LaTeX is worse**

**LaTeX is comparable**

**LaTeX is better**

Tables

Plain text

Equations

Reviewing

Images

Bibliography, References

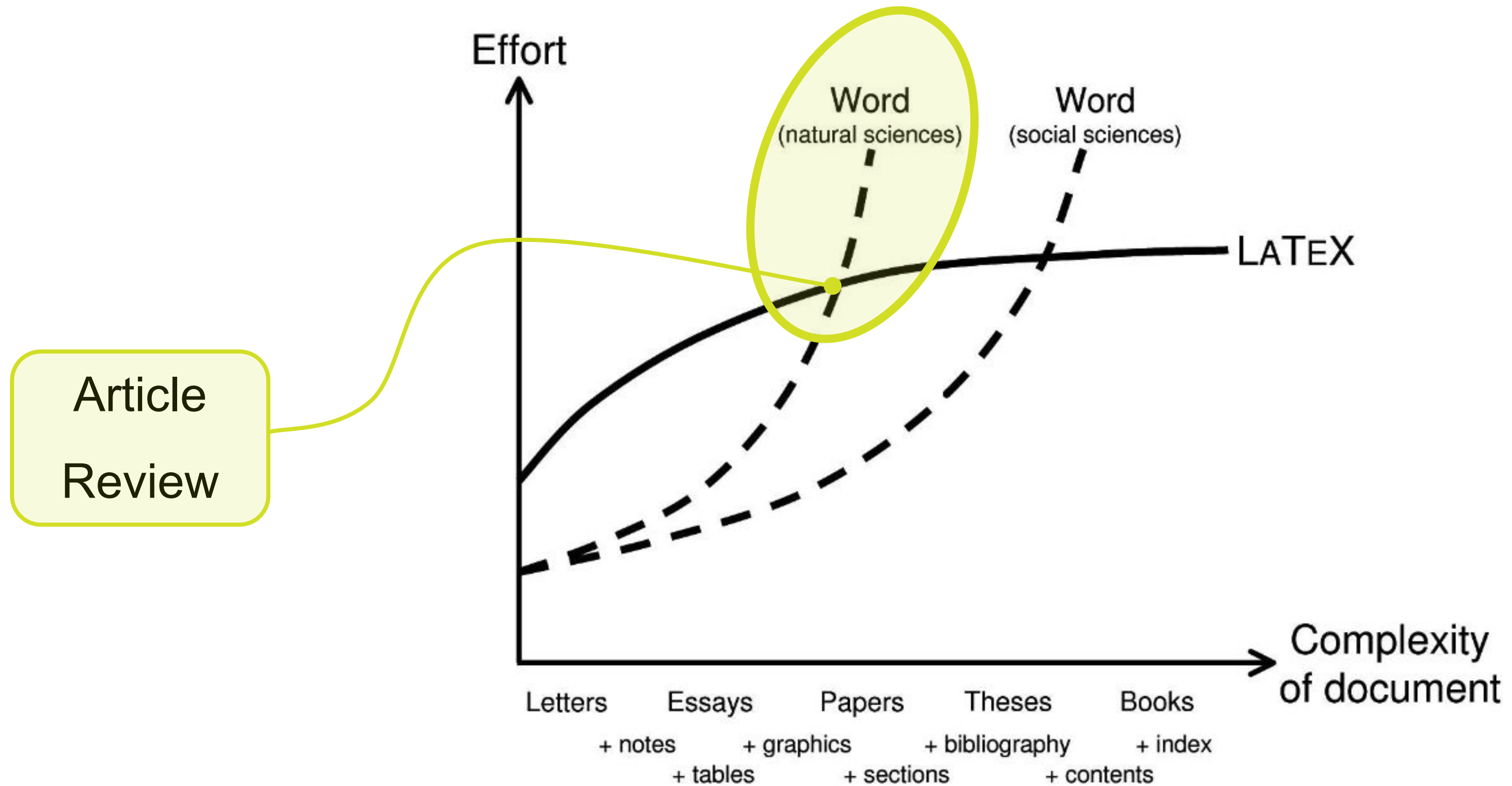
\*Gifs, Videos

Justification, Outline

Fonts

Hyperlinks

# Why not Word?



# Why may I need LaTeX?

- I can further use Word & Mendeley. Why do I need LaTeX?
  - These functions work much worse in Word and may break on another OS or environment.
- The collaboration and version control is bad in LaTeX.
  - Online editors like Overleaf have these functions as built-in.
- I can submit my paper in .docx format to journals.
  - Most likely, you will need to adjust your figures for the two-column template and change template to another publisher, while in LaTeX it takes a couple of minutes.
- Why do we need LaTeX over LyX?
  - LyX is much more complicated and still requires basic knowledge of LaTeX markdown.



# Latex: When to use over alternatives?

**LaTeX is worse**

Presentation

Conference thesis

**LaTeX is comparable**

Notes

Motivation Letter

Reports

Letters

Home assignments

**LaTeX is better**

Article

Review

Dissertation

Books

CV

# Other advantages of LaTeX

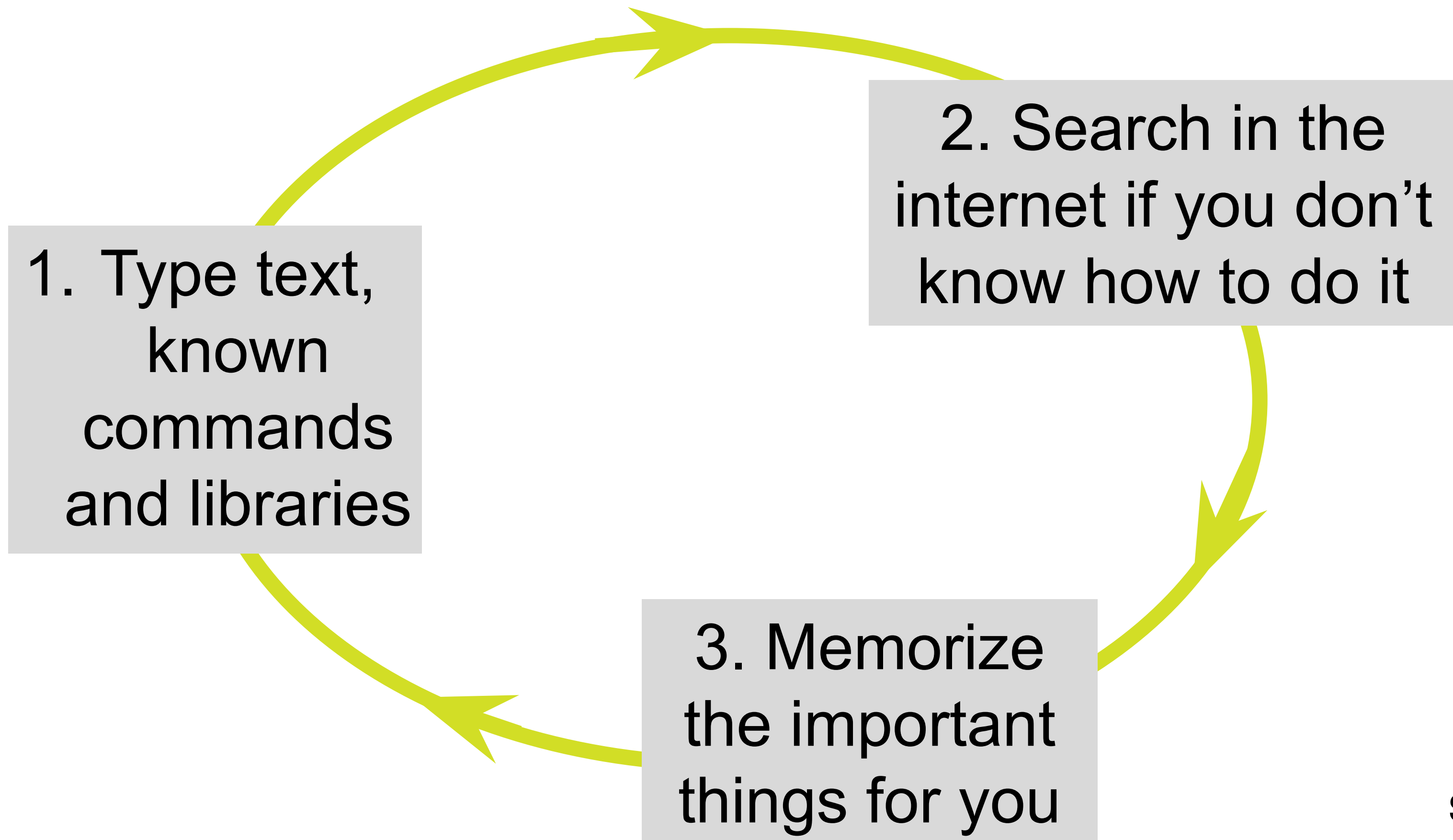
- Can be used as a markdown in programming languages as R and some libraries (matplotlib, pandas for python).
- Similar markdown is used in Jupyter Notebook or Github.
- Some fields of science, like math, are using LaTeX as a standard for person-to-person texting.
- **arXiv** and **ChemRxiv** have strict rules for their templates. It is more convenient to use LaTeX other than MS Word to follow the rules.

Summary statistics of the use of LaTeX in science disciplines (% of submitted papers).

Disciplines	L <sup>A</sup> T <sub>E</sub> X rate
Mathematics	96.9%
Statistic and Probability	89.1%
Physics	74.0%
Computer Sciences	45.8%
Engineering	1.0%

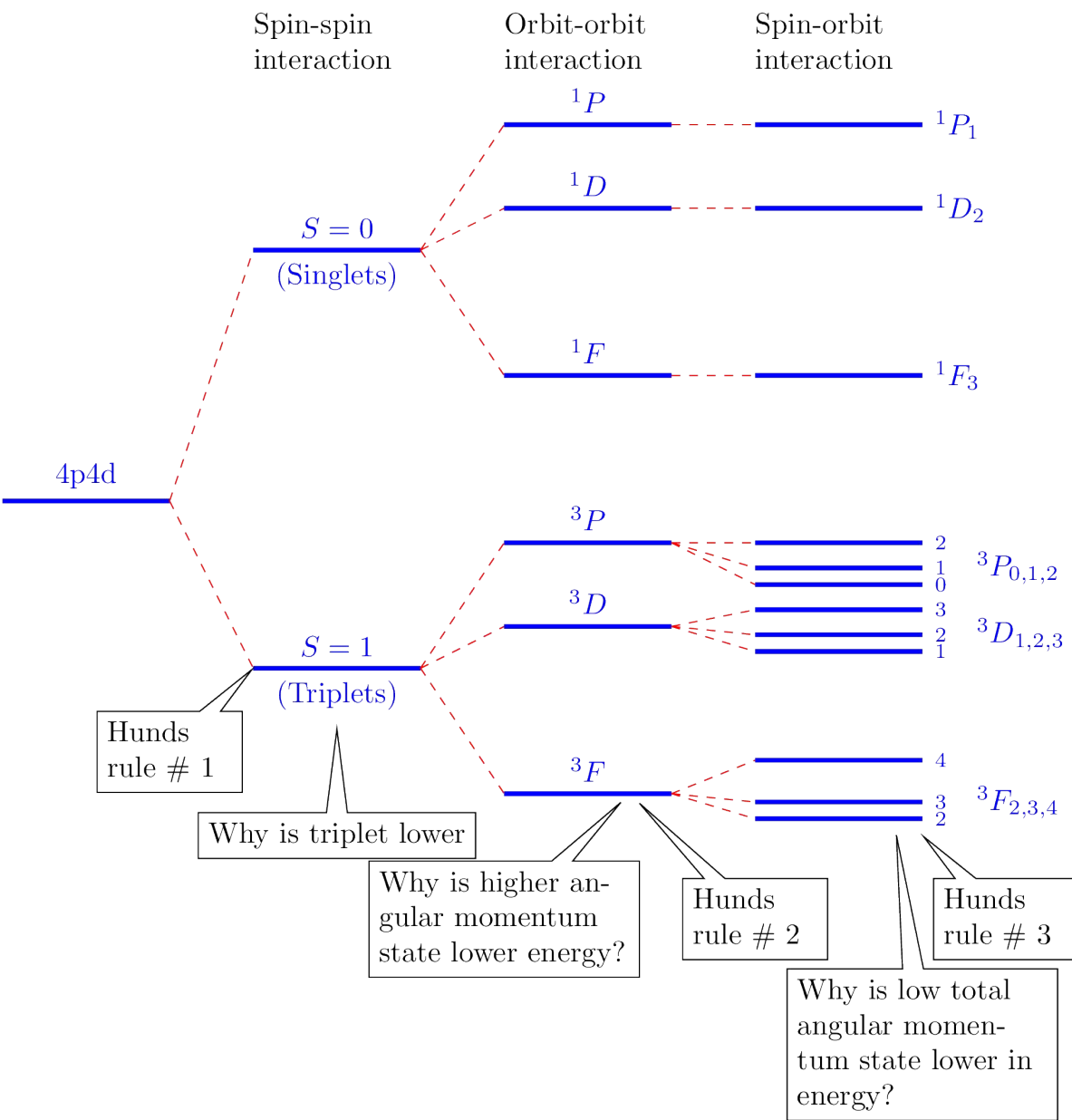
[data source of this statistics](#)

# How to start using LaTeX for articles?



# Examples of LaTeX

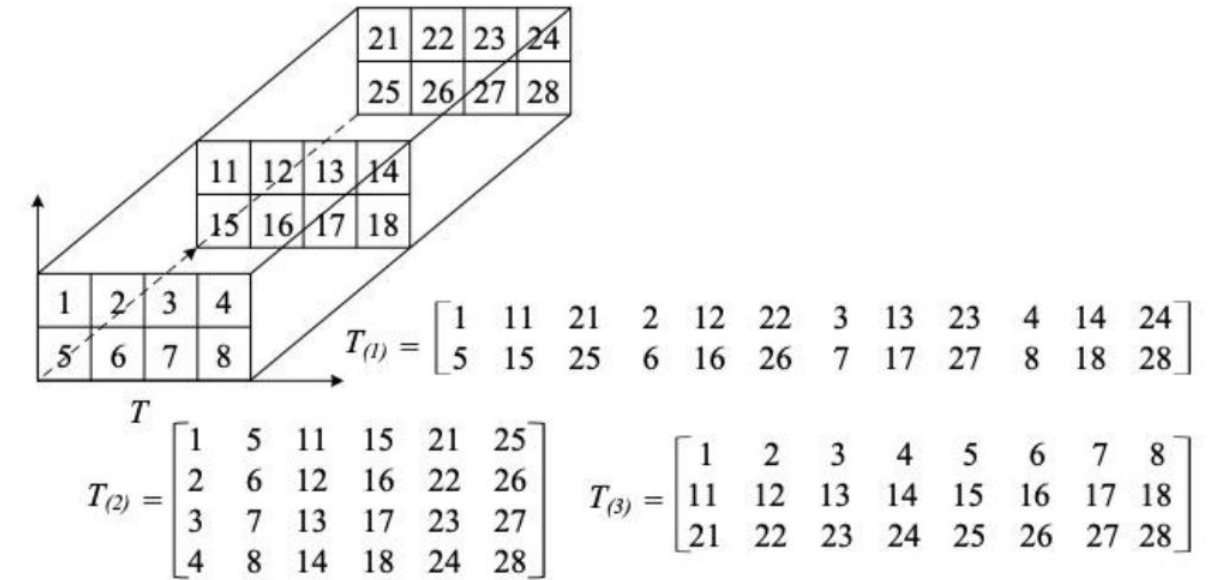
## Energy levels



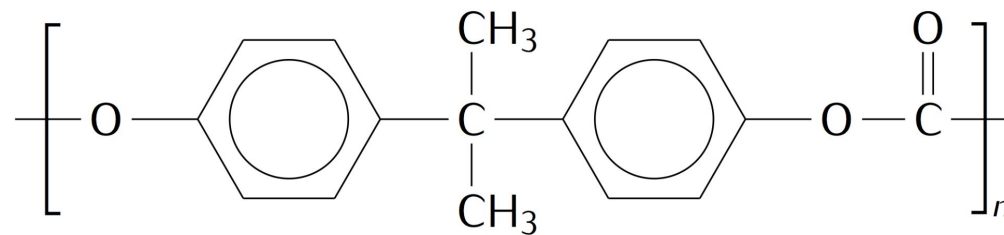
## Tables

	PM	PB	MT_RACHAT	TAUX	AGE
Min	0	0	0	0	0.1006
Median	7685	143.68	0	0	64.3333
Mean	32 231	886.31	1541	0.3449	60.5677
Max	3 528 826	204 718.24	1 358 526	2.0000	107.2355

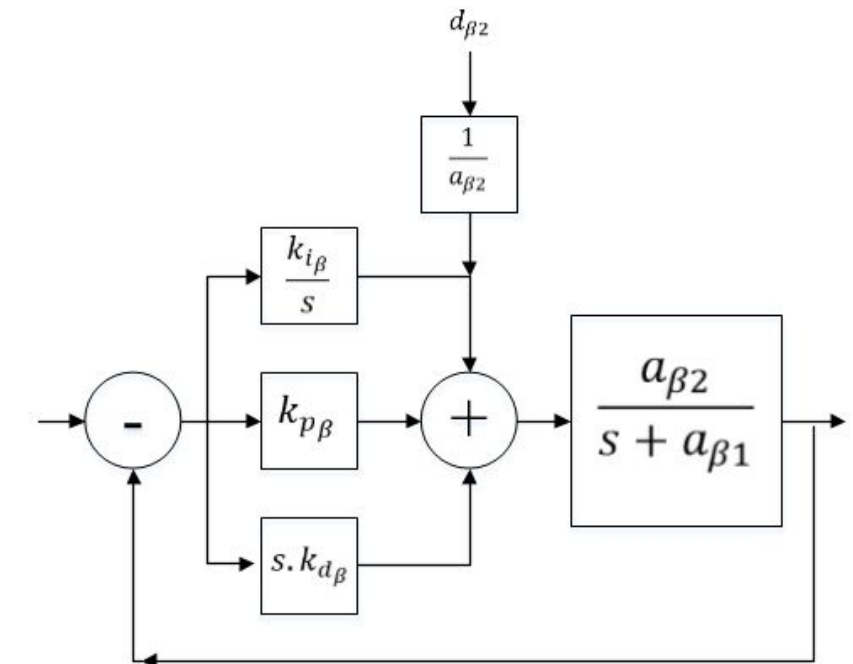
## Tensors



## Molecules and reactions



## Schemes



# Some more examples of LaTeX

## Matrices

$c_1$	$a_1$	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$a_1$	$c_2$	$a_2$	0	0	0	0	0	0	0	0	0	0	0	0	0
0	$a_2$	$c_3$	$a_3$	0	0	0	0	0	0	0	0	0	0	0	0
0	0	$a_3$	$c_4$	$a_4$	0	0	0	0	0	0	0	0	0	0	0
0	0	0	$a_4$	$c_5$	$a_5$	0	0	0	0	0	0	0	0	0	0
0	0	0	0	$a_5$	$c_6$	$a_6$	0	0	0	0	0	0	0	0	0
0	0	0	0	0	$a_6$	$c_7$	$a_7$	0	0	0	0	0	0	0	0
0	0	0	0	0	0	$a_7$	$c_8$	$a_8$	0	0	0	0	0	0	0
0	0	0	0	0	0	0	$a_8$	$c_9$	$a_9$	0	0	0	0	0	0
0	0	0	0	0	0	0	0	$a_9$	$c_{10}$	$a_{10}$	0	0	0	0	0
0	0	0	0	0	0	0	0	0	$a_{10}$	$c_{11}$	$a_{11}$	0	0	0	0
0	0	0	0	0	0	0	0	0	0	$a_{11}$	$c_{12}$	$a_{12}$	0	0	0
0	0	0	0	0	0	0	0	0	0	0	$a_{12}$	$c_{13}$	$a_{13}$	0	0
0	0	0	0	0	0	0	0	0	0	0	0	$a_{13}$	$c_{14}$	$a_{14}$	0
0	0	0	0	0	0	0	0	0	0	0	0	0	$a_{14}$	$c_{15}$	$a_{15}$
0	0	0	0	0	0	0	0	0	0	0	0	0	0	$a_{15}$	$c_{16}$

## Multi-line equations

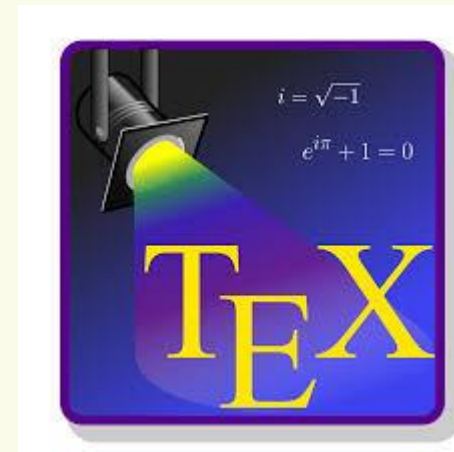
$$\left\{ \left[ \sum_i y_i x_i(r) - \frac{1}{n} \sum_i y_i \sum_i x_i(r) \right] \left[ \sum_i x_i^2(r) - \frac{1}{n} \left( \sum_i x_i(r) \right)^2 \right]^{-2} \right. \\ \left. \times \left[ \sum_i \frac{d^2 x_i^2(r)}{dr^2} - \frac{2}{n} \left[ \left( \sum_i \frac{dx_i^2(r)}{dr} \right)^2 + \left( \sum_i x_i(r) \right) \left( \sum_i \frac{d^2 x_i(r)}{dr^2} \right) \right] \right] \right\}$$

## Equations with brackets

$$\text{RHS of 1.9} \rightarrow \begin{cases} |1\rangle \left[ \frac{2\beta}{\sqrt{\alpha^2+4\beta^2}} |B\rangle - \frac{\alpha}{\sqrt{\alpha^2+4\beta^2}} |A\rangle \right], & D_1 \text{ clicks, probability } \frac{\alpha^2}{4} \\ |2\rangle |A\rangle, & D_2 \text{ clicks, probability } \frac{\alpha^2}{4} \\ |\text{scattered}\rangle |A\rangle, & \text{no clicks with probability } \frac{\alpha^2}{2} \end{cases} \quad (1.10)$$

# LaTeX editors

Editors  
(only for LaTeX, faster)



Integrated Development Environments  
(for many other things, but harder to set-up)



Visual Studio Code



# Briefly Overleaf

Edit your text using the **Code Editor** or **Visual Editor**.

The screenshot displays the Overleaf web interface. At the top, a navigation bar includes icons for Menu, Home, Review, Share, Submit, History, Layout, and Chat. Below this, a secondary bar shows the current project name 'A sample paper' and tabs for 'Code Editor' (selected) and 'Visual Editor'. A green 'Recompile' button is visible on the right side of this bar. The main area is split into two panes. The left pane is a code editor showing LaTeX source code with line numbers 1 through 15. The right pane is a preview window showing the rendered output of the code. The code in the left pane includes document class settings, language and font encodings, page size and margins, and various packages like amsmath, graphicx, todonotes, and hyperref. The preview window shows a document with the title 'Your Paper', author 'You', date 'June 19, 2023', an abstract section, and two numbered sections: '1 Introduction' and '2 Some examples to get started'.

```
1 \documentclass[a4paper]{article}
2
3 %% Language and font encodings
4 \usepackage[english]{babel}
5 \usepackage[T1]{fontenc}
6
7 %% Sets page size and margins
8 \usepackage[a4paper,top=3cm,bottom=2cm,left=3cm,right=3cm,marginparwidth=1.75cm]{geometry}
9
10 %% Useful packages
11 \usepackage{amsmath}
12 \usepackage{graphicx}
13 \usepackage[colorinlistoftodos]{todonotes}
14 \usepackage[colorlinks=true,allcolors=blue]{hyperref}
15
```

Your Paper

You

June 19, 2023

**Abstract**

Your abstract.

**1 Introduction**

Your introduction goes here! Some examples of commonly used commands and features below, to help you get started. If you have a question, please use the Overleaf menu in the editor to see various project settings, and to view our help documentation.

**2 Some examples to get started**



# Basic concepts in Overleaf

<https://www.overleaf.com/>



**Thnx**

