



Centre of Excellence  
in Quark Matter



JYVÄSKYLÄN YLIOPISTO  
UNIVERSITY OF JYVÄSKYLÄ



HELSINKI INSTITUTE OF PHYSICS

Research Council  
of Finland



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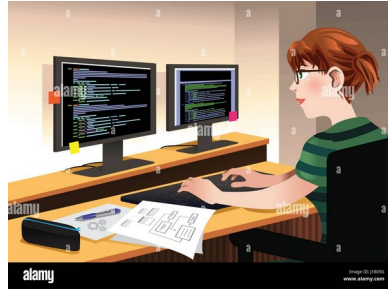
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# Computational and Statistical Methods

Particle and Nuclear physics graduate student retreat 2025

# Outline

- **Split in teams á 3 persons:**



- **But first let me talk about some useful tools and concepts**
- **And then you will work on a practical example**
- **Sessions: Friday 15-17 & Saturday 12:30-14**

# git and GitHub

- **Version control provides reproducibility**
- **Easy backup option**
- **Version control systems have a unique source of truth with which you have to sync your state**
- **GitHub is one popular online git provider**



# Important git commands



- `git help` open manual
- `git status` check current state
- `git pull` load most true state
- `git diff` check current changes
- `git add a.txt` add a file
- `git commit` take a snapshot of the current state
- `git push` transfer snapshots

# Python Libraries: Numpy + SciPy + Matplotlib



- **Efficient vector/matrix lib**
- **Basic Linear Algebra**
- **Includes all basic numeric algorithms, e.g. Integration, Differentiation, ...**
- **Basic plotting tool**

# Why write your own library?

- Reuse parts of your code
- Split math/physics from pheno
- Easier access for externals
- Easier to extend

# Testing your code

- **When writing code we usually test along the way**  
→ let's keep those tests in a dedicated way
- **Unit tests test atomic pieces of code**  
→ e.g. symmetries, analytic solutions
- **Benchmarks test against external references**  
→ e.g. other papers, programs
- **Most popular Python library: pytest**

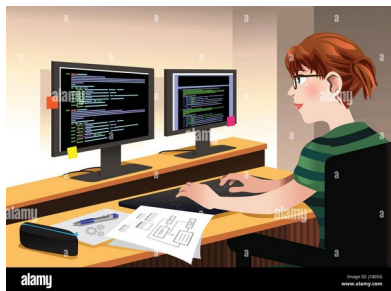


# Let's get practical!

- **Let's rediscover gravity by observing a ski jumper!**



- CAPTAIN
- General overview
- Code Reviews
- Infrastructure



- Develop library
- Develop unit tests
- Generate data



- Solve exercises
- Apply library
- Analyze data

<https://github.com/felixhekhorn/topi-git-template>