



Centre of Excellence
in Quark Matter



JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ



Research Council
of Finland

HELSINKI INSTITUTE OF PHYSICS



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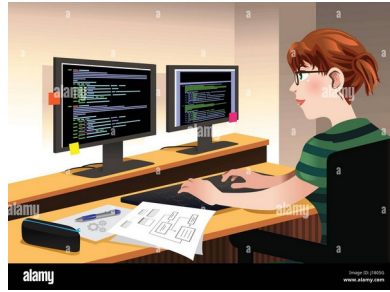


Computational and Statistical Methods

Particle and Nuclear physics graduate student retreat 2025

Outline

- Let me talk about some useful tools and concepts
- Split in teams á 3 persons:



- And then you will work on a practical example
- Sessions: Friday 15-17 & Saturday 12:30-14

git and GitHub

- **Version control systems provide reproducibility**
- **Trackable changes**
- **Easy backup option**
- **Version control systems have a unique source of truth with which you have to sync your state (Collaborations!)**
- **GitHub is one popular online git provider**



Important git commands

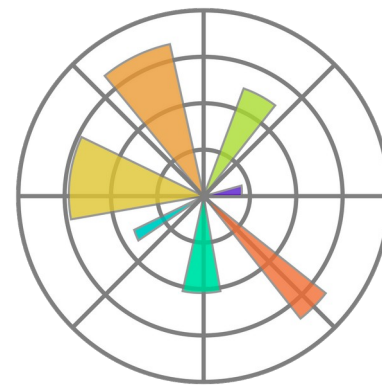


- `git help` open manual
- `git status` check current state
- `git pull` load most recent “true state”
- `git diff` check current changes
- `git add a.txt` add a file
- `git commit` take a snapshot of the current state
- `git push` transfer snapshots

Python

- **Python is very popular inside and outside academia**
- **Let's use virtual environments:**
 - We have a reproducible setup
 - We can control versions

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**

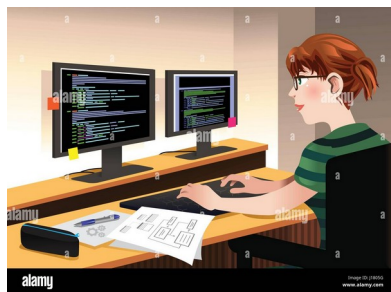


Let's get practical!

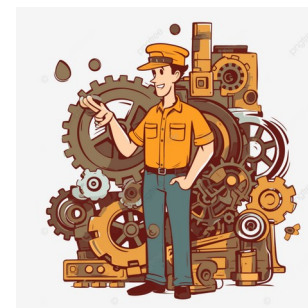
- **Let's rediscover gravity by observing a ski jumper!**



- TEAM 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>