

# MolSim WS 23/24

Sheet 1

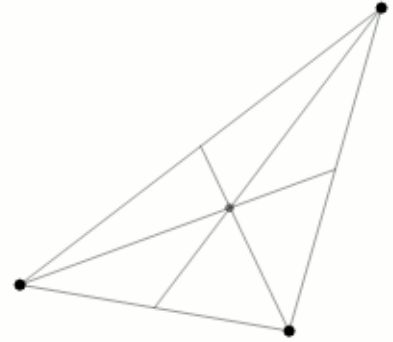
## Project Setup, Planetary Simulation

**Group C** [Manuel, Tobias, Daniel]

11/1/2023

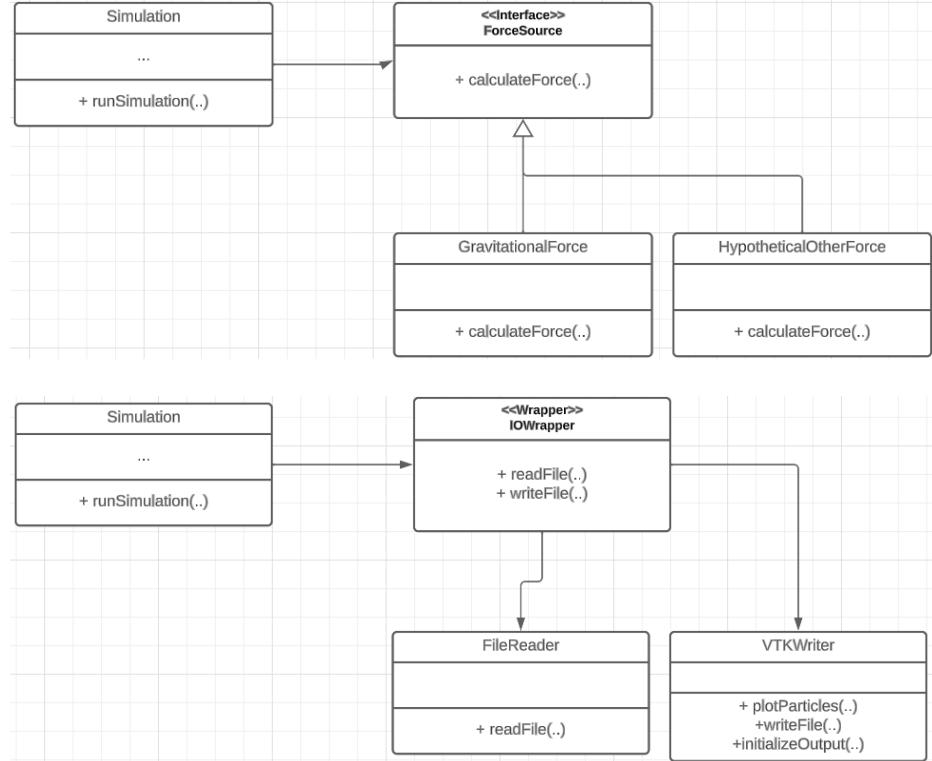
# N Body Simulation

- **Simulations with  $n \leq 2$ :**
  - Very stable and simple orbits
  - Often no approximations needed
- **Simulation with  $n \geq 3$ :**
  - Rarely analytic solution, approximation required
  - More complex orbits
  - Approximation artifacts



# Code Refactoring

- **Design patterns used:**
  - Adapter pattern
  - Bridge pattern
- **Goals:**
  - Not having to change the code structure much
  - Extend functionality easily



# Input File Reverse Engineering

- Input File isn't labeled
  - ⇒ Reverse engineer each body
- Observation
  - Position in AUs
  - Mass normalized to sun
- Therefore
  - Sun, Earth, Jupiter, Halley's Comet

#	xyz-coord	velocity	mass
4			
0.0	0.0 0.0	0.0 0.0 0.0	1.0
0.0	1.0 0.0	-1.0 0.0 0.0	3.0e-6
0.0	5.36 0.0	-0.425 0.0 0.0	9.55e-4
34.75	0.0 0.0	0.0 0.0296 0.0	1.0e-14

# Visualization

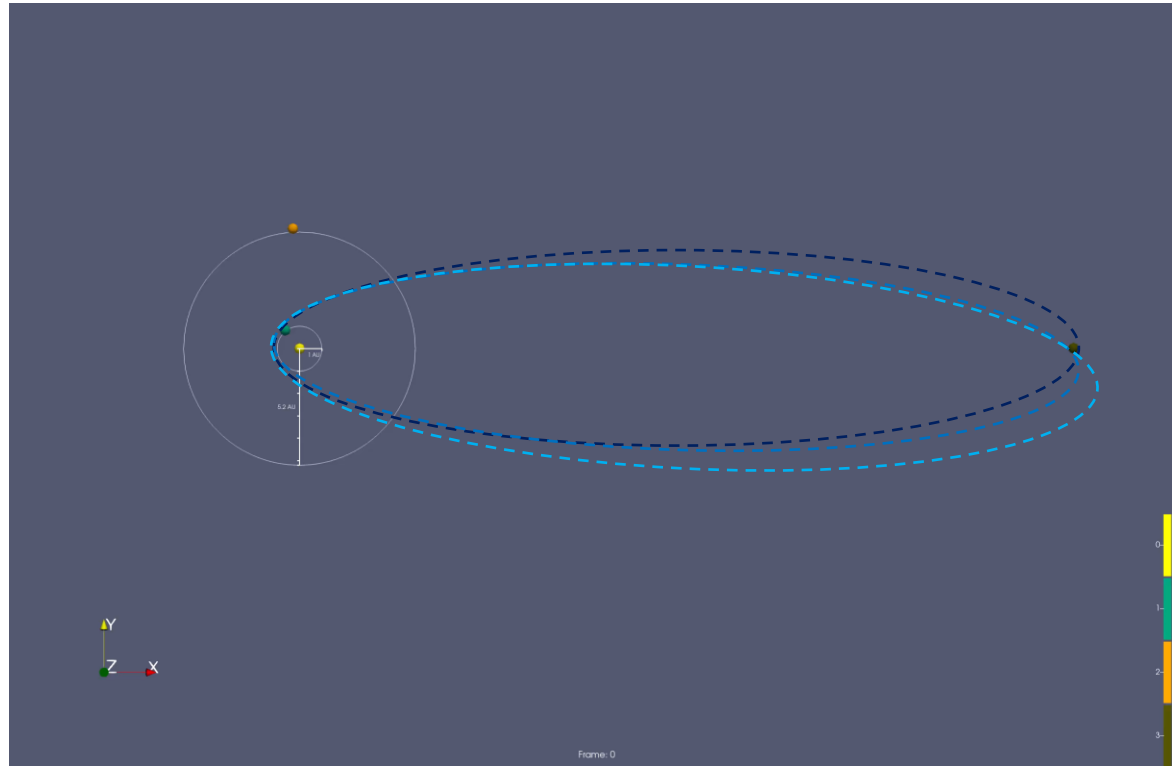
- Added some visuals to the simulation
  - Color represents planet type
  - Average orbit radius
- Looks very cool!



# Visualization



# Visualization



# Github Project Management

- Task Planning via Github
- Kanban Board View
- Easy way to see open issues

The screenshot displays a Github Project Management interface for a project named 'MoSim-WS23-24'. The interface is organized into three columns: 'Todo', 'In Progress', and 'Done'. Each column contains a list of tasks, each represented by a card with a title and a description. The 'Todo' column has three items, 'In Progress' has one, and 'Done' has seven. The tasks are color-coded by status: green for 'Todo', yellow for 'In Progress', and purple for 'Done'. The 'Done' column also includes a small green plus icon next to some items, indicating they are completed. The interface includes a search bar at the top, a filter option, and a navigation menu.

ManuelLerchner / Projects / MoSim-WS23-24

MoSim-WS23-24

View 1 + New View

Filter by keyword or by field

**Todo** 3

This item hasn't been started

- MoSim-WS23-24 #7  
[Sheet 1] Refactor Codebase
- MoSim-WS23-24 #12  
[Sheet 1] Create Presentation
- MoSim-WS23-24 #13  
Default Timestep and Video

**In Progress** 0

This is actively being worked on

**Done** 7

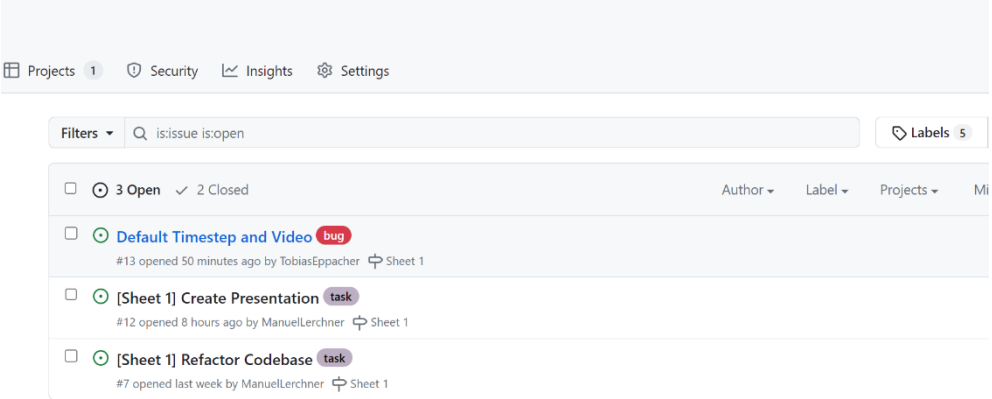
This has been completed

- MoSim-WS23-24 #3  
Implement Movement Calculations Sheet 1
- MoSim-WS23-24 #6  
Implemented the 3 formulas and added setters to particle attributes
- MoSim-WS23-24 #1  
add basic github convenience actions
- MoSim-WS23-24 #8  
Pass arguments via comand line
- MoSim-WS23-24 #9  
A bit of refactoring and command line input with boost\_program\_options
- MoSim-WS23-24 #10  
Show help message when executed with no arguments;
- MoSim-WS23-24 #11  
fix bug in formula



# Github Issues

- We organize open tasks in issues
- Issues can be assigned to persons
- Everyone can work in parallel
- Hopefully not many merge conflicts



The screenshot shows a GitHub Issues page for a repository. At the top, there are navigation tabs: Projects (1), Security, Insights, and Settings. Below this is a search bar with the filter 'is:issue is:open' and a 'Labels 5' button. The main content area displays a list of issues with the following details:

- 3 Open, 2 Closed (Status summary)
- Author, Label, Projects, Mi (Dropdown menus)
- Issue 1:  [Default Timestep and Video](#) **bug**  
#13 opened 50 minutes ago by TobiasEppacher [Sheet 1](#)
- Issue 2:  [\[Sheet 1\] Create Presentation](#) **task**  
#12 opened 8 hours ago by ManuelLerchner [Sheet 1](#)
- Issue 3:  [\[Sheet 1\] Refactor Codebase](#) **task**  
#7 opened last week by ManuelLerchner [Sheet 1](#)

💡 ProTip! Type `g` `p` on any issue or pull request to go back to the pull request listing page.

# Github Actions

- Small CI/CD pipeline
- Build-Check
  - Compile source code
  - Run Doxygen
- Format-Check
- Host Docs on GitHub-Pages

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<> Code Issues 4 Pull requests 1 Actions Projects 1 Security Insights Settings

Actions [New workflow](#)

All workflows

Build Docs

Build Project

clang-format Check

pages-build-deployment

Pull Request Auto Assing

Management

Caches

Deployments ↗

Runners [Beta](#)

All workflows

Showing runs from all workflows

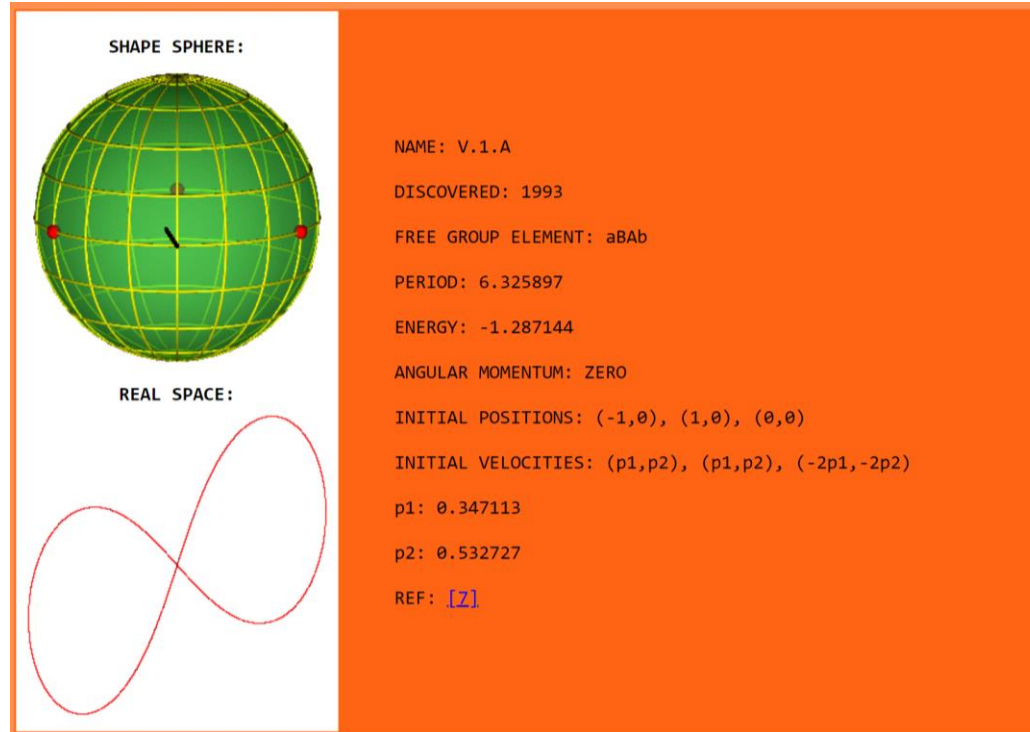
132 workflow runs

- ✓ Report  
Build Project #64: Pull request #17 synchronize by DanielSafyan [report](#)
- ✓ Report  
clang-format Check #20: Pull request #17 synchronize by DanielSafyan [report](#)
- ✓ New ready presentation.  
clang-format Check #19: Commit 9b5f6b2 pushed by DanielSafyan [report](#)
- ✓ New ready presentation.  
Build Project #63: Commit 9b5f6b2 pushed by DanielSafyan [report](#)
- ✓ Merge pull request #26 from ManuelLerchner/24-sheet-1-more-docstrings  
clang-format Check #18: Commit 84c156d pushed by ManuelLerchner [master](#)
- ✓ Merge pull request #26 from ManuelLerchner/24-sheet-1-more-docstrings  
Build Docs #34: Commit 84c156d pushed by ManuelLerchner [master](#)

# Summary of cool things

- We drew a pretty planet simulation
- We used fancy software engineering patterns
  - Bridge Pattern
  - Adapter Pattern
- We implemented a nice collaboration workflow
- We set up a basic CI/CD pipeline

# Perfectly periodic system



# References

- 3-body-problem GIF: [https://commons.wikimedia.org/wiki/File:Three-body\\_Problem\\_Animation\\_with\\_COM.gif](https://commons.wikimedia.org/wiki/File:Three-body_Problem_Animation_with_COM.gif)
- Figure 8 initial conditions: [http://three-body.ipb.ac.rs/sV\\_sol.php?id=0](http://three-body.ipb.ac.rs/sV_sol.php?id=0)