

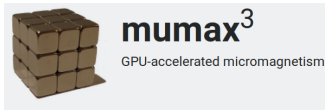
ALMA Tutorials | MuMaX3 Workshop

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Introduction



Welcome to the introductory **MuMax3** workshop! During these sessions I will guide you through the main functionalities of the finite-difference micromagnetic software **MuMax3**, developed at Ghent University by the Dynamat group. As you might know MuMax3 runs with an Nvidia Graphics Processing Unit (GPU) because the calculations are parallelized, which means they run simultaneously in multiple processors. Further, MuMax3 is written in the **Go** programming language although to run simulations only a small subset of functions are used to create a micromagnetic simulation.

In this workshop we will learn to:

- Understand numerical micromagnetics
- Create a MuMax3 simulation by analysing most of the basic functions from the **Mumax3 interface**
- Analyze MuMax3 outputs from static and dynamic micromagnetic simulations
- Understand and interpret the Standard Problems from the μ Mag website <https://www.ctcms.nist.gov/~rdm/mumag.org.html>
- Convert MuMax3 output files and study the different output formats
- Some nice tricks that can help you to organize and optimize your simulations

Requirements

- If you have an Nvidia GPU, you need to install MuMax3 in your machine. You can follow the instructions in the [MuMax3](#) website. You can test the installation and check that the `mumax3-convert` tool also works.
- If you do not have an Nvidia GPU you can use **Google Colab** which offers free GPU resources by means of a Python Notebook interface similar to Jupyter notebooks. For this you will only need a Google account. You have two alternatives:
 - ▣ Open the [Google Colab notebook](#) directly, which you can then save to your own Google Drive storage using the **Copy to Drive** button.
 - ▣ Open Google Colab, and then from the menu:
File -> Open Notebook -> Github , copy and paste this [LINK](#) (use right click)
- The Nvidia GPU in the Google Colab is probably not activated. For this you can go to the menu at the top and select:
Runtime -> Change runtime type -> GPU . Now all the commands from the notebook should work.

Requirements

- I will not use the MuMax3 graphical interface but you can get familiar with it using the interactive mode when running a simulation: `mumax3 -i ...`. The workshop will be based on the command line interface.
- To create/modify MuMax3 scripts you can use any text editor: MS VisualStudio, Spyder, Notepad, Vim, Emacs, Atom, etc.

Requirements: Data

- To analyze the data I will use the **Python** programming language, which is highly readable, full of open source libraries and straightforward to use.
 - I will show step by step the analysis of the simulations using a Jupyter notebook or via Google Colab notebook.
 - For Python I recommend installing and become familiar with the Anaconda distribution <https://www.anaconda.com/> . It is available for all platforms, Windows, Linux and MacOS.
 - It is not essential but it will be easier for you if you can learn the basics of Python, the **Numpy** library for matrix/vector analysis, and the **Matplotlib** library for plotting. There is plenty of material online, such as [Fangohr's Python book](#) (chapter 14 introduces Numpy) or [Youtube](#). I will not use advanced Python features such as functions or classes.
 - If you are not comfortable with Python you can use MS Excel or Matlab for plotting and reading the data although I cannot provide support for these software. If you know Matlab it is easy to understand Python/Numpy.
 - For 3D visualization we will use Paraview or [MuMax View](#)

Simulations

During the workshop we will solve the micromagnetic problems together via Google Colab or the command line (using Linux). The basic material of the workshop will be uploaded to this Github repository

- https://github.com/davidcortesortuno/alma_tutorials_mumax3_workshop
- If you have any questions please raise an issue in the repository, and I will try to respond in the next days. You will need a Github account.

Note

The material and the slides are a work in progress, thus expect some changes happening in the repository

Extra Notes

- If you have trouble installing MuMax3 in your machine I recommend watching Session 2 of the [MuMax Workshop](#)
- Have a look at the [Standard Problems for micromagnetics](#)
- For experienced Windows users: you might want to take a look at the Windows Subsystem for Linux (WSL) which allows you to use Ubuntu Linux within your Windows environment. Ubuntu offers a good interface to run Python to process MuMax3 data.
- If you have run some MuMax3 simulations before, you might want to take a look at my [OOMMFPy](#) library, which allows you to read **OVF** and **OMF** files using Python to easily analyse the output of the simulations. But this is not necessary for this workshop.

Looking forward to see you at the workshop!