



UNIVERSITY OF  
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# Software Preparation for Modelling Workshop

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## Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Installation of simulation tools</b>	<b>2</b>
2.1	I am a Python user and have Anaconda/Conda installed already (Windows, OSX, or Linux) . . .	2
2.2	I am a Python user and have my own environment already set up that I want to use . . . . .	2
2.3	For Windows users without Conda installed . . . . .	3
2.4	For Mac OSX without Conda installed . . . . .	4
2.5	For Linux users without Conda installed . . . . .	4
2.5.1	Installing PyKat, Finesse and Jupyter with Conda . . . . .	5
<b>3</b>	<b>Using Jupyter notebook to run Finesse</b>	<b>5</b>

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# 1 Introduction

This document provides information on getting started for the workshop on optical simulations. The aim is to provide an introduction to the concepts behind the optical simulation tools used in the gravitational wave community, by working directly with code and simulation tools. The installation instructions below should guide you through the process of installing all the required software packages. If you have questions or need help, you can contact us via email.

## 2 Installation of simulation tools

This workshop will make use of **Python** and **Jupyter notebook**. The Python ecosystem has to be installed first. The way we recommend to run Finesse and PyKat is through the Conda package manager: <https://docs.conda.io/en/latest/miniconda.html>. We have created Conda packages to automate and easily install both PyKat and Finesse in one command.

Python version	Name	Size	SHA256 hash
Python 3.7	Miniconda3 Windows 64-bit	51.5 MiB	f18060cc0bb59ae75e4d602b7ce35197c9e31e81288d069b758594f1bb46ab45
	Miniconda3 Windows 32-bit	54.0 MiB	7c30778941d2bba03531ba269a78a108b01fa366530290376e7c3b467f3c66ba
Python 2.7	Miniconda2 Windows 64-bit	50.9 MiB	8647c54058f11842c37854edef4d20bc1fbdad8b88d9d34d76fda1630e64846
	Miniconda2 Windows 32-bit	48.7 MiB	0d106228d6a4610b599df965dd6d9bb659329a17e3d693e3274b20291a7c6f94

Figure 1: We recommend running Python 3 (Python 2 is now being phased out), so select the installer according to the operating system of your computer.

From the section titles pick the one that suits your current condition the most.

### 2.1 I am a Python user and have Anaconda/Conda installed already (Windows, OSX, or Linux)

If you already use Anaconda or Miniconda on your system, then installation is very easy! You can just straight ahead to section 2.5.1.

### 2.2 I am a Python user and have my own environment already set up that I want to use

If you have Python already installed on your machine and you are using it regularly for other tasks, you might not want to follow the instructions exactly as they are written below, as you don't want to interfere with your previous Python setup. You can install Conda as per the instructions below just to try out Finesse and in such a way that it doesn't interfere with your Python setup as you have it. You need to follow the instructions below as described for your operating system. On Windows you can install Conda, Pykat, and Finesse and it will be entirely separate from your original setup, if you don't want it anymore just uninstall it. On OSX and Linux, you should follow the instructions below but should avoid the commands that edit the `/.bash_profile` or `/.bashrc` changing the PATH variable and setting a default environment to start up. Just install it and call the `miniconda3/bin/activate` tool just when you want to use Finesse. This will temporarily setup your environment to use the Pykat and Finesse tools but is easily deactivated and returned to your normal setup.

## 2.3 For Windows users without Conda installed

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For those that don't want to use Conda at all you need to install the Finesse binary file for your operating system. Please see the installation instructions for Finesse and PyKat on the project pages at <http://www.gwoptics.org/finesse> and <http://www.gwoptics.org/pykat> on how to do this.

If you're not sure what to do at any point and have general questions about setting it all up, please email us and we'll be happy to advise you.

## 2.3 For Windows users without Conda installed

First download the Python 3 Miniconda installer from the website linked above. Double click on the \*.exe and follow the instructions on screen. You can just use all default settings given by the installer. Once Miniconda has been installed, search for **Anaconda Prompt** in the start menu. This could be in the **Anaconda3** folder. See Figure 2.

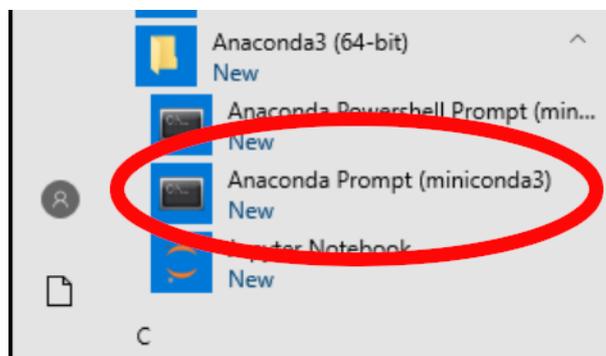


Figure 2

This will open a new command window which can run Conda and Python. Type: `conda info`. If the installation has been successful, you should see the information related to Conda on the screen (see Figure 3).

```

Anaconda Prompt (miniconda3)
(base) C:\Users\Phil>conda info

  active environment : base
  active env location : C:\Users\Phil\AppData\Local\Continuum\miniconda3
  shell level        : 1
  user config file   : C:\Users\Phil\.condarc
  populated config files : C:\Users\Phil\.condarc
  conda version      : 4.7.12
  conda-build version : not installed
  python version     : 3.7.4.final.0
  virtual packages   :
  base environment   : C:\Users\Phil\AppData\Local\Continuum\miniconda3 (writable)
  channel URLs       : https://conda.anaconda.org/gwoptics/win-64
                     https://conda.anaconda.org/gwoptics/noarch
                     https://repo.anaconda.com/pkgs/main/win-64
                     https://repo.anaconda.com/pkgs/main/noarch
                     https://repo.anaconda.com/pkgs/r/win-64
                     https://repo.anaconda.com/pkgs/r/noarch
                     https://repo.anaconda.com/pkgs/msys2/win-64
                     https://repo.anaconda.com/pkgs/msys2/noarch
  package cache      : C:\Users\Phil\AppData\Local\Continuum\miniconda3\pkgs
                     C:\Users\Phil\.conda\pkgs
  envs directories   : C:\Users\Phil\AppData\Local\conda\conda\pkgs
                     C:\Users\Phil\AppData\Local\Continuum\miniconda3\envs
                     C:\Users\Phil\.conda\envs
                     C:\Users\Phil\AppData\Local\conda\conda\envs
  platform          : win-64
  user-agent        : conda/4.7.12 requests/2.22.0 CPython/3.7.4 Windows/10.0.18362
  administrator     : False
  netrc file        : None
  offline mode      : False
```

Figure 3

Now move on to section 2.5.1.

## 2.4 For Mac OSX without Conda installed

Open up a new Terminal window. Here we will download the latest Conda installer and setup the terminal to use the default environment. Run each command one after another:

---

```
curl "https://repo.continuum.io/miniconda/Miniconda3-latest-MacOSX-x86_64.sh" -o ~/Miniconda3.sh
bash ~/Miniconda3.sh -b
echo #Added during Finesse and Pykat Conda installation >> ~/.profile
echo export PATH="~/miniconda3/bin:\$PATH" >> ~/.profile
echo conda activate base >> ~/.profile
source ~/.profile
```

---

Type `conda info`, you should see similar output to below:

---

```
active environment : base
active env location : /Users/phil/miniconda3
    shell level : 1
    user config file : /Users/phil/.condarc
populated config files :
    conda version : 4.7.12
conda-build version : not installed
    python version : 3.7.4.final.0
...

```

---

The main Conda environment will be activated each time you open a new terminal and will be ready for you to use straight away. You can tell that the environment is activated by the fact that `(base)` should now appear before each line in the terminal. If you want to switch off the environment, simply type `conda deactivate`. You can stop the environment from being permanently activated by removing the `conda activate base` line from the file `/.profile` in your home directory.

Now move on to section [2.5.1](#).

## 2.5 For Linux users without Conda installed

Open up a new Terminal window. Here we will download the latest Conda installer and setup the terminal to use the default environment. Run each command one after another:

---

```
wget "https://repo.continuum.io/miniconda/Miniconda3-latest-Linux-x86_64.sh" -O ~/Miniconda3.sh
bash ~/Miniconda3.sh -b
echo #Added during Finesse and Pykat Conda installation >> ~/.bashrc
echo export PATH="~/miniconda3/bin:\$PATH" >> ~/.bashrc
echo conda activate base >> ~/.bashrc
source ~/.bashrc
```

---

Type `conda info`, you should see similar output to below:

---

```
active environment : base
active env location : /home/phil/miniconda3
    shell level : 1
    user config file : /home/phil/.condarc
populated config files : /home/phil/.condarc
    conda version : 4.7.12
conda-build version : not installed

```

---

---

```
python version : 3.7.4.final.0
...
```

---

The main Conda environment will be activated each time you open a new terminal and will be ready for you to use straight away. You can tell that the environment is activated by the fact that `(base)` should now appear before each line in the terminal. If you want to switch off the environment, simply type `conda deactivate`. You can stop the environment from being permanently activated by removing the `conda activate base` line from the file `/.bashrc` in your home directory.

Now move on to section [2.5.1](#).

### 2.5.1 Installing PyKat, Finesse and Jupyter with Conda

Note to Windows users: When we say open a Terminal, we mean open Anaconda Prompt from now on.

Open up a new Terminal window use the following commands one after another to install all packages we need:

```
conda update conda
conda config --add channels gwoptics
conda install pykat jupyter
conda activate base
```

Type `y` for yes when asked and wait for the installation complete. If you run the following command:

```
python -c "import pykat"
```

You should see the PyKat header. Then type:

```
kat -v
```

and it should show the Finesse version. If any errors appear at this stage please contact us.

One can see the list of the installed packages with the command `conda list`. Now see section [3](#) on Jupyter notebooks.

## 3 Using Jupyter notebook to run Finesse

Using Jupyter notebook is a nice way to keep your technical notes with results. The Jupyter notebook should already have been installed on your computer in Section [2.5.1](#).

**For Windows system**, to open the Jupyter notebook, open the **Anaconda Prompt** command window, and type `jupyter notebook`. Or you can also find it in your computer **Start** menu under **Anaconda3** folder (see Figure [4](#)).

**For OS X and Linux system**, to open the Jupyter notebook, open the **Terminal** window, and type `jupyter notebook`.

The Jupyter notebook will be opened with your default Internet browser. You can go to, or create, your preferred working folder. Press **New** and chose **Python 3** (shown in Figure [5](#)) to create a new notebook.

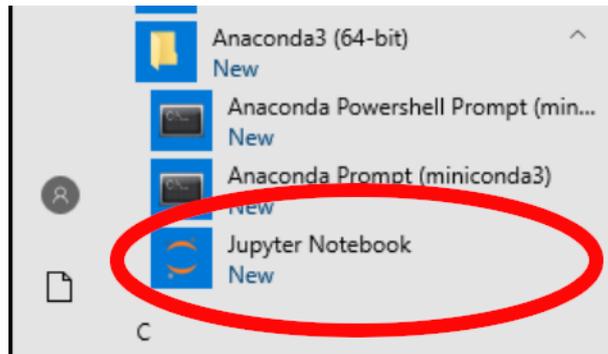


Figure 4

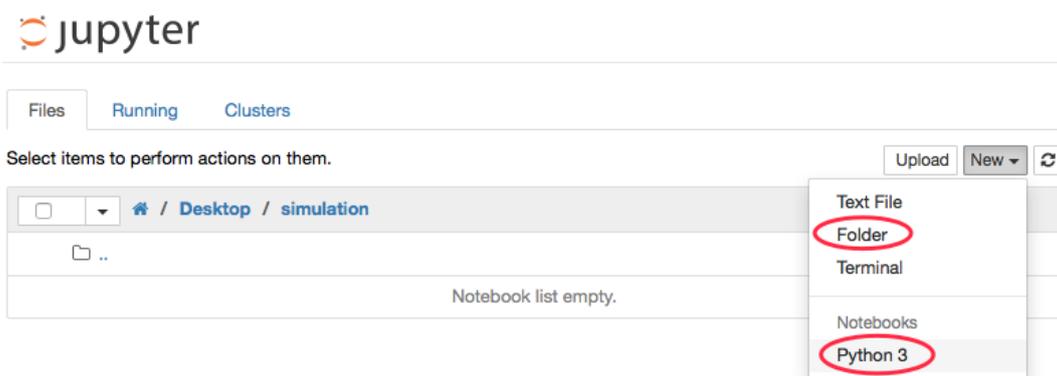


Figure 5