COSPAR Capacity-Building Workshop Ethiopia 2018  
PYTHON Lectures by Christian Monstein

**Lecture 1/5**

* Python basics, introduction
* Installation and configuration
* Maintenance (pip)
* My first Python script hello.py
* Plot a mathematical function r\_ft.py and dfdt.py {play with font-size, colour, log-scale, etc.}

**Lecture 2/5**

* How to access Callisto data (locaccess.py, sepaccess.py, webaccess.py)
* Plotting dynamic spectra with background subtraction methods (constant.py, average.py, individual.py)
* Merge 2D-spectra in frequency space (mergefrequency.py)
* Plotting useful axis (axis/FITplotWithAxis.py)
* Pseudo intensity calibration and intensity bar plot [dB] (pseudocal.py and psudocal\_BBG.py)

**Lecture 3/5**

* How to plot light curve (plotLightcurve.py)
* How to plot a single spectrum (plotSingleSpec.py)
* Manipulation frequency axis (FITplotAxisFlip.py)

**Lecture 4/5**

* Plotting histograms (histogram.py)
* Plotting bar charts (barchart.py)
* Plotting pie charts (piechart.py)
* How to plot 2-d images (imgplot.py)
* Generate event-list(s) for type II 2010-2017 from SPWC/NOAA FTP-server

**Lecture 5/5**

* Read and plot light-curves from FIT-files from GOES-satellite
* Curve fitting on a GOES-x-ray-light curve (6 different methods linear and non-linear)
* Image resizing and stacking vertically and horizontally

During the lectures in the morning, I will demonstrate several Python scripts step by step and I will provide all data (FIT-files, images, plots etc.).  
For the hands-on activity, the students have to get their data themselves either from the internet or from the local server. Students have to complete axis-descriptions, titles, fonts, log-scale etc. themselves. They will have to prepare plots in a way that they are acceptable by a journal. Therefore, they need to save their results in an appropriate format to be compliant with TeX and MS-office products.

Detailed activities during hands-on activities, related to the morning lectures:  
- Provide plots in a readable form, ready for publication  
- Play with font-size  
- Play with font-colour  
- Play with line thickness,   
- Play with plot-size  
- Play with saving of different graphic formats (jpg, png, pdf, bmp, tiff, etc.)  
- Play with grid  
- Play with lin/log and log/log axis format  
- Play with transparency

Exercises in folder ‘Hands-On’:

* Produce histogram from CME-velocities 2010-2017 (Solutions in folder HistoCMEspped, scripts: CMEhistogram.py and CMEfull\_histogram.py)
* Generate pixel-listing out of a type II burst to import into EXCEL (Folder InteractivePixel, script interactive4.py)
* Generate plots out of several type II bursts, based on Newkirk model (Folder InteractiveCME, script Multi\_FIT\_Newkirk.py)
* Read and plot a text-file (ASCII-listing) (Plott\_XY.py)
* Read spectral overview file from Callisto and produce a ‘nice’ plot (Folder ReadPlotTXTfile, script Plott\_OVS.py)
* Plot type II burst together with GOES-15 light-curves with two y-axis  
  Folder PlotManyFITSandGOESsingleImageDualYaxis, script PlotManyFITSandGOESsingleImageDualYaxis.py  
  Do the same with type II of 20160504 around 14UT and combine with GOES14 fluxes.
* Demo on how to put a plot into a TeX-file (requires MikTeX and WinEdt)