In-Class Work: Talk Tools

1. Sample File(s) for Latex Beamer:

The following files are also available on our course webpage.
1a. If you plan to use overleaf, then use
`~kvollmay/share.dir/talks.dir/beamer_example_All.zip`
to make a new project within overleaf.
1b. If you plan to use latex within the linux environment, copy into your working directory
`~kvollmay/share.dir/talks.dir/beamer_example.tex`
`~kvollmay/share.dir/talks.dir/fig[1-3].eps`
Have a look at `beamer_example.tex`.

The commands for compiling this sample tex-file and for looking at the resulting pdf-file are as comments at the beginning of `beamer_example.tex`.

In-Class Work: Fractal Growth

We are implementing the Diffusion Limited Aggregation (DLA) model by Witten and Sander [T.A. Witten, L.M. Sander, Phys. Rev. Lett **47**, 1400 (1981)]

8. Finished DLA program

Last class you all worked on the DLA ([T. A. Witten Jr, L. M. Sander, Phys. Rev. Lett. 47, 1400 (1981)]) program. In previous years it took several classes to finish all steps of the DLA program, so even if you did not finish last class the program, you were all showing great progress! Today we will work on how the resulting DLA-cluster can be analyzed, namely you will measure the so called fractal dimension. To ensure that everybody will work on this analysis (instead of finishing their own version of the program), copy the following program into your working directory
`~kvollmay/share.dir/inclass2021.dir/classfractal8.py`
I will guide you through this program.

9. Fractal Dimension of DLA Cluster

9a. I will give you an intro to a defintion for the fractal dimension.

9b. Now lets get ready to analyze the pattern of the DLA model. You will determine the fractal dimension of one pattern using the method of checking squares of length `b`, as just described in class.

To avoid having to run the DLA program again and again, let us first prepare one pattern, which you then will analyze in 9c. Run the program
`~kvollmay/share.dir/inclass2021.dir/classfractal8.py`
This program makes the file `bigDLAcluster.dat` (and a nice pdf-file `frame8.pdf` just for fun). (Or if you have your own finished DLA program, have a look at the last few lines of `classfractal8.py` to see how to write the file `bigDLAcluster.dat`.) Ensure that you run the program for `LATSIZE=500` and for `NPARTMAX=3000`. This will take a while, but we have to do this only once, because for the analysis we use `bigDLAcluster.dat`.

9c. Now you need a program which reads in the 224x224 matrix from your file `bigDLAcluster.dat`. You may use for this task
`~kvollmay/share.dir/inclass2021.dir/classfractal9start.py`
To get the fractal dimension d_{f} we use the following relation.

$$\ln(N) = \ln(c) + d_{\mathrm{f}} * \ln(b) \tag{2}$$

where N is the number of occupied sites, c is some constant and b is the length of your square for which you count the number of occupied sites. You see that Eq.(2) defines d_f and it tells us that if we plot $\ln(N)$ as a function of $\ln(b)$ then we should get a line with slope d_{f}. So our task is to get N and b. Add to your program that you count the number of occupied sites N for a lattice of lenght b, where you center your lattice of lenght b around the midpoint of your 224 x 224 lattice. Loop over the length of your lattice and print out $\mathrm{l}n(N)$ as a function of $\ln(b)$. Let's say you do
`classfractal9c.py` $>$ `lnNoflnb.dat`
Hint: $\ln(N)$ is in python `np.log(N)`

9d. Next we fit a line to our data from 9c stored in file `lnNoflnb.dat`. For this we use gnuplot. So type in the command line "`gnuplot`". Then type "`plot "lnNoflnb.dat"`". Define a function $f(x)$ by typing "`f(x) = a*x + b`". Now fit your data within the xrange [2.0,4.2] to a line by typing "`fit [2.0:4.2] f(x) "lnNoflnb.dat" via a,b`". The resulting a is the fractal dimension d_{f}. You can look at the data and fit with "`plot "lnNoflnb.dat",f(x)`" Compare your fractal dimension with the expected value of 1.71