# Computational Physics (Physics.566.01.Sp15)–Group Assignment

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## I. INTRODUCTION

### A. 2D random walk

In this part, we would do a problem about random walk in 2 dimensions, taking steps of unit length in ±x or ±y direction on a discrete square lattice.

## II. METHOD

### A. 2D random walk

## III. RESULTS

### A. 2D random walk

In this part, we plot $< x_n >$ and $< (x_n)^2 >$ up to n=100 by averaging over at least $10^4$ different walks. The result are shown in Fig. **??**.

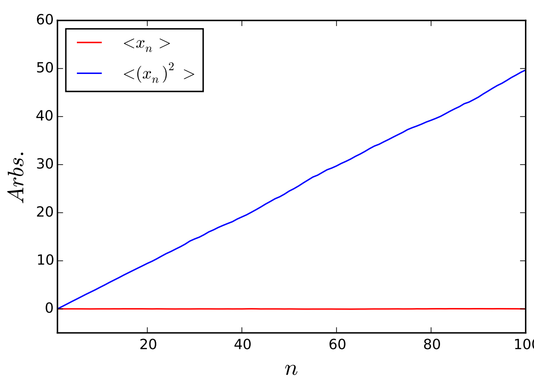


FIG. 1. $< x_n >$ and $< (x_n)^2 >$ up to n=100 by averaging over at least $10^4$ different walks.

You can see that the $< x_n >$ is always zero which is agree with our expectation. For the random walk is walking randomly along +x direction and -x direction, so the average of that would be zero after many times of random walks. As you can see that correlation between $< (x_n)^2 >$ and n is linearly, and the ratio is like 0.5. The reason for that is that the random walks in two axis, neither ±x direction or ±y direction, so the probability of walking in ±x direction is almost 0.5 which is also agree with our results.

By see the mean square distance from the starting point $< r^2 >$ up to 100 times by averaging over at least $10^4$ different walks, shown in Fig. **??**.

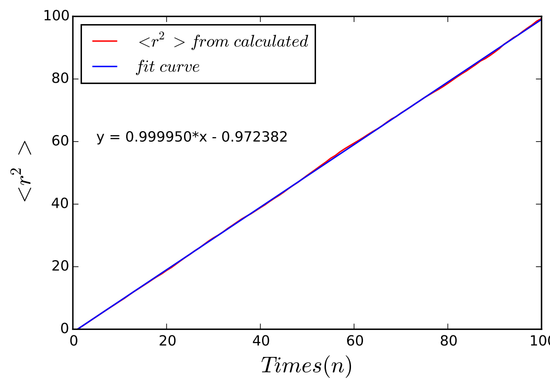


FIG. 2. $< r^2 >$ up to n=100 by averaging over at least $10^4$ different walks.

we can see that the motion is diffusive and the value of the diffusion constant after an curve fit is like 0.99995 which is very close to 1. The reason for that the mean square distance from the starting point stands for the walk of two aixs (x and y), so the probability of that is equal to 1 which is agree with our plot.

## IV. CONCLUSION

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