Random Walks

Computational Physics

Random Walks

Outline

- Random Walk Description
- Random Walk Examples and Properties
- Exercise 9 – Radiative Transfer as Random Walk Process

1D Random Walk in MATLAB

```
n = 101;
p = zeros(n,1);
rand('state',sum(100*clock));

p(1) = 0.0;
for i=1:n-1
    % test to see whether step
    % forward or step back
    if(rand > 0.5)
        p(i+1) = p(i) + 1;
    else
        p(i+1) = p(i) - 1;
    end
end
```

initialize array for number of steps

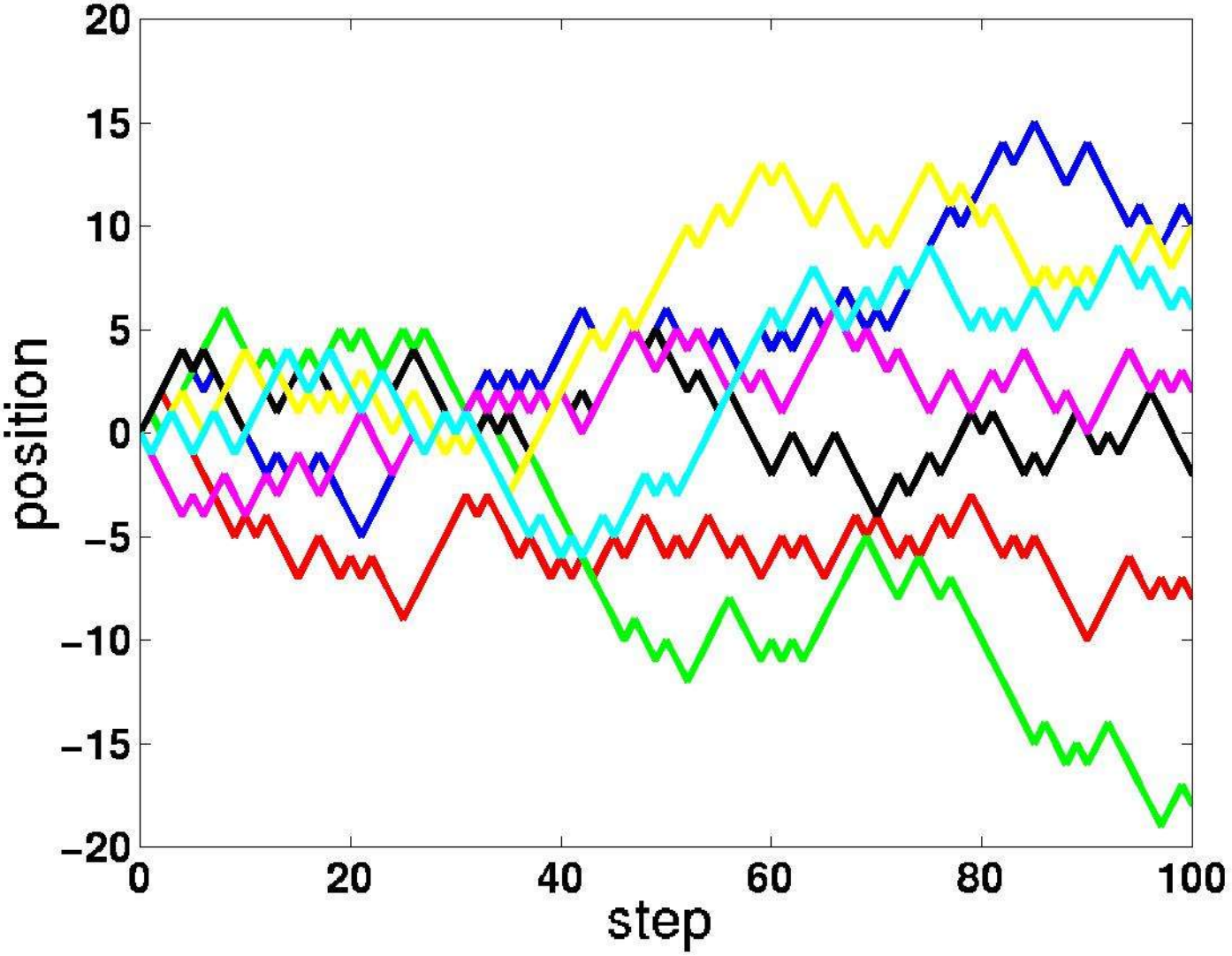
initialize random number seed

start at position = 0
loop through n-1 steps

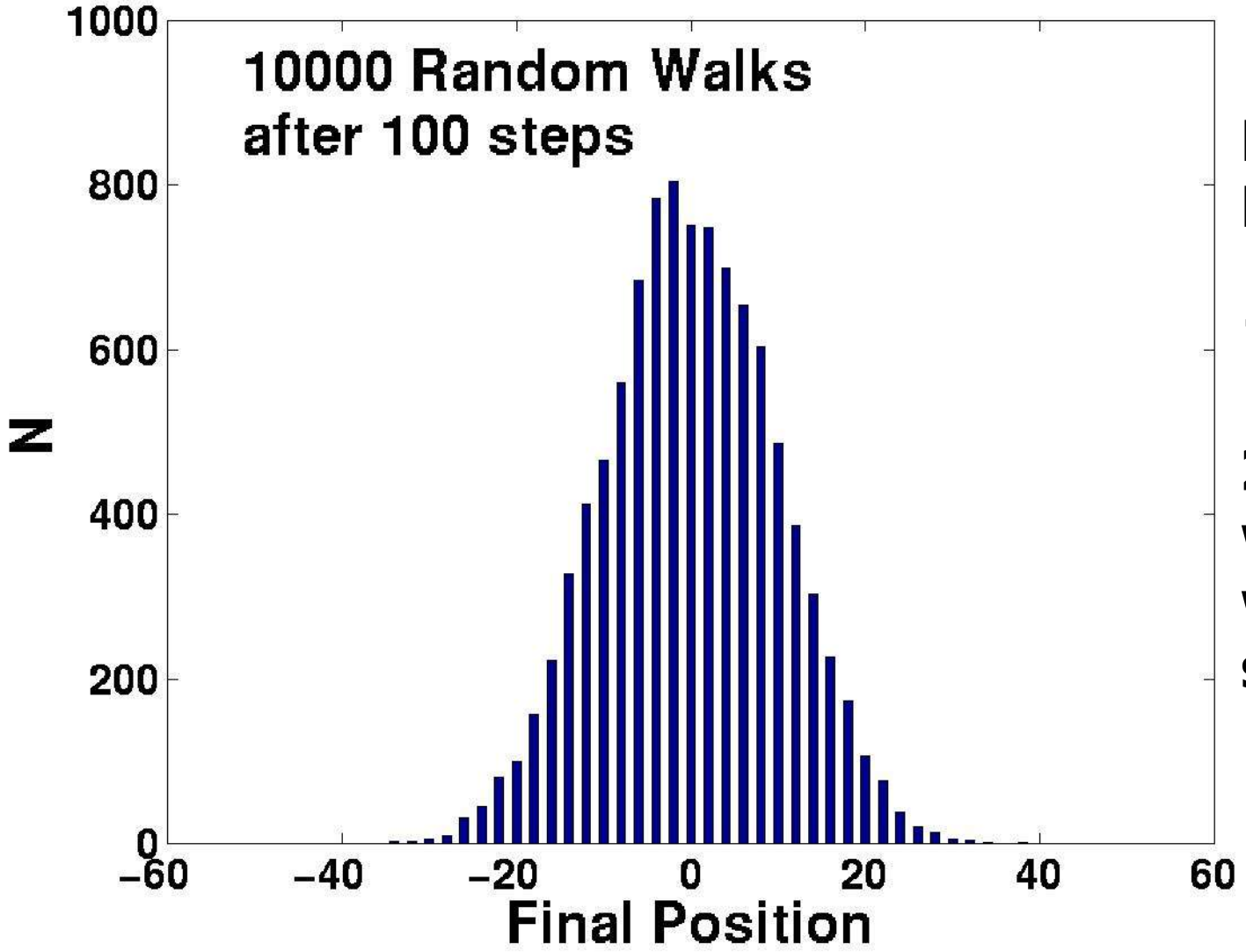
***rand* is uniformly distributed: 0->1**
take forward step if > 0.5

take backward step if < 0.5

7 Random Walks
100 steps



Random Walk Results



Random Walk Properties:

1. Zero Mean

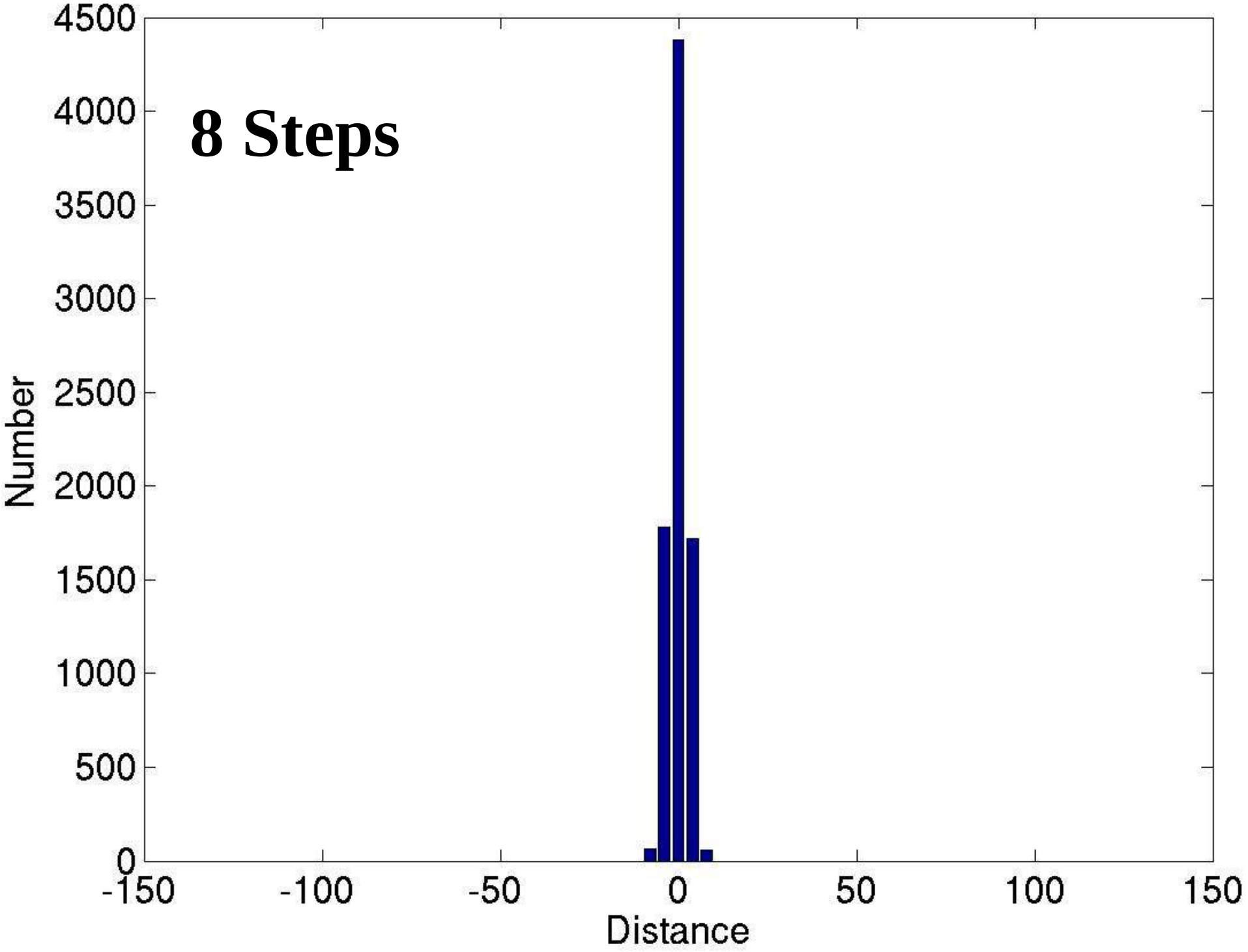
2. Dispersion which increases with number of steps

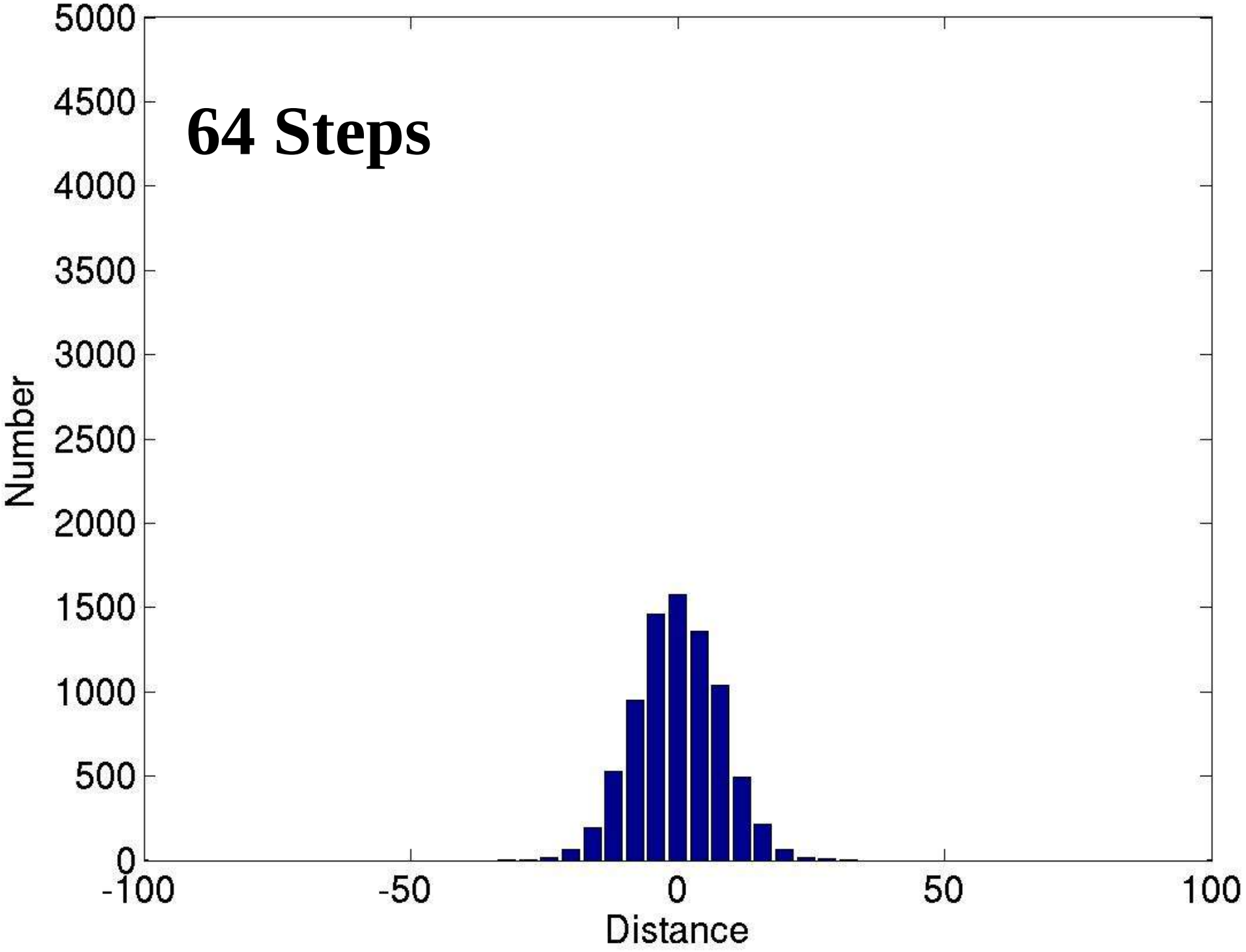
Example 2

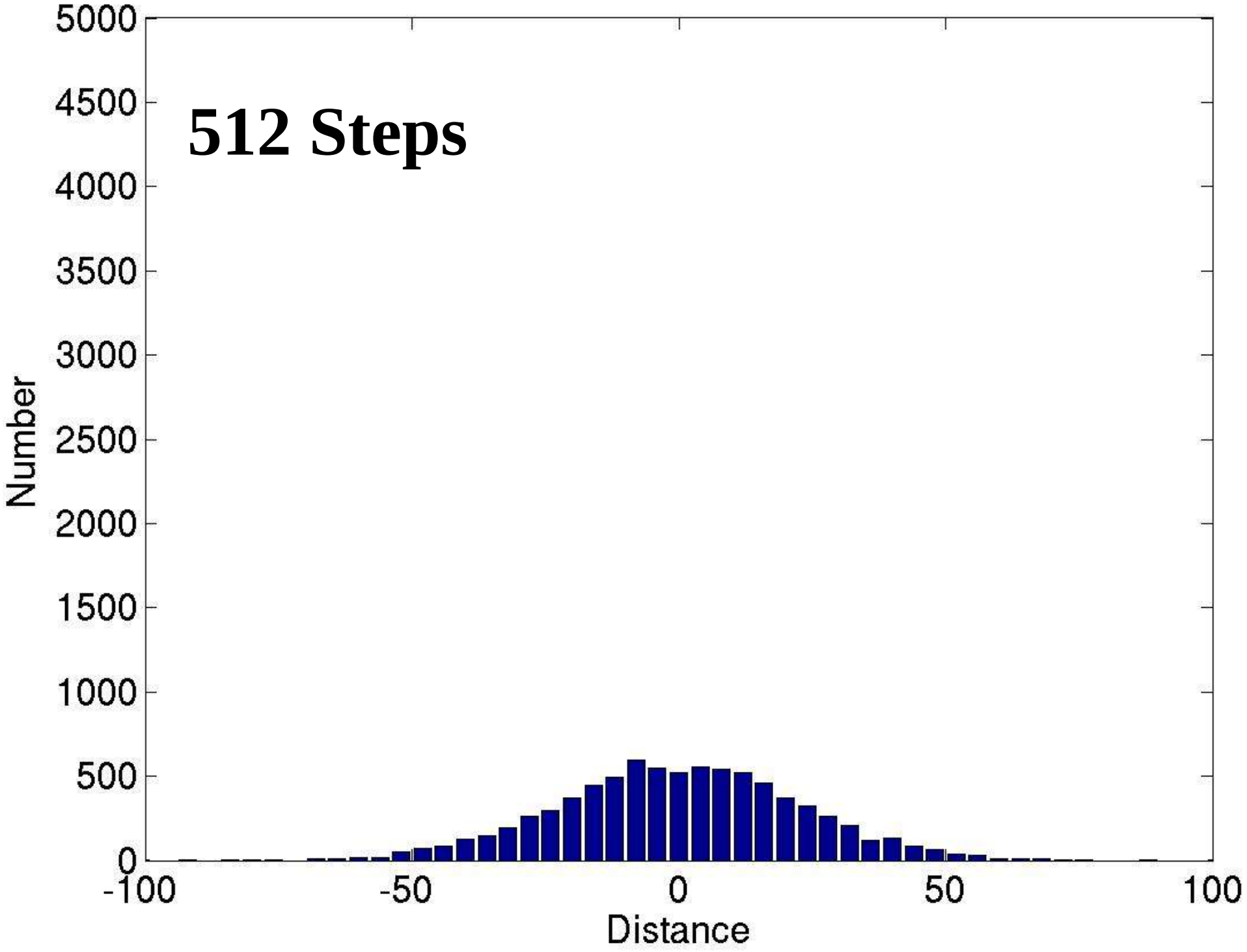
Random Walk with 8000 "Walkers" demonstrate that:

Mean Square Distance = Number of Random Steps

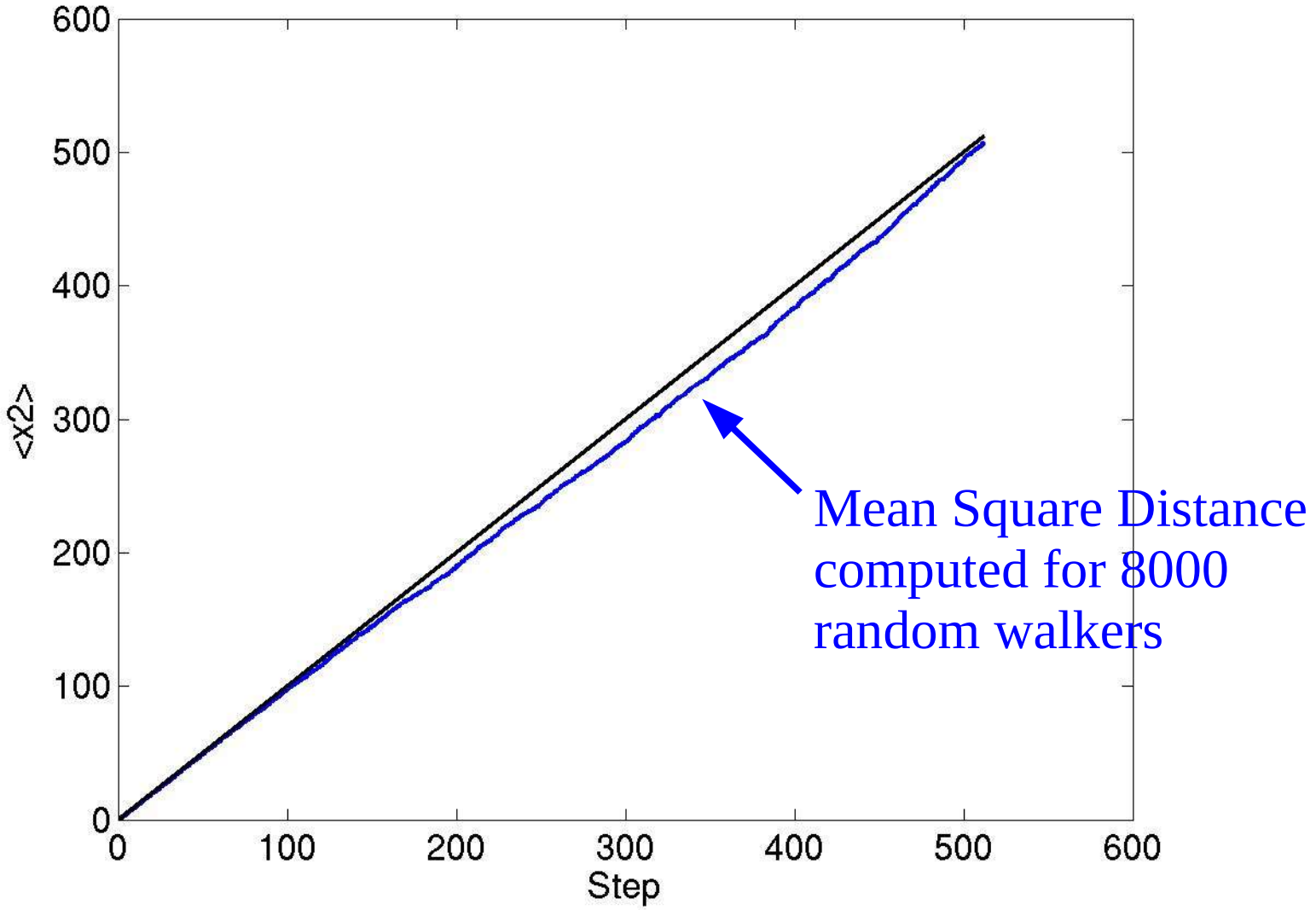
$$MeanSquareDistance = \frac{1}{N}\sum_{i=1}^{N} d_i^2$$


8 Steps
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Number
-150
-100
-50
0
50
100
150
Distance


64 Steps
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Number
-100
-50
0
50
100
Distance


512 Steps
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Number
-100
-50
0
50
100
Distance

Mean Square Distance = Number of Random Steps



Exercise 9
Random Walk Model of Radiation Transfer through "stack of plates"