Prepare

Some parameters to be used

In[299]:=
```
SetDirectory@NotebookDirectory[]
imgSize = Large
```

Out[299]=
```
/Users/leima/GitHub/WhyMathematica/Physics/andersonLocalization
```

Out[300]=
```
Large
```

Anderson Localization Demonstration

This notebook demonstrates the Anderson Localization using MatrixPlot or ArrayPlot.

Define Parameters

Define the dimonsion of the matrix

In[301]:=
```
dim = 200;
```

Construct Matrices

Construct two matrices, one with random tridiagonal elements the other with 0.1 for second diagonal elements.

In[302]:=
```
matRandom = SparseArray[{Band[{2, 1}] → RandomReal[0.1, dim - 1],
    Band[{1, 1}] → 1., Band[{1, 2}] → RandomReal[0.1, dim - 1]}, dim];
```

In[303]:=
```
matRegular =
  SparseArray[{Band[{2, 1}] → 0.1, Band[{1, 1}] → 1., Band[{1, 2}] → 0.1}, dim];
```

Show the matrix form of these matrices

In[304]:=
```
matRandom // MatrixForm;
```

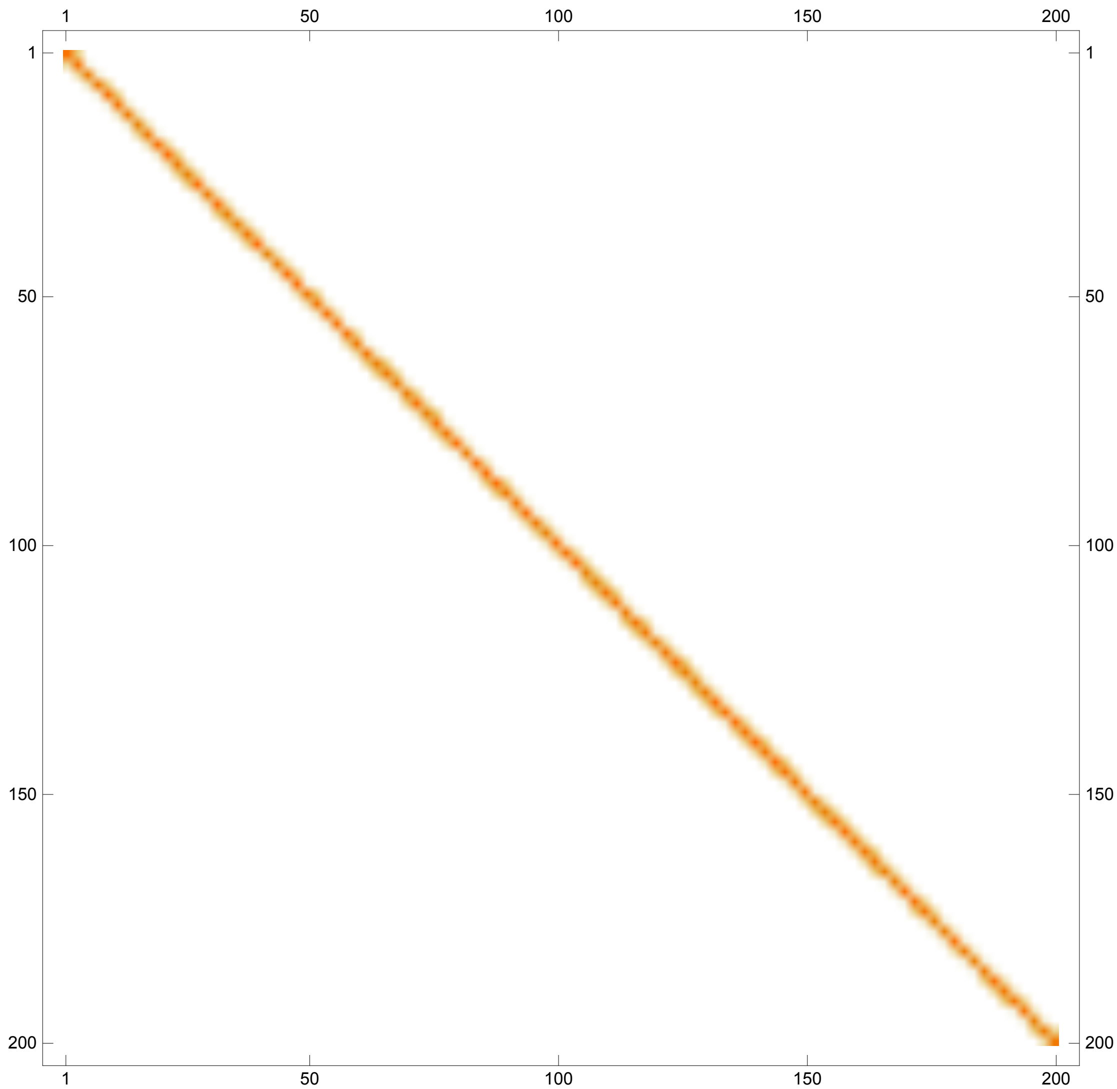
In[305]:=
```
matRegular // MatrixForm;
```

Plot the matrix themselves

In[306]:=

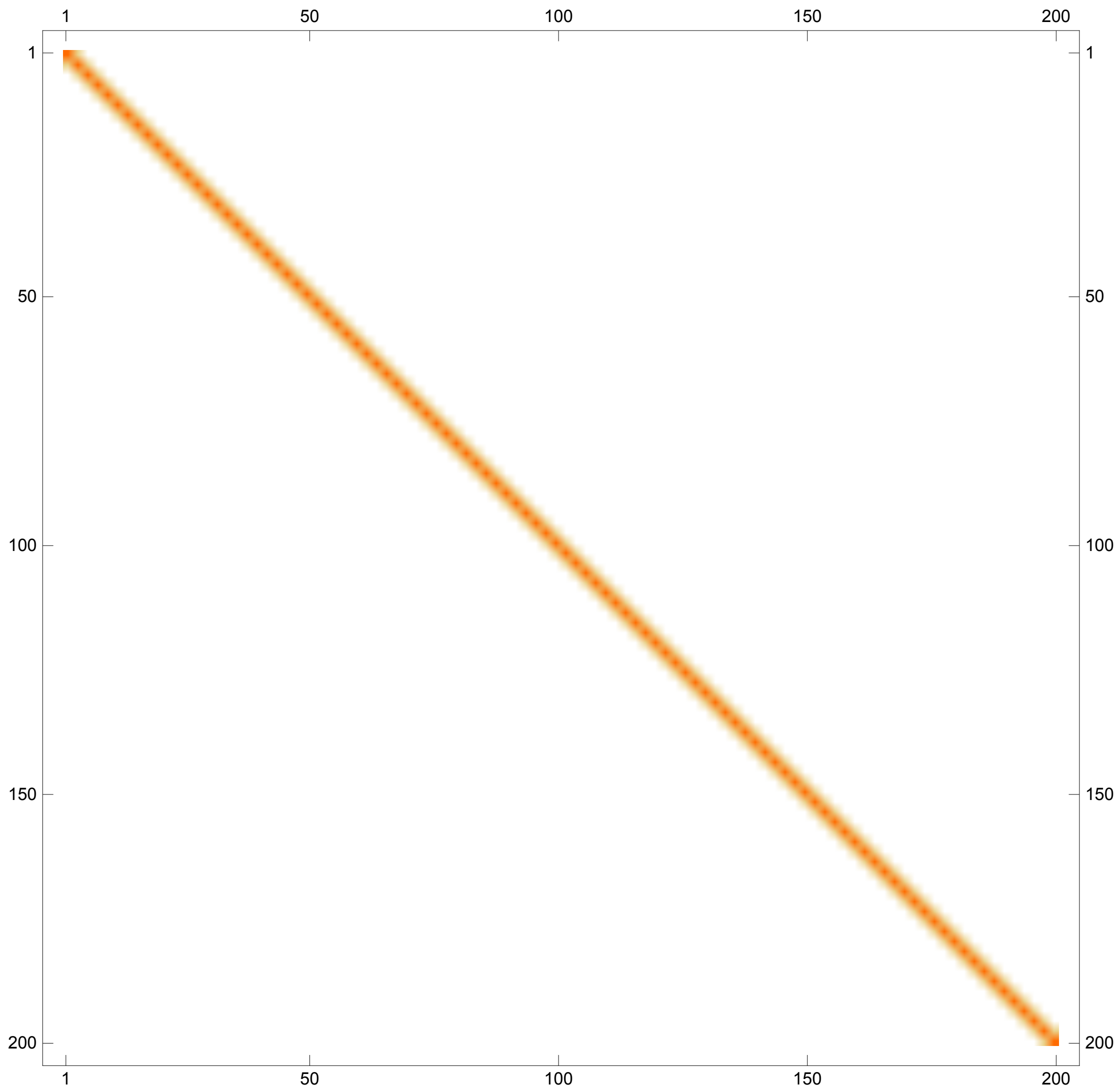
```
MatrixPlot[matRandom, ImageSize → imgSize]
```

Out[306]=



In[307]:=
```
MatrixPlot[matRegular, ImageSize → imgSize]
```

Out[307]=



Find Eigen Vectors

Find the eigen vectors of the matrices

In[308]:=
```
eigVRand = Transpose@Eigenvectors[matRandom] // Quiet;
% // MatrixForm;
```

In[310]:=
```
eigVReg = Transpose@Eigenvectors[matRegular] // Quiet;
% // MatrixForm;
```

Plot Eigen Vectors

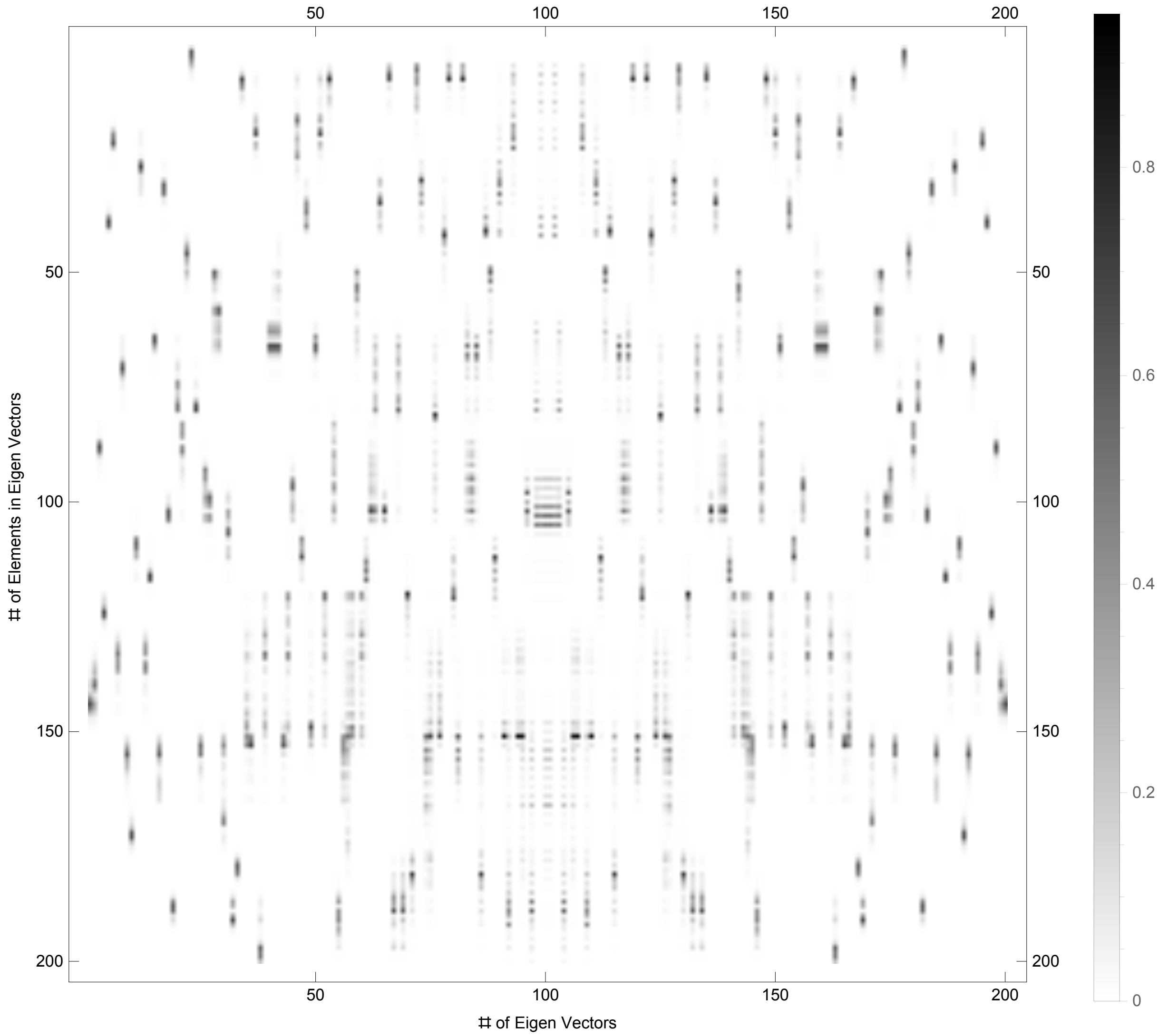
Define frame labes

In[312]:=
```
frameLabel = {"# of Elements in Eigen Vectors", "# of Eigen Vectors"};
```

Plot the eigen vectors

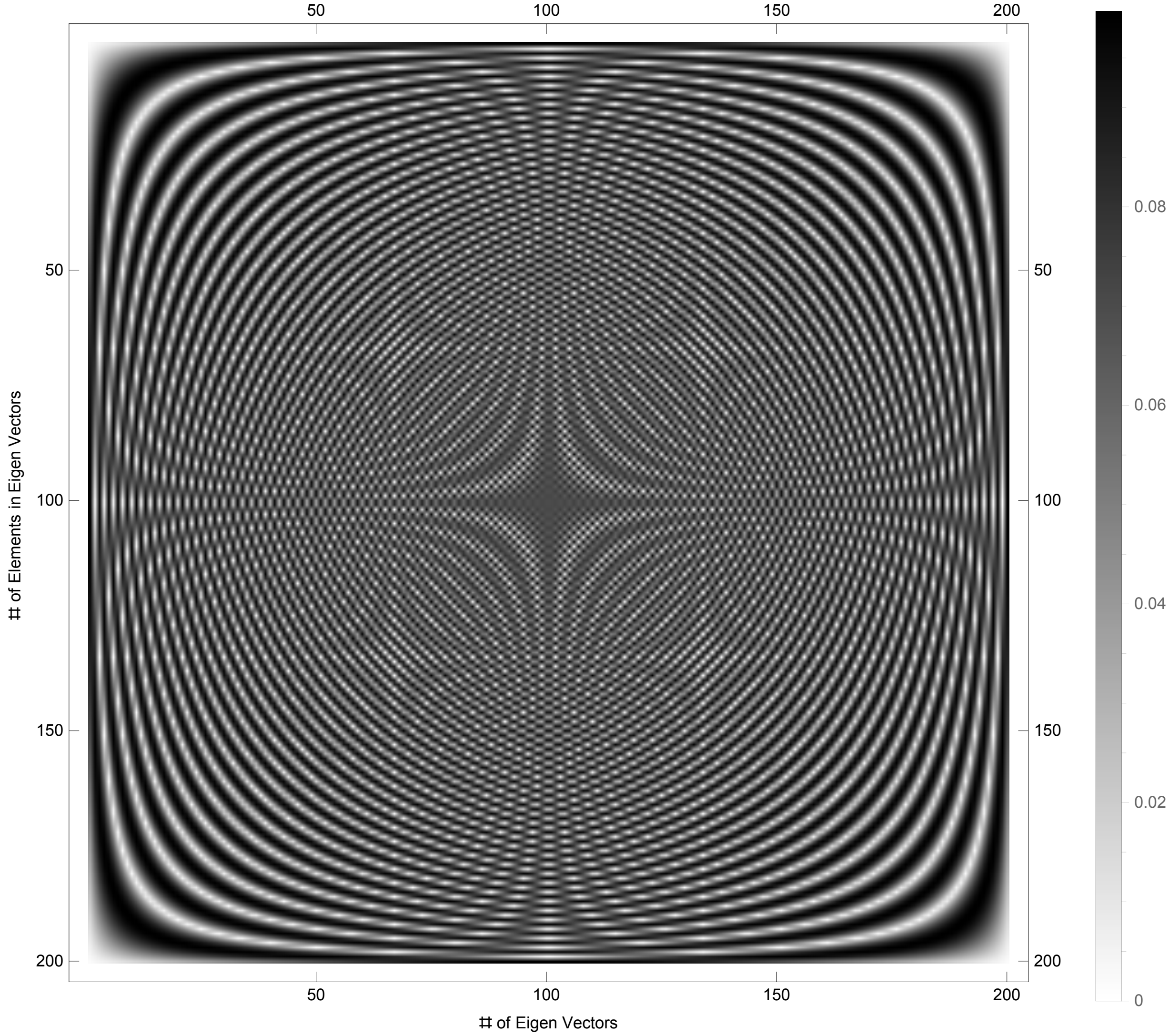
In[313]:=
```
pltRand = ArrayPlot[eigVRand, PlotLegends → Automatic,
  ImageSize → imgSize, FrameLabel → frameLabel, FrameTicks -> Automatic]
```

Out[313]=



In[314]:=
```
pltReg = ArrayPlot[eigVReg, PlotLegends → Automatic,
  FrameTicks -> Automatic, FrameLabel → frameLabel, ImageSize → imgSize]
```

Out[314]=



Export Images

In[315]:=
```
Export["pltRand.png", pltRand]
```

Out[315]= pltRand.png

In[316]:=
```
Export["pltReg.png", pltReg]
```

Out[316]= pltReg.png