```
In[ ]:= SetDirectory@NotebookDirectory[];
        设置目录         当前笔记本的目录
```

# Parameters

```
In[ ]:= Nq = 10;
```

# Data

```
In[ ]:= path = "data/Heisenberg-Chain-Nq=" <> ToString[Nq] <> ".dat";
                                            转换为字符串

        file = File[path];
               文件位置的符号表示
        Data = Import[file];
               导入
        γHC = Data〚2 ;; 8〛;
        Length[Transpose[γHC]]
        长度      转置
        (*γHC={{},{},{},{},{},{},{}};*)

Out[ ]= 8
```

```
In[ ]:= path = "data/Heisenberg-Ladder-Nq=" <> ToString[Nq] <> ".dat";
                                              转换为字符串

        file = File[path];
               文件位置的符号表示
        Data = Import[file];
               导入
        γHL = Data〚2 ;; 8〛;
        Length[Transpose[γHL]]
        长度      转置
        (*γHL={{},{},{},{},{},{},{}};*)

Out[ ]= 7
```

```
In[ ]:= γHR = {};
        Do[(
        Do循环
          path = "data/Heisenberg-Random-Nq=" <> ToString[Nq] <> "-" <> ToString[l] <> ".dat";
                                                转换为字符串                转换为字符串

          file = File[path];
                 文件位置的符号表示
          Data = Import[file];
                 导入
          γHR = Join[γHR, Transpose[Data〚2 ;; 8〛]]
                连接         转置
         ), {l, 1, 5}]
        γHR = Transpose[γHR];
              转置
        (*γHR={{},{},{},{},{},{},{}};*)
```

```
In[ ]:= path = "data/FermiHubbard-Chain-Nq=" <> ToString[Nq] <> ".dat";
                                          转换为字符串

       file = File[path];
              文件位置的符号表示
       Data = Import[file];
              导入
       γFHC = Data[[2 ;; 8]];
       Length[Transpose[γFHC]]
       长度      转置
       (*γFHC={{},{},{},{},{},{},{}};*)

Out[ ]= 10

In[ ]:= path = "data/FermiHubbard-Ladder-Nq=" <> ToString[Nq] <> ".dat";
                                          转换为字符串

       file = File[path];
              文件位置的符号表示
       Data = Import[file];
              导入
       γFHL = Data[[2 ;; 8]];
       Length[Transpose[γFHL]]
       长度      转置
       (*γFHL={{},{},{},{},{},{},{}};*)

Out[ ]= 8

In[ ]:= γFHR = {};
       Do[(
       Do循环
         path = "data/FermiHubbard-Random-Nq=" <> ToString[Nq] <> "-" <> ToString[l] <> ".dat";
                                                转换为字符串              转换为字符串

         file = File[path];
                文件位置的符号表示
         Data = Import[file];
                导入
         γFHR = Join[γFHR, Transpose[Data[[2 ;; 8]]]]
                连接          转置
        ), {l, 1, 5}]
       γFHR = Transpose[γFHR];
              转置
       (*γFHR={{},{},{},{},{},{},{}};*)
```

# Comparison

```
In[ ]:= γMin = 1.*^-4;
       γMax = Max[Flatten[Flatten[{γHC, γHL, γHR, γFHC, γFHL, γFHR}]]]
       γMax = 10.^Ceiling[Log10[γMax]];
       PR = {{γMin, γMax}, {γMin, γMax}};
       plot = ListLogLogPlot[{{{γMin, γMin}, {γMax, γMax}}, {{γMin, 10.}, {γMax, 10.}}},
           PlotRange → PR, Joined → True, PlotStyle → {Gray, Cyan}];
```

$Out[ ]=$ $7.38587 \times 10^{20}$

```
In[ ]:= b = 7;
       plotHC =
         ListLogLogPlot[Transpose[{γHC[[b]], γHC[[3]]}], PlotRange → Full, PlotStyle → {Red}];
       plotHL =
         ListLogLogPlot[Transpose[{γHL[[b]], γHL[[3]]}], PlotRange → Full, PlotStyle → {Blue}];
       plotHR =
         ListLogLogPlot[Transpose[{γHR[[b]], γHR[[3]]}], PlotRange → Full, PlotStyle → {Green}];
       plotFHC = ListLogLogPlot[
           Transpose[{γFHC[[b]], γFHC[[3]]}], PlotRange → Full, PlotStyle → {Orange}];
       plotFHL = ListLogLogPlot[
           Transpose[{γFHL[[b]], γFHL[[3]]}], PlotRange → Full, PlotStyle → {Purple}];
       plotFHR = ListLogLogPlot[
           Transpose[{γFHR[[b]], γFHR[[3]]}], PlotRange → Full, PlotStyle → {Magenta}];
       Show[{plot, plotHC, plotHL, plotHR, plotFHC, plotFHL, plotFHR}]
```
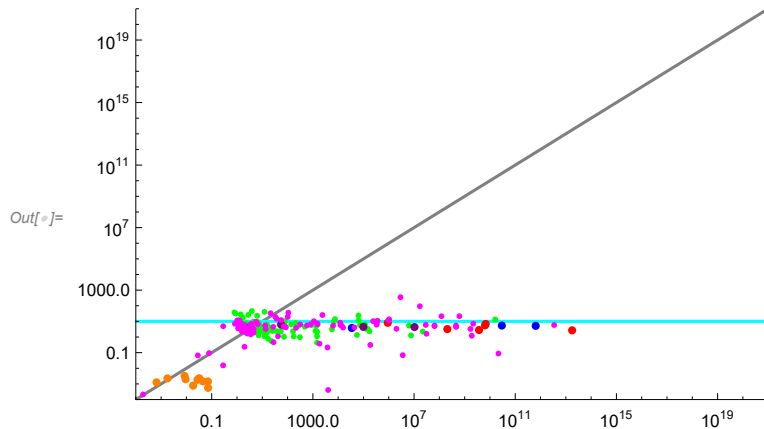
# Empirical Distribution

```
In[ ]:=  γList = {};
         γList = Join[γList, Transpose[γHC]];
              连接            转置

         γList = Join[γList, Transpose[γHL]];
              连接            转置

         γList = Join[γList, Transpose[γHR]];
              连接            转置

         γList = Join[γList, Transpose[γFHC]];
              连接            转置

         γList = Join[γList, Transpose[γFHL]];
              连接            转置

         γList = Join[γList, Transpose[γFHR]];
              连接            转置

         Length[γList]
         长度
         γList = Transpose[γList];
                 转置

Out[ ]=  233
```

```
In[ ]:=  γMax = 1.*^15;
         Do[(
         Do循环
           Do[If[γList[[b, i]] == 0. || Abs[γList[[b, i]]] > γMax, γList[[b, i]] = 2. * γMax],
              …    如果                     绝对值
             {i, 1, Length[γList[[b]]]}]
                    长度
          ), {b, 1, 7}]
         γMin = Min[Flatten[γList]]
                …    压平
         γMin = 10.^Floor[Log10[γMin]]

Out[ ]=  0.0000145445

Out[ ]=  0.00001
```

```
In[ ]:= curves = {};
       Do[(
           γ = γList[[b]];
           γ = Sort[γ];
           AppendTo[curves, Transpose[{γ, Table[i / Length[γ], {i, 1, Length[γ]}]}]];
           Print[(γ[[Floor[Length[γ] / 2]]] + γ[[Ceiling[Length[γ] / 2]]]) / 2];
           If[b == 3, (
               pro = 0;
               Do[(
                   If[γ[[i]] ≤ 100, pro = i]
                 ), {i, 1, Length[γ]}];
               Print[{Length[γ] - pro, N[pro / Length[γ]]}]
             )]
         ), {b, 1, 7}]

       PR = {{γMin, γMax}, {0, 1}};
       ListLogLinearPlot[curves, PlotRange → PR, Joined → True,
         PlotStyle → {Red, Yellow, Blue, Green, Orange, Purple, Magenta}]
```

$1.05795 \times 10^7$

$2. \times 10^{15}$

$4.38356$

$\{1, 0.995708\}$

$7.45311 \times 10^8$

$8.76573 \times 10^6$

$7.56026 \times 10^{12}$

$12.97$

Out[ ]=
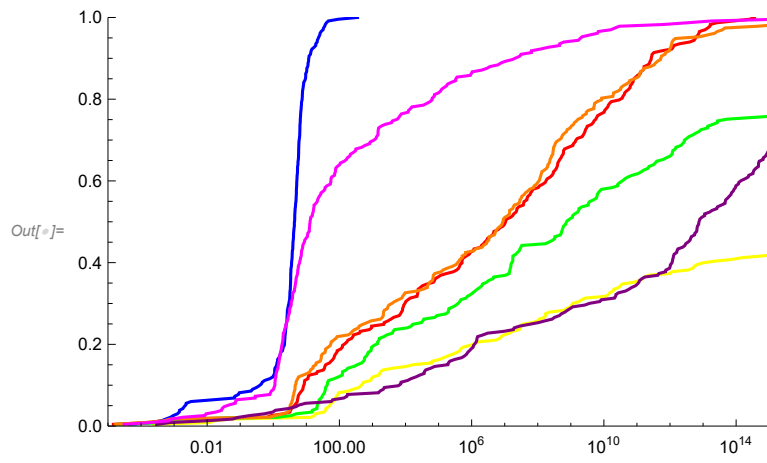
```
In[◦]:= PR = {{1.*^-3, 1.*^15}, {0, 1}};

     Fig = ListLogLinearPlot[curves, PlotRange → PR, Joined → True,

       PlotStyle → {{Thickness[0.006], Red}, {Thickness[0.006], Yellow},

         {Thickness[0.006], Blue}, {Thickness[0.006], Green}, {Thickness[0.006], Orange},

         {Thickness[0.006], Purple}, {Thickness[0.006], Magenta}},

       Frame → True, FrameStyle → Directive[Black, Thickness[0.002]],

       FrameTicksStyle → Directive[Black, Thickness[0.002]],

       PlotLegends → Placed[LineLegend[{"P", "CP", "GP", "IP", "ITE", "RTE", "F"},

         LegendFunction → (Framed[#, FrameStyle → LightGray] &), LegendMarkerSize → {16, 8},

         LabelStyle → Directive[Black, Bold, FontSize → 12, FontFamily → "Arial"],

         LegendMargins → 0], {0.09, 0.68}],

       FrameLabel → {"γ", "Empirical Cumulative Probability"},

       LabelStyle → Directive[Black, FontSize → 18, FontFamily → "Arial"], ImageSize → 500]
```
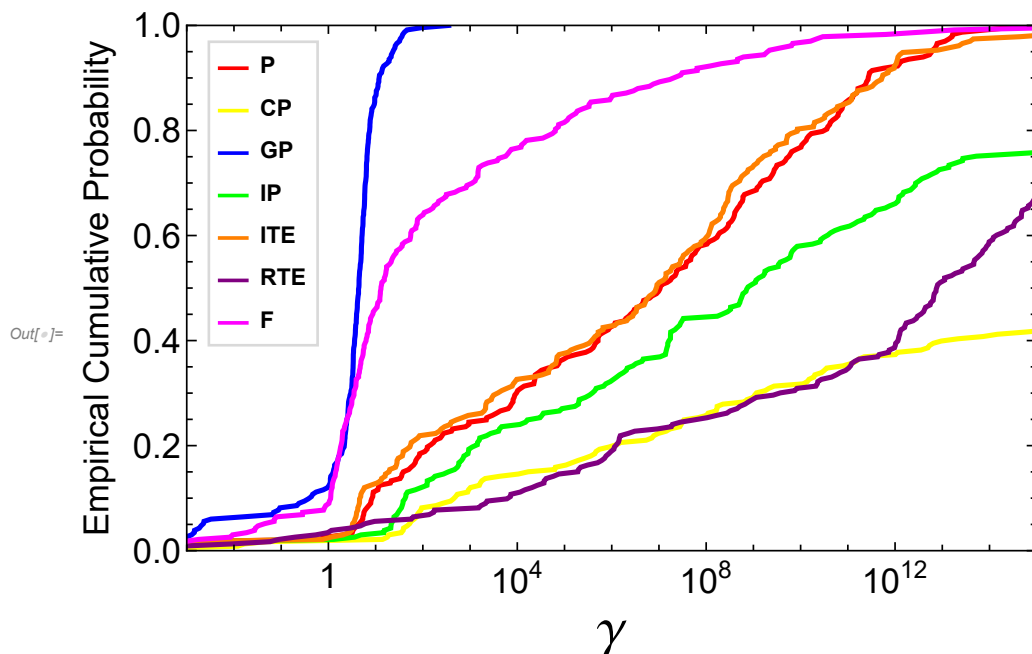


```
In[◦]:= Export["C:\\Users\\John\\Desktop\\Revise\\distribution.pdf", Fig];
```