In[1]:=
```
(*num of trials*)
num = 100 000;
nSamples = 2;
(*num of recombinations per base per gen*)
pi = 1*^-7;
(*pi=1e-7/gen/base*)
sequenceLength = 5000;
(* R=1e-3/gen*)
populationSize = 20 000;
(* T=10/gen (~1/gen) *)
parameterS = 2 pi * sequenceLength * populationSize;
(* S = 20*)
```

Prediction

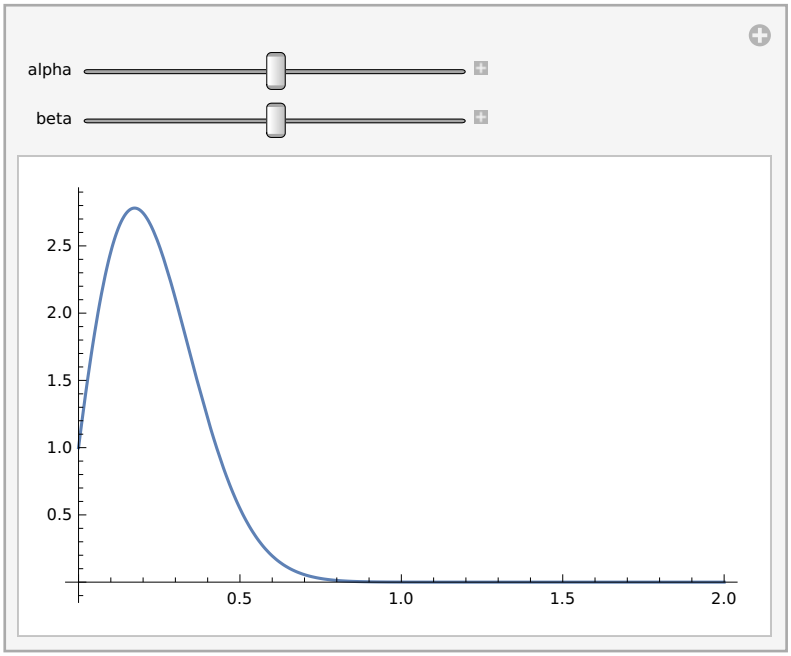
$$F(\tau) = \exp\left(-\frac{S}{2}\tau^2 - \tau\right),\ \exp\left(-\frac{aS}{2}\tau^2 - b\tau\right)$$

$$P(\tau) = (S\tau + 1)\exp\left(-\frac{S}{2}\tau^2 - \tau\right),\ (aS\tau + b)\exp\left(-\frac{aS}{2}\tau^2 - b\tau\right)$$

In[7]:=
```
predictionFree[tau_, alpha_, beta_] :=
 (alpha * parameterS * tau + beta) * Exp[-(alpha * parameterS)/2 tau^2 - beta * tau]
```
指數形式

In[8]:=
```
Manipulate[Plot[predictionFree[tau, alpha, beta], {tau, 0, 2}],
 {{alpha, 1}, 0.5, 1.5}, {{beta, 1}, 0.5, 1.5}]
```
交互式操作 繪圖

Out[8]=



NonlinearModelFit

In[9]:=
```
(*histdata = Transpose[StringReplace[Import[
        "~/Emory/Research/Coalescent_Theory/zhao/sim_hist.txt"],{"["→"{","]"→"}"}]];*)
histdata = Transpose[Interpreter[DelimitedSequence[
    DelimitedSequence["Number", {"[", ", ", "]"}], {"[", ", ", "]"}]][
  Import["~/Emory/Research/Coalescent_Theory/zhao/2mrca/sim_hist.txt"]]];
```
轉置 字串替代 導入 轉置 解譯器 分隔序列 分隔序列 數 導入

In[10]:=
```
fit = NonlinearModelFit[histdata, predictionFree[tau, alpha, beta], {alpha, beta}, tau];
```
非線性模型擬合

In[11]:=
```
fit["ParameterTable"]
```

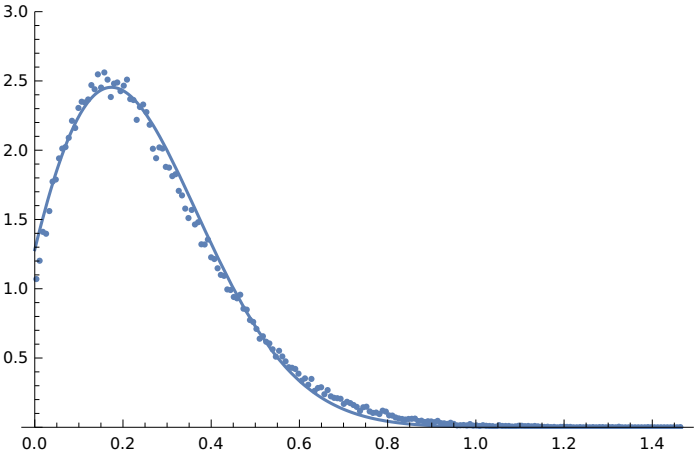
Out[11]=

	Estimate	Standard Error	t-Statistic	P-Value
alpha	0.731512	0.00867701	84.3046	4.25498×10^{-157}
beta	1.28224	0.0204837	62.5981	1.97252×10^{-132}

In[12]:=
```
predictionFixed[tau_] := predictionFree[tau, 1, 1]
```

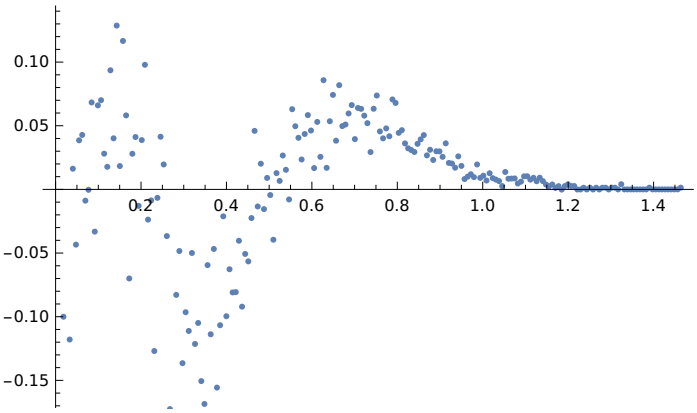
In[13]:=
```
Show[ListPlot[histdata, PlotRange → {0, 3}],
 Plot[fit[tau], {tau, 0, Max[Transpose[histdata][[1]]]}],
 Plot[prediction[tau], {tau, 0, Max[Transpose[histdata][[1]]]}]]
```
顯示 點集圖 繪製範圍 繪圖 … 轉置 繪圖 … 轉置

Out[13]=



In[14]:=
```
errorsAfter = histdata;
Do[errorsAfter[[idx, 2]] = errorsAfter[[idx, 2]] - fit[errorsAfter[[idx, 1]]],
 {idx, Length[errorsAfter]}]
ListPlot[errorsAfter]
```
Do迴圈 長度 點集圖

Out[16]=



In[17]:=
```
errorsBefore = histdata;
Do[errorsBefore[[idx, 2]] = errorsBefore[[idx, 2]] - predictionFixed[errorsBefore[[idx, 1]]],
 {idx, Length[errorsBefore]}]
ListPlot[errorsBefore]
```
Do迴圈
長度
點集圖

Out[19]=