

# Quantum Well Explorer

In[4]:=

```
EigenSolver[V_, {q_, qmin_, qmax_}, matchPoint_, EnergyGuess_] :=  
Module[{leftψ, rightψ, scaleLeft, scaledLeft, MatchingPoint, ψ, ε, scaleRight,  
模块  
    DRight, DLeft, Energy, result, normalization, plot1, plot2, gr},  
Developer`SetSystemOptions["EvaluateNumericalFunctionArgument" → False];  
MatchingPoint = Rule[q, matchPoint];  
规则  
leftψ[ε_, q] :=  
First[NDSolve[{-D[ψ[q], {q, 2}] + V ψ[q] == ε ψ[q], ψ'[qmin] == 0.0001, ψ[qmin] == 0},  
第一个 数值求解... 偏导  
    ψ[q], {q, qmin, q /. MatchingPoint}]] [[1, 2]];  
rightψ[ε_, q] := First[NDSolve[{-D[ψ[q], {q, 2}] + V ψ[q] == ε ψ[q], ψ'[qmax] ==  
第一个 数值求解... 偏导  
    0.0001, ψ[qmax] == 0}, ψ[q], {q, qmax, q /. MatchingPoint}]] [[1, 2]];  
scaleLeft[ε_] := leftψ[ε, q] /. MatchingPoint;  
scaleRight[ε_] := rightψ[ε, q] /. MatchingPoint;  
scaledLeft[ε_, q] := leftψ[ε, q] scaleRight[ε] / scaleLeft[ε];  
DRight[ε_, q] := D[rightψ[ε, q], q];  
偏导  
DLeft[ε_, q] := D[scaledLeft[ε, q], q];  
偏导  
Energy =  
ε /. FindRoot[(DLeft[ε, q] /. MatchingPoint) == (DRight[ε, q] /. MatchingPoint),  
求根  
    {ε, EnergyGuess, EnergyGuess + EnergyGuess / 10.0}];  
result = First[ψ[q] /. NDSolve[{-D[ψ[q], {q, 2}] + V ψ[q] == Energy ψ[q],  
第一个 数值求解... 偏导  
    ψ'[qmin] == 0.0001, ψ[qmin] == 0}, ψ[q], {q, qmin, qmax}]];  
normalization = 1 /  $\sqrt{\text{NIntegrate[result}^2, \{q, qmin, qmax\}]}$  ;  
plot1 = Show[  
显示  
    Plot[Tooltip[V, ToString[TraditionalForm[V]]], {q, qmin, qmax}, PlotPoints → 100,  
提示条 转换为... 传统格式 绘图点  
    PlotStyle → {RGBColor[1, 0, 0], Opacity[.5]}, AxesOrigin → {qmin, 0},  
RGB颜色 不透明度 坐标轴原点  
    AxesLabel → "energy", Exclusions → None, AxesStyle → Red], Graphics[Text[  
排除 无 坐标轴样式 红色 图形 文本  
        StringJoin["E=", ToString[NumberForm[Energy, 3]]], {qmax / 2, 0.8 Energy}]],  
... 转换为... 数值近似  
    Graphics[{RGBColor[0, 0, 1], Line[{qmin, Energy}, {qmax, Energy}]}]];  
RGB颜色 线段  
plot2 = Plot[normalization^2 result^2, {q, qmin, qmax}, AxesOrigin → {qmin, 0},  
绘图 坐标轴原点  
    PlotRange → All, AxesLabel → {"q", "probability"}, RotateLabel → True];  
全部 坐标轴标签 旋转标签 直
```

```

gr = GraphicsGrid[{{plot1}}, {plot2}}, Spacings → Scaled[-1],
  ImageSize → {500, 300}];
Developer`SetSystemOptions["EvaluateNumericalFunctionArgument" → True];
gr]

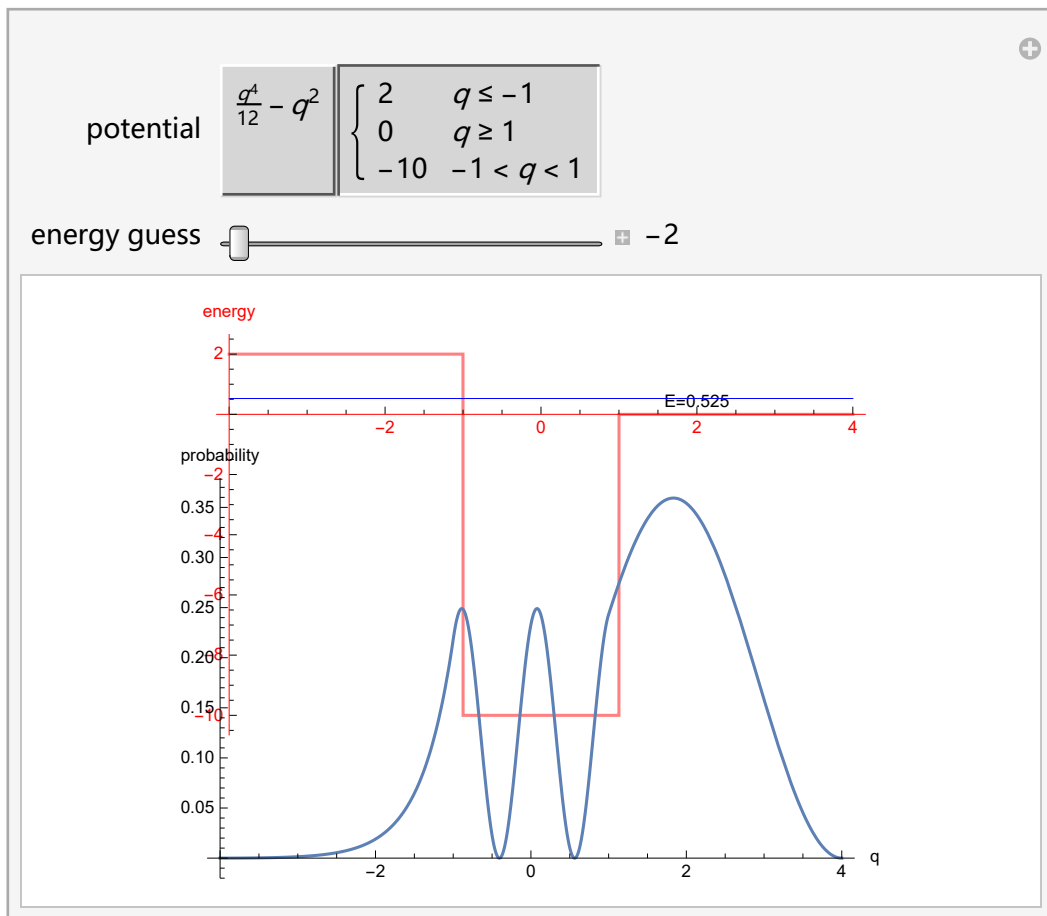
```

```

In[11]:= V0 = -10;
V1 = 2;
V2 = 0;
a = 1;
Manipulate[Quiet[EigenSolver[V, {q, -4, 4}, -3.6, EnergyGuess]],
  {{V, -q2 + q4/12, "potential"}, {-q2 + q4/12 → ToString[-q2 + q4/12, TraditionalForm],
  Piecewise[{{V1, q ≤ -a}, {V2, q ≥ a}, {V0, -a < q < a}}] → ToString[
  Piecewise[{{V1, q ≤ -a}, {V2, q ≥ a}, {V0, -a < q < a}}], TraditionalForm]}},
  {{EnergyGuess, -2, "energy guess"}, -2, 3, Appearance → "Labeled"},
  SaveDefinitions → True, TrackedSymbols → {V, EnergyGuess}, ContinuousAction → False]

```

Out[15]=



## CAPTION

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## DETAILS

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### THIS NOTEBOOK IS THE SOURCE CODE FROM

"Quantum Well Explorer" from the Wolfram Demonstrations Project  
<http://demonstrations.wolfram.com/QuantumWellExplorer/>

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A full-function Wolfram *Mathematica* system (Version 6 or higher) is required to edit this notebook.

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