Quantum Well Explorer

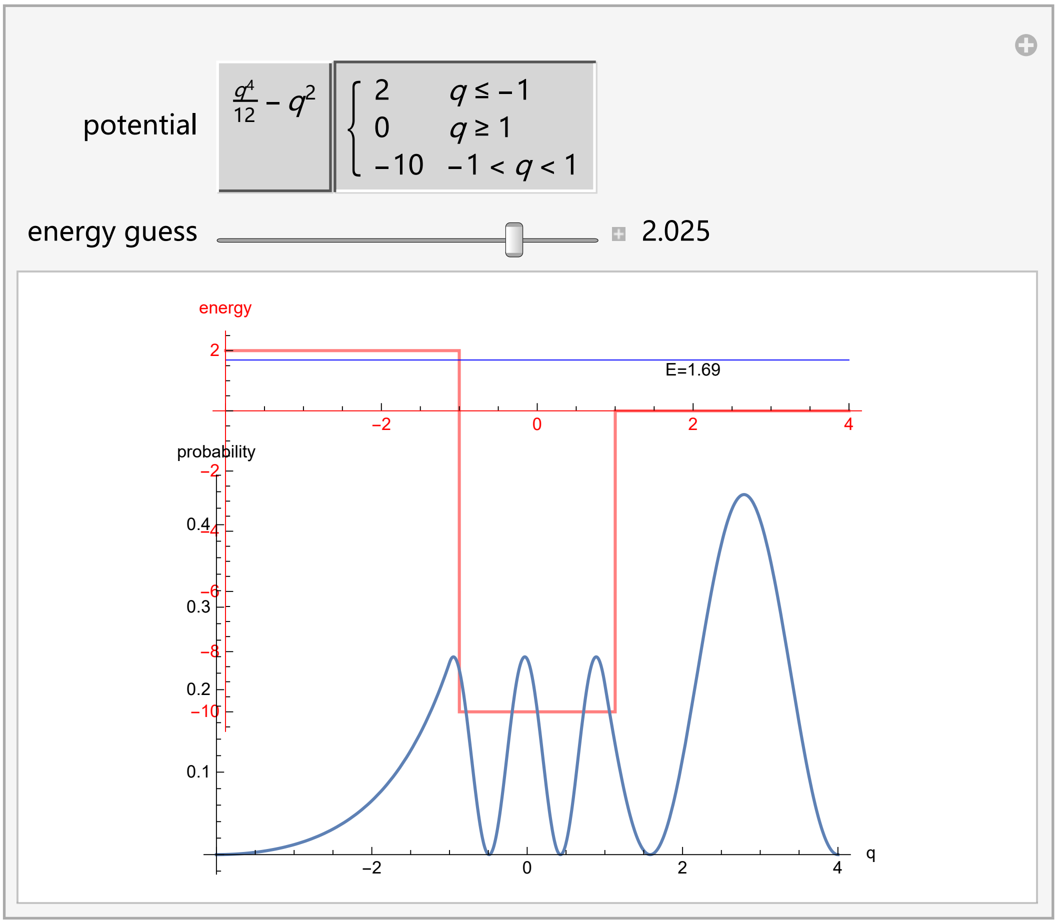
In[4]:=

```
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];
                                                                   假
  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 / √NIntegrate[result^2, {q, qmin, qmax}];
                       数值积分
  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      真
```

```
  gr = GraphicsGrid[{{plot1}, {plot2}}, Spacings → Scaled[-1],
       图形网格                            间隔         比例坐标
    ImageSize → {500, 300}];
    图像尺寸
  Developer`SetSystemOptions["EvaluateNumericalFunctionArgument" → True];
                                                                   真
  gr]
```

In[11]:=
```
V0 = -10;
V1 = 2;
V2 = 0;
a = 1;
Manipulate[Quiet[EigenSolver[V, {q, -4, 4}, -3.6, EnergyGuess]],
交互式操作  不输出任何消息
 {{V, -q^2 + q^4 / 12, "potential"}, {-q^2 + q^4 / 12 → ToString[-q^2 + q^4 / 12, TraditionalForm],
                                                        转换为字符串                传统格式
    Piecewise[{{V1, q <= -a}, {V2, q ≥ a}, {V0, -a < q < a}}] → ToString[
    分段函数                                                    转换为字符串
      Piecewise[{{V1, q <= -a}, {V2, q ≥ a}, {V0, -a < q < a}}], TraditionalForm]}},
      分段函数                                                   传统格式
 {{EnergyGuess, -2, "energy guess"}, -2, 3, Appearance → "Labeled"},
                                            外观           标记
 SaveDefinitions → True, TrackedSymbols :→ {V, EnergyGuess}, ContinuousAction → False]
 保存定义          真      被跟踪的符号                          连续行为            假
```

Out[15]=



CAPTION

DETAILS

THIS NOTEBOOK IS THE SOURCE CODE FROM

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

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