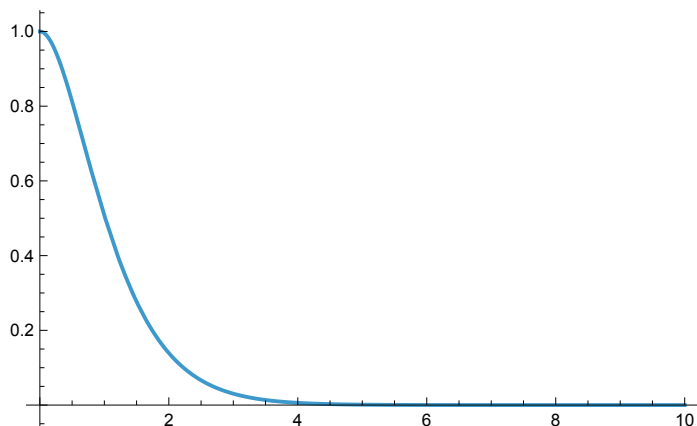```
In[ ]:= ClearAll["Global`*"]

In[ ]:= Table[{R, NIntegrate[8 / π r Exp[-2 r] Exp[-2 r Sqrt[1 + (R / r) ^ 2 - 2 R / r Cos[ϕ]]],
        {ϕ, 0, 2 Pi}, {r, 0, ∞}]}, {R, 0, 30, 0.2}];
    S = Interpolation[%];
```

⋯ General : Further output of   NIntegrate::slwcon   will be suppressed during this calculation.
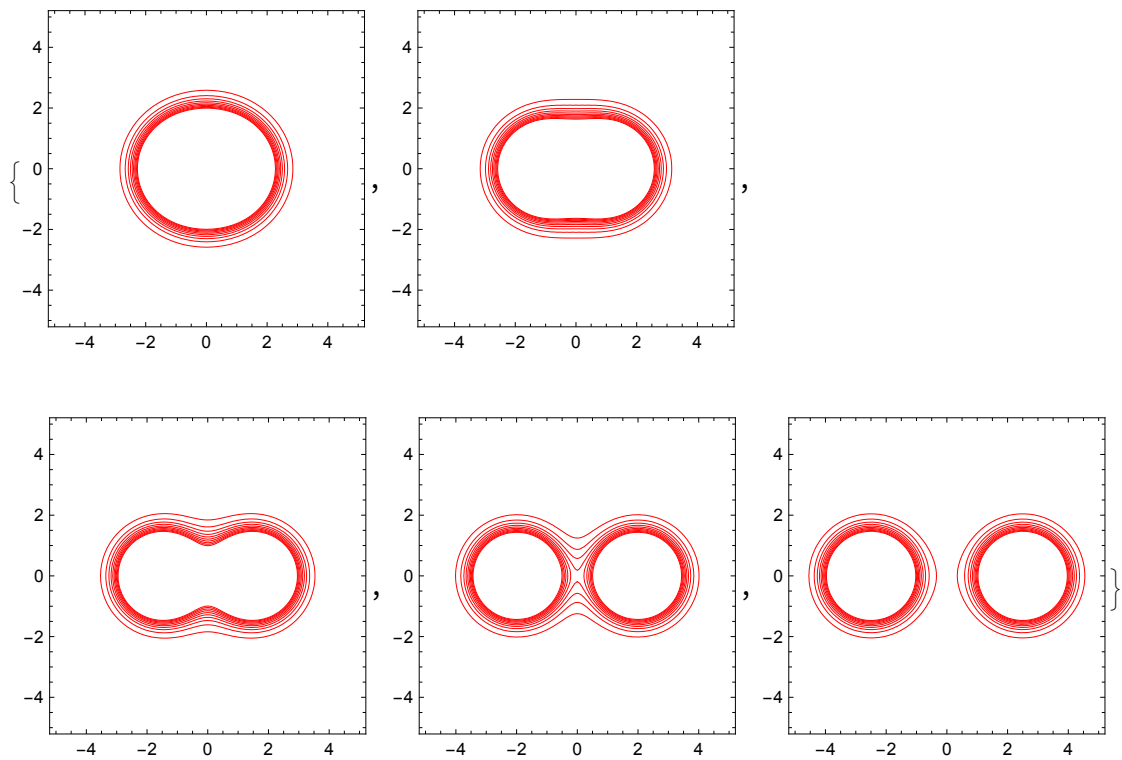
```
In[ ]:= Plot[S[R], {R, 0, 10}, PlotRange → All]
```

Out[ ]=



```
ψg[x_, y_, R_] := 1 / Sqrt[2 (1 + S[R])] × 4 / Sqrt[2 π]
    (Exp[-2 √(x^2 + y^2 + R^2 / 4 - x R)] + Exp[-2 √(x^2 + y^2 + R^2 / 4 + x R)])
ψu[x_, y_, R_] := 1 / Sqrt[2 (1 - S[R])] × 4 / Sqrt[2 π]
    (Exp[-2 √(x^2 + y^2 + R^2 / 4 - x R)] - Exp[-2 √(x^2 + y^2 + R^2 / 4 + x R)])
```

In[ ]:= `Table[ContourPlot[ψg[x, y, R]^2, {x, -5, 5}, {y, -5, 5}, Contours → 10,`
`PlotPoints → 50, ContourShading → None, ContourStyle → Red], {R, 1, 5}]`

Out[ ]=

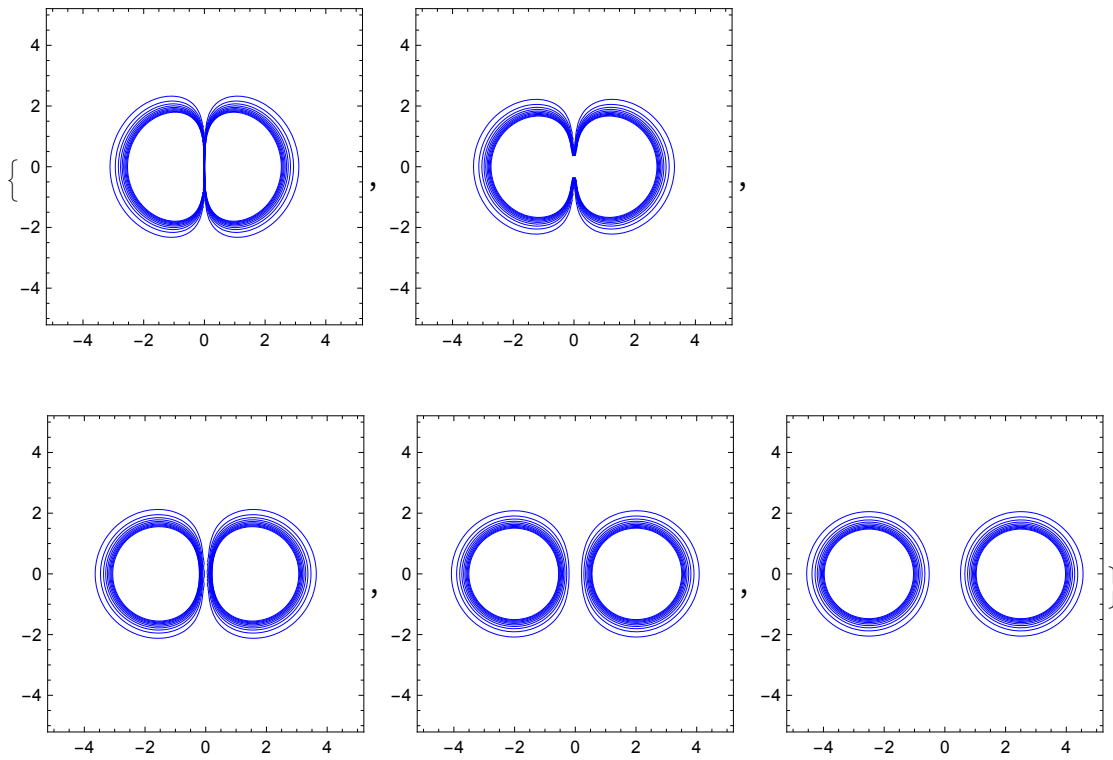*In[ ]:=* `Table[ContourPlot[ψu[x, y, R]^2, {x, -5, 5}, {y, -5, 5}, Contours → 10,`
`PlotPoints → 50, ContourShading → None, ContourStyle → Blue], {R, 1, 5}]`

Out[ ]=
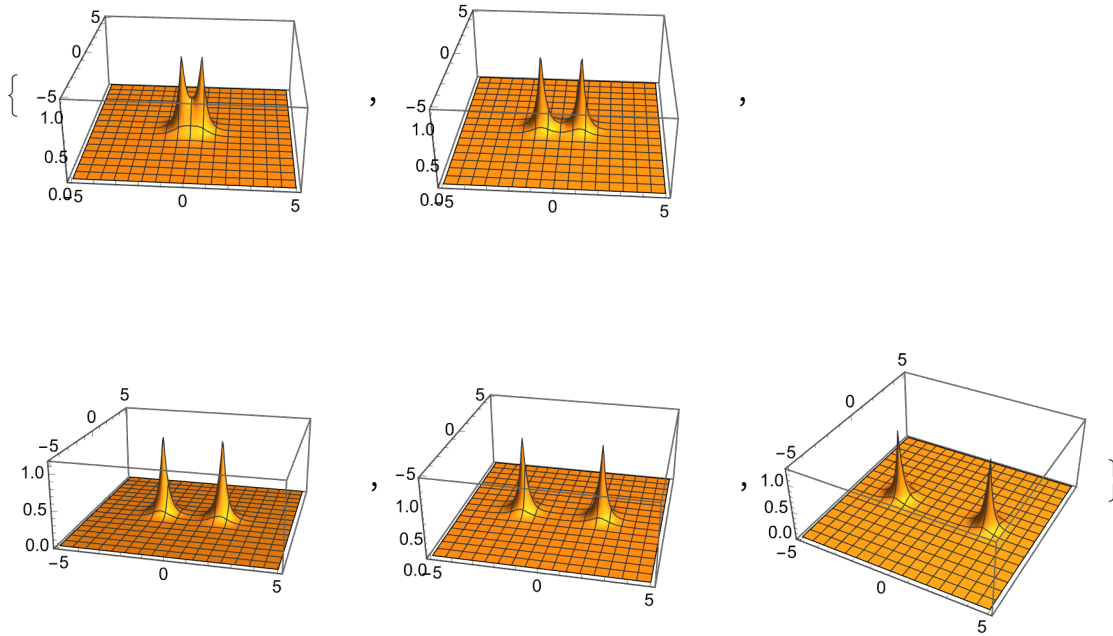
In[ ]:= `Table[Plot3D[ψg[x, y, R]^2, {x, -5, 5},`
`{y, -5, 5}, PlotPoints → 50, PlotRange → All], {R, 1, 5}]`

Out[ ]=

In[ ]:= `Table[Plot3D[ψu[x, y, R]^2, {x, -5, 5},`
`{y, -5, 5}, PlotPoints → 50, PlotRange → All], {R, 1, 5}]`

Out[ ]=