2.1 Appetizer: Wigner’s Surmise

In[∘]:=
```
Clear[Hs, x1, x2, x3, λ, s, λs]
Hs = {{x1, x3}, {x3, x2}};
λs = Solve[λ^2 - Tr[Hs] λ + Det[Hs] == 0, λ]
s = λs[[2, 1, 2]] - λs[[1, 1, 2]] // FullSimplify
```

Out[∘]=
$$\left\{\left\{\lambda \to \frac{1}{2}\left(x1 + x2 - \sqrt{x1^2 - 2\,x1\,x2 + x2^2 + 4\,x3^2}\right)\right\}, \left\{\lambda \to \frac{1}{2}\left(x1 + x2 + \sqrt{x1^2 - 2\,x1\,x2 + x2^2 + 4\,x3^2}\right)\right\}\right\}$$

Out[∘]=
$$\sqrt{(x1 - x2)^2 + 4\,x3^2}$$

In[∘]:=
```
(* eq 2.3 *)
Clear[x1, x2, x3, r, θ, ψ]
Solve[{x1 - x2 == r Cos[θ], 2 x3 == r Sin[θ], x1 + x2 == ψ}, {x1, x2, x3}]
```

Out[∘]=
$$\left\{\left\{x1 \to \frac{1}{2}\left(\psi + r\,\mathrm{Cos}[\theta]\right),\ x2 \to \frac{1}{2}\left(\psi - r\,\mathrm{Cos}[\theta]\right),\ x3 \to \frac{1}{2}\,r\,\mathrm{Sin}[\theta]\right\}\right\}$$

Figure 2.1 Wigner’s surmise

In[∘]:=
```
(*Integrate[s/2 Exp[-s^2/4],{s,0,∞}]*)
pbar = π s/2 Exp[-π s^2 / 4]
Plot[pbar, {s, 0, 4}, PlotRange → {0, 0.8},
 Frame → True, FrameLabel → {"s", "p(s)"}]
```

Out[∘]=
$$\frac{1}{2}\,e^{-\frac{\pi s^2}{4}}\,\pi\,s$$

Out[∘]=