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In[*]:= (*
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TransitionFunction_Visualizer.nb Version 2.2 (July 2025)
Purpose:This notebook visualizes the statistical transition between fermionic
and bosonic components using energy-dependent transition functions.
Key Concept:The animation shows two fixed S-shaped transition curves:
• Blue line=probability of electron remaining fermionic ( $e_F \equiv \gamma_B$ )
• Orange line=probability of electron becoming bosonic ( $e_B \equiv \gamma_F$ )
A gray dashed vertical line acts as a "sweep cursor"
that moves from left to right along the energy axis (E).
The height at which this line intersects each curve gives the actual
transition probability of each statistical component at that energy.
This represents the continuous redistribution
of the four components ( $e_F, e_B, \gamma_F, \gamma_B$ ) during energy variation.
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(*=====1. PARAMETERS=====*)
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Efb = 1.0; (*threshold energy E_fb*)
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hbarv = 0.2; (*width  $\hbar v$ *)
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TF[E_] := 1 / (1 + Exp[(E - Efb) / hbarv]); (*F component*)
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```
TB[E_] := 1 - TF[E]; (*B component*)
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```
style2 = {{Blue, Thick}, {Orange, Thick}}; (* $e_F/\gamma_B, e_B/\gamma_F$ *)
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(*=====2.INTERACTIVE PANEL--cursor only moves=====*)Manipulate[
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```
Column[{{(* Dynamic explanation panel -----*)Panel[Style[Row[
{"The gray dashed line marks the current observation energy E = ", NumberForm[
s, {3, 2}], ".\nIts intersections with the blue ( $e_F \equiv \gamma_B$ ) and orange ",
"( $e_B \equiv \gamma_F$ ) curves give the corresponding transition ",
"probabilities at this energy."}],
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11, LineSpacing -> 1.2], Background -> LightYellow],
```

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(* Plot:two fixed curves+moving cursor+live probability labels*)
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```
Show[Plot[{TF[x], TB[x]}, {x, 0, 3}, PlotRange -> {0, 1}, PlotStyle -> style2,
```

```
PlotLegends -> {" $e_F (\gamma_B)$ ", " $e_B (\gamma_F)$ "}, AxesLabel -> {"E", "Probability"},
```

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ImageSize -> 420], Graphics[{{Gray, Dashed, Line[{{s, 0}, {s, 1}}]},
```

```
Text[Style[Row[{" $e_F$  prob  $\approx$  ", NumberForm[TF[s], {2, 2}], "\n  $e_B$  prob  $\approx$  ",
```

```
NumberForm[TB[s], {2, 2}]}], 9], {s + 0.18, 0.8}]]],
```

```
(* Slider/animator-----*)
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{s, 0, "E"}, 0, 3, ControlType -> Animator, AnimationRate -> .1, AnimationRunning -> False},
```

```
SaveDefinitions -> True]
```

```
(*=====3. STATIC SNAPSHOT=====*)
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Plot[Evaluate@{TF[x], TB[x]}, (*two curves*)
```

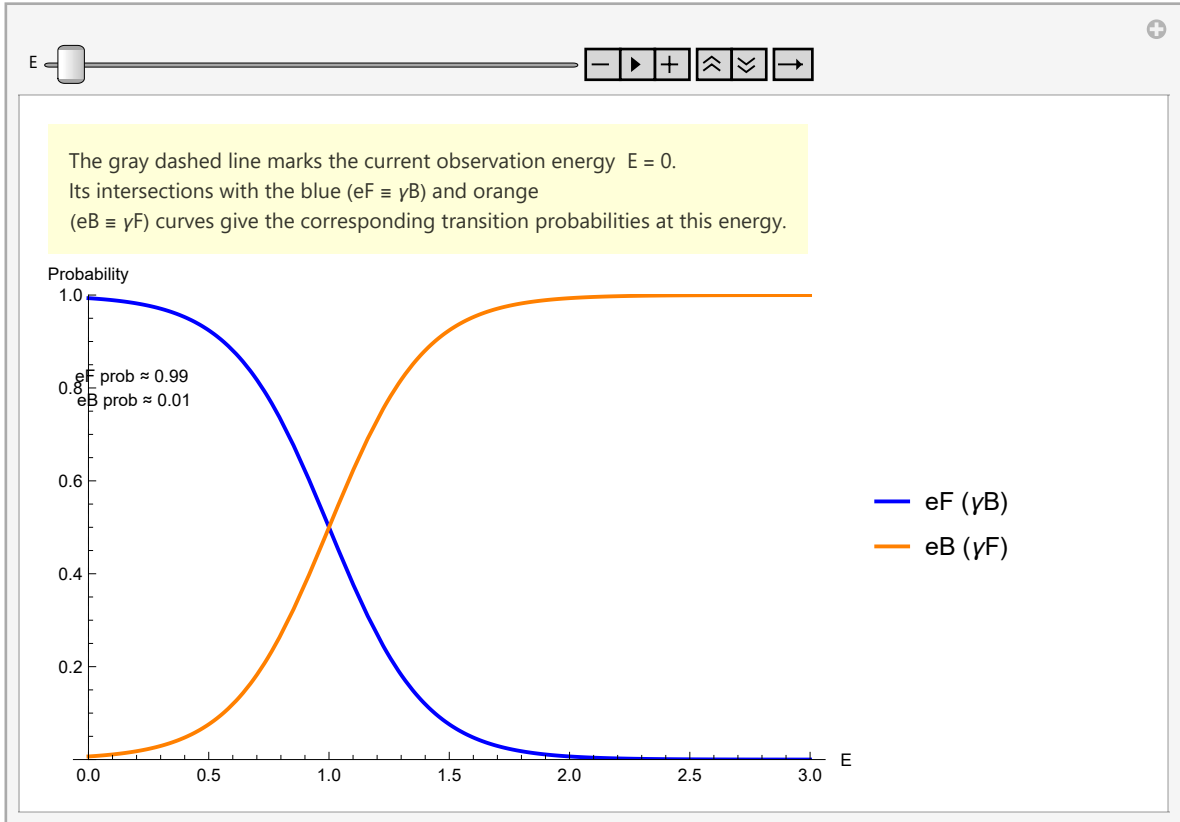
```
{x, 0, 3}, PlotRange -> {0, 1}, PlotStyle -> style2, ImageSize -> 400,
```

```
PlotLegends -> {" $e_F (\gamma_B)$ ", " $e_B (\gamma_F)$ "}, AxesLabel -> {"E", "Probability"}]
```

```
(*=====4. ANIMATED GIF=====*)
frames = Table[Plot[Evaluate@{TF[x - s], TB[x - s]}, {x, 0, 3},
  PlotRange -> {0, 1}, PlotStyle -> style2, ImageSize -> 400, PlotLegends -> None,
  Epilog -> {Gray, Dashed, Line[{{s, 0}, {s, 1}}]}, {s, 0, 3, 0.05}];

Export["Movie_S1.gif", frames, "DisplayDurations" -> .08];
(*=====*)
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Out[ ]=



Out[ ]=

