In[•]:=
```
(* C3.AI COVID CHALLENGE *)
```

In[•]:=
```
(* Sweden *)
```

In[723]:=
```
Clear["Global`*"]
```

```
type = "Deaths_per_Million";
policy = "H2_Policy";
```

In[724]:=
```
pD0 = 0.6650;
pD1 = 0.1372;
pD2 = 0.0598;
pD3 = 0.1188;
pD4 = 0.0192;
pD0 + pD1 + pD2 + pD3 + pD4
```

Out[•]=
```
1.
```

In[•]:=
```
(* COnditional Prob *)
```

In[731]:=
```
pD0C6l1 = 0.783019;
pD1C6l1 = 0.513441;
pD2C6l1 = 0.00617;
pD3C6l1 = 0.003106;
pD4C6l1 = 0.01923;
```

In[736]:=
```
pD0C6l0 = 1 - pD0C6l1;
pD1C6l0 = 1 - pD1C6l1;
pD2C6l0 = 1 - pD2C6l1;
pD3C6l0 = 1 - pD3C6l1;
pD4C6l0 = 1 - pD4C6l1;
```

In[•]:=
```
(* C6 - 1 *)
```

In[742]:=
```
prC6l0 = pD0 pD0C6l0 + pD1 pD1C6l0 + pD2 pD2C6l0 + pD3 pD3C6l0 + pD4 pD3C6l0
```

Out[•]=
```
0.408051
```

In[743]:=
```
prC6l1 = pD0 pD0C6l1 + pD1 pD1C6l1 + pD2 pD2C6l1 + pD3 pD3C6l1 + pD4 pD3C6l1
```

Out[•]=
```
0.591949
```

In[•]:=
```
(* Quantum Prob *)
```

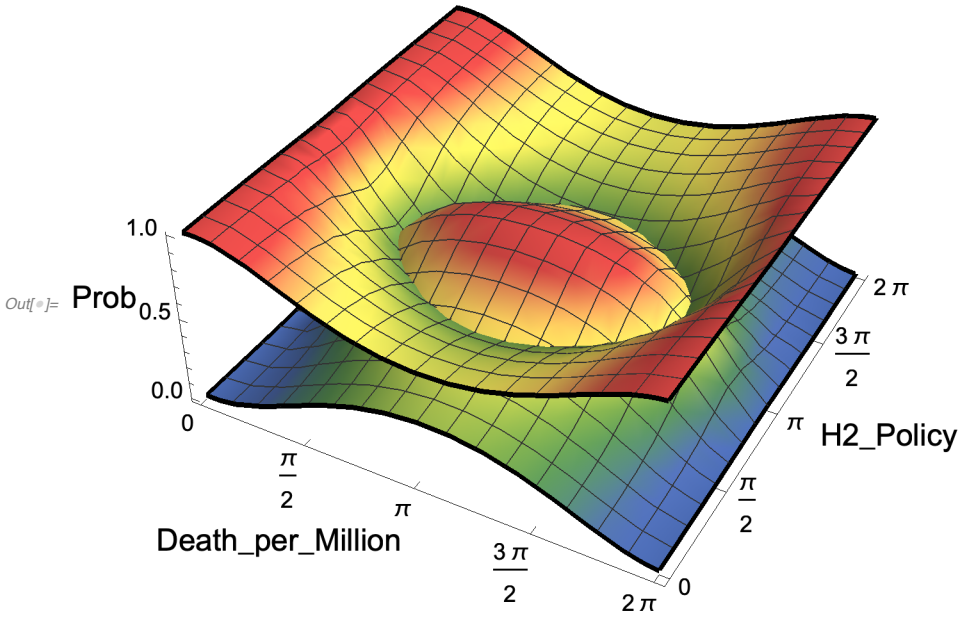
In[745]:=
```
interfC6l0 = Sqrt[pD0 pD0C6l0 pD1 pD1C6l0] Cos[θ00 - θ10] +
    Sqrt[pD0 pD0C6l0 pD2 pD2C6l0] Cos[θ00 - θ20] + Sqrt[pD0 pD0C6l0 pD3 pD3C6l0]
     Cos[θ00 - θ30] + Sqrt[ pD0 pD0C6l0 pD4 pD4C6l0] Cos[θ00 - θ40] +
    Sqrt[pD1 pD1C6l0 pD2 pD2C6l0 ] Cos[θ10 - θ20] +
    Sqrt[pD1 pD1C6l0 pD3 pD3C6l0] Cos[θ10 - θ30] +
    Sqrt[pD1 pD1C6l0 pD4 pD4C6l0 ] Cos[θ10 - θ40] +
    Sqrt[pD2 pD2C6l0 pD3 pD3C6l0] Cos[θ20 - θ30] + Sqrt[pD2 pD2C6l0 pD4 pD4C6l0 ]
     Cos[θ20 - θ40] + Sqrt[pD3 pD3C6l0 pD4 pD4C6l0 ] Cos[θ30 - θ40];
```

```
In[746]:= interfC6l1 = Sqrt[pD0 pD0C6l1 pD1 pD1C6l1] Cos[θ01 - θ11] +
    Sqrt[pD0 pD0C6l1 pD2 pD2C6l1] Cos[θ01 - θ21] + Sqrt[pD0 pD0C6l1 pD3 pD3C6l1]
     Cos[θ01 - θ31] + Sqrt[ pD0 pD0C6l1 pD4 pD4C6l1] Cos[θ01 - θ41] +
    Sqrt[pD1 pD1C6l1 pD2 pD2C6l1 ] Cos[θ11 - θ21] +
    Sqrt[pD1 pD1C6l1 pD3 pD3C6l1] Cos[θ11 - θ31] +
    Sqrt[pD1 pD1C6l1 pD4 pD4C6l1 ] Cos[θ11 - θ41] +
    Sqrt[pD2 pD2C6l1 pD3 pD3C6l1 ] Cos[θ21 - θ31] + Sqrt[pD2 pD2C6l1 pD4 pD4C6l1 ]
     Cos[θ21 - θ41] + Sqrt[pD3 pD3C6l1 pD4 pD4C6l1 ] Cos[θ31 - θ41];

In[747]:= qprC6l0 = prC6l0 + 2 interfC6l0;

In[748]:= qprC6l1 = prC6l1 + 2 interfC6l1;

In[749]:=

In[750]:= qprC6l0Norm = FullSimplify[qprC6l0/(qprC6l0 + qprC6l1)];

In[751]:= qprC6l1Norm = 1 - qprC6l0Norm;
    (*FullSimplify[qprC6l1/(qprC6l0+qprC6l1)]; *)

In[752]:= res = Minimize[{qprC6l0Norm, qprC6l0Norm + qprC6l1Norm == 1},
      {θ00, θ01, θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41}]

Out[]= {0.000283684, {θ00 → 0.10881, θ01 → -0.315844,
      θ10 → -1.65395, θ20 → 1.90559, θ30 → -3.48026, θ40 → -1.20925,
      θ11 → -0.315844, θ21 → -0.315844, θ31 → -0.315844, θ41 → -0.315844}}

In[]:= (* Params *)

In[754]:= θ10 = res[[2]][[3]][[2]];
    θ20 = res[[2]][[4]][[2]];
    θ30 = res[[2]][[5]][[2]];
    θ40 = res[[2]][[6]][[2]];
    θ11 = res[[2]][[7]][[2]];
    θ21 = res[[2]][[8]][[2]];
    θ31 = res[[2]][[9]][[2]];
    θ41 = res[[2]][[10]][[2]];

In[]:=

In[]:= qprC6l0Norm = FullSimplify[qprC6l0/(qprC6l0 + qprC6l1)];

In[]:= qprC6l1Norm = 1 - qprC6l0Norm;

In[]:= (* Updated probabilities *)

In[]:= {qprC6l0Norm, qprC6l1Norm}

Out[]= {(1.55984 - 1.54896 Cos[θ00] - 0.16921 Sin[θ00])/
     (4.93312 - 1.54896 Cos[θ00] + 2.39277 Cos[θ01] - 0.16921 Sin[θ00] - 0.781916 Sin[θ01]),
    1 - (1.55984 - 1.54896 Cos[θ00] - 0.16921 Sin[θ00])/(4.93312 -
       1.54896 Cos[θ00] + 2.39277 Cos[θ01] - 0.16921 Sin[θ00] - 0.781916 Sin[θ01])}
```

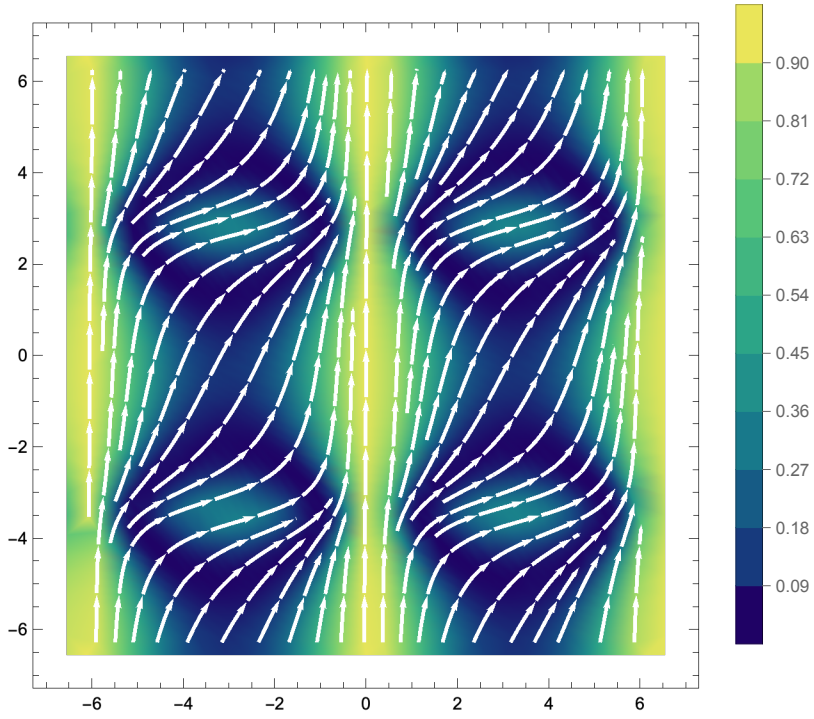
```
p0 = Plot3D[qprC6l0Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];

p1 = Plot3D[qprC6l1Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];
```

In[769]:=
```
Show[p0, p1]
```

Out[•]=




```
fig = StreamDensityPlot[{qprC6l0Norm, qprC6l1Norm},
  {θ00, -2 π, 2 π}, {θ01, -2 π, 2 π}, ColorFunction → "BlueGreenYellow",
  PlotLegends → BarLegend[{"BlueGreenYellow", {0, 1}}, 10],
  AxesLabel → Automatic, StreamStyle → {White, Thick}]
```

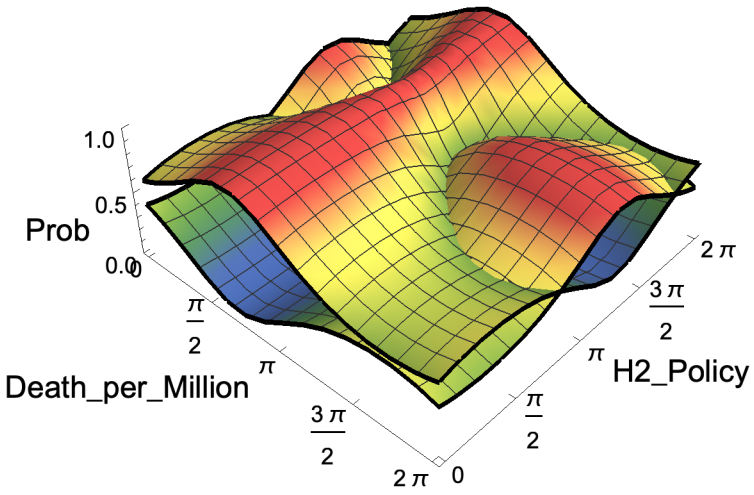



```
In[•]:= Clear[θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41]

In[•]:= res = Maximize[{qprC6l0Norm, qprC6l0Norm + qprC6l1Norm == 1},
          {θ00, θ01, θ10, θ20, θ30, θ40, θ11, θ21, θ31, θ41}]

Out[•]= {0.784602,
          {θ00 → -3.03278, θ01 → 2.82575, θ10 → -1.50482, θ20 → 4.38485, θ30 → 0.584017,
           θ40 → -1.46307, θ11 → 1.07557, θ21 → 0.2242, θ31 → 1.54998, θ41 → 0.646562}}

In[•]:= θ10 = res[[2]][[3]][[2]];
        θ20 = res[[2]][[4]][[2]];
        θ30 = res[[2]][[5]][[2]];
        θ40 = res[[2]][[6]][[2]];
        θ11 = res[[2]][[7]][[2]];
        θ21 = res[[2]][[8]][[2]];
        θ31 = res[[2]][[9]][[2]];
        θ41 = res[[2]][[10]][[2]];

In[•]:= qprC6l0Norm = FullSimplify[qprC6l0 / (qprC6l0 + qprC6l1)];

In[•]:= qprC6l1Norm = 1 - qprC6l0Norm;

In[•]:= (* Updated probabilities *)

In[•]:= {qprC6l0Norm, qprC6l1Norm}

Out[•]= {(1.49904 + 0.698729 Cos[θ00] - 1.26494 Sin[θ00]) / (3.86404 +
            0.698729 Cos[θ00] + 0.886502 Cos[θ01] - 1.26494 Sin[θ00] + 1.48256 Sin[θ01]),
          1 - (1.49904 + 0.698729 Cos[θ00] - 1.26494 Sin[θ00]) / (3.86404 +
            0.698729 Cos[θ00] + 0.886502 Cos[θ01] - 1.26494 Sin[θ00] + 1.48256 Sin[θ01])}
```

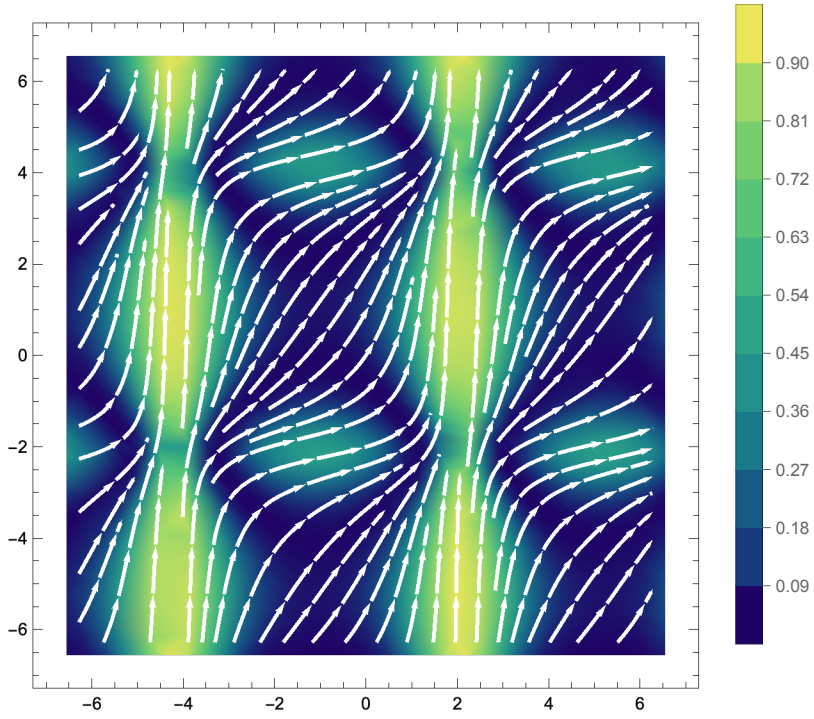
```
p0 = Plot3D[qprC6l0Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];

p1 = Plot3D[qprC6l1Norm, {θ00, 0, 2 π},
    {θ01, 0, 2 π}, ColorFunction → (ColorData["DarkRainbow"][#3] &),
    AxesLabel → {Style[type, 16], Style[policy, 16], Style["Prob", 16]},
    BoundaryStyle → Thick, Boxed → False,
    Ticks → {{0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, {0, Pi / 2, Pi, 3 Pi / 2, 2 Pi}, Automatic},
    TicksStyle → Directive[Black, 12]];
```

In[•]:=
```
Show[p0, p1]
```

Out[•]=




```
fig = StreamDensityPlot[{qprC6l0Norm, qprC6l1Norm},
  {θ00, -2 π, 2 π}, {θ01, -2 π, 2 π}, ColorFunction → "BlueGreenYellow",
  PlotLegends → BarLegend[{"BlueGreenYellow", {0, 1}}, 10],
  AxesLabel → Automatic, StreamStyle → {White, Thick}]
```


6
4
2
0
−2
−4
−6
−6
−4
−2
0
2
4
6
0.90
0.81
0.72
0.63
0.54
0.45
0.36
0.27
0.18
0.09