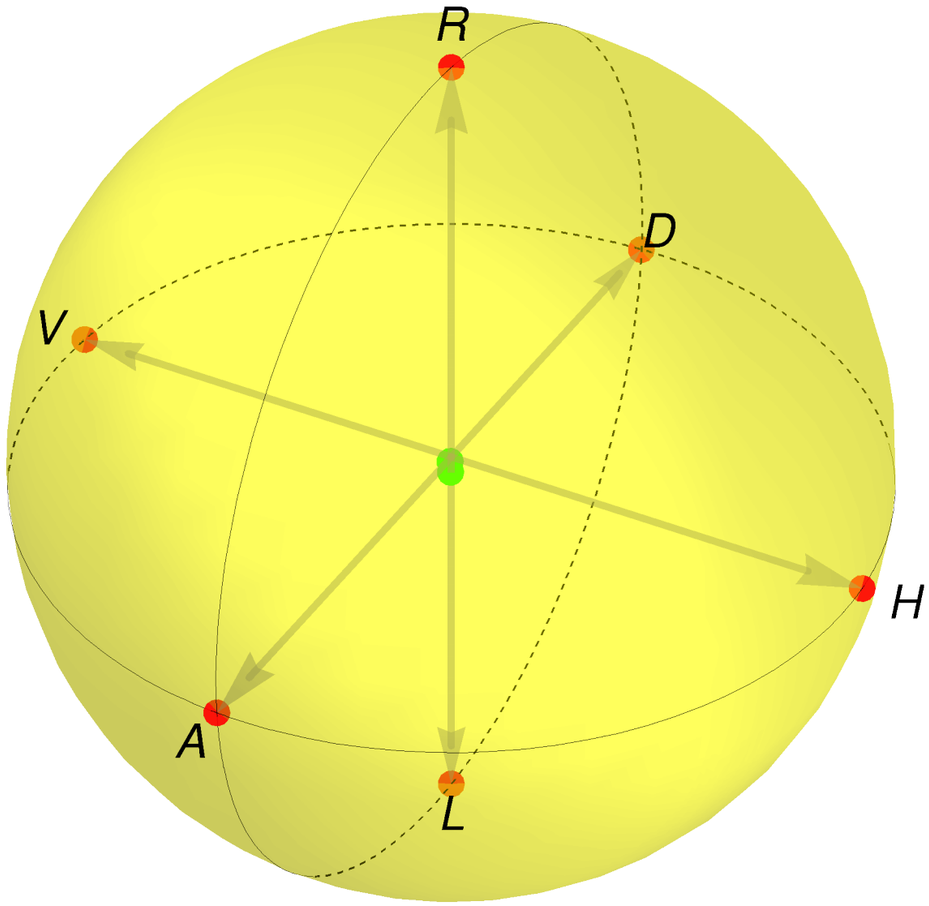
```
In[ ]:= SetDirectory[NotebookDirectory[]];

In[ ]:= (* Import data *)
        NamData0 = Import["Data/Rhos.txt", "Table"];

In[ ]:= Rho[i_] := {{NamData0[[4 + 16 i, 1]], NamData0[[5 + 16 i, 1]]}, {NamData0[[6 + 16 i, 1]], NamData0[[7 + 16 i, 1]]}} + {{NamData0[[9 + 16 i, 1]], NamData0[[10 + 16 i, 1]]}, {NamData0[[11 + 16 i, 1]], NamData0[[12 + 16 i, 1]]}} * I
        RhoList1 = ParallelTable[Rho[i], {i, 0, NamData0[[1, 1]] - 1}];

In[ ]:= (* HVDARL states *)
        StateH = {{1}, {0}};
        StateV = {{0}, {1}};
        StateD = (1 / (2 ^ (1 / 2))) {{1}, {1}};
        StateA = (1 / (2 ^ (1 / 2))) {{1}, {-1}};
        StateR = (1 / (2 ^ (1 / 2))) {{1}, {I}};
        StateL = (1 / (2 ^ (1 / 2))) {{1}, {-I}};
        States = {StateH, StateV, StateD, StateA, StateR, StateL};
        Dimensions[States]

Out[ ]= {6, 2, 1}

In[ ]:= StateToRho[i_] := States[[i]].ConjugateTranspose[States[[i]]]
        Rhos = ParallelTable[StateToRho[i], {i, 1, Dimensions[States][[1]]}];
        Dimensions[Rhos]

Out[ ]= {6, 2, 2}

In[ ]:= sigma2 = {{0, 1}, {1, 0}};
        sigma3 = {{0, -I}, {I, 0}};
        sigma1 = {{1, 0}, {0, -1}};
        sigma = {sigma1, sigma2, sigma3}; blochStates[i_, x_] := ConjugateTranspose[States[[x]]].sigma[[i]].States[[x]]
        blochlistStates = ParallelTable[Re[blochStates[i, x][[1, 1]]], {x, 1, Dimensions[States][[1]]}, {i, 1, 3}];

In[ ]:= RhoToBloch[Rho_, i_, j_] := Re[Tr[Rho[[i]].sigma[[j]]]]

In[ ]:= BlochList1 = ParallelTable[RhoToBloch[RhoList1, i, j], {i, 1, Dimensions[RhoList1][[1]]}, {j, 1, Dimensions[sigma][[1]]}];
        blochlistStates = ParallelTable[RhoToBloch[Rhos, i, j], {i, 1, Dimensions[Rhos][[1]]}, {j, 1, Dimensions[sigma][[1]]}];
        States1 = ParallelTable[RhoToBloch[RhoList1, i, j], {i, 1, Dimensions[RhoList1][[1]]}, {j, 1, Dimensions[sigma][[1]]}];

In[ ]:= (* States on the Bloch sphere *)
        Angle1 = Pi / 8 + Pi / 10;
        Angle2 = -Pi / 8 - Pi / 20;
```

In[ ]:=
```
Show[ListPointPlot3D [blochlistStates , BoxRatios → {1, 1, 1}, PlotRange → {{-1, 1}, {-1, 1}, {-1, 1}}, PlotStyle → Directive [PointSize [0.03], Opacity [0.9], RGBColor [1, 0, 0]], Axes → False , Boxed → False],
 ListPointPlot3D [States1 , BoxRatios → {1, 1, 1}, PlotRange → {{-1, 1}, {-1, 1}, {-1, 1}}, PlotStyle → Directive [PointSize [0.03], Opacity [0.9], RGBColor [0, 1, 0]], Axes → False , Boxed → False],
 ParametricPlot3D [{0, Sin[a], Cos[a]}, {a, 0 + Angle1 , Pi + Angle1}, PlotStyle → {Black , Dashed , Thin}], ParametricPlot3D [{0, Sin[a], Cos[a]}, {a, Pi + Angle1 , 2 Pi + Angle1}, PlotStyle → {Black , Thin}],
 ParametricPlot3D [{Sin[a], Cos[a], 0}, {a, -Pi / 2 + Angle2 , Pi / 2 + Angle2}, PlotStyle → {Black , Dashed , Thin}],
 ParametricPlot3D [{Sin[a], Cos[a], 0}, {a, Pi / 2 + Angle2 , 3 Pi / 2 + Angle2}, PlotStyle → {Black , Thin}], Graphics3D [{{RGBColor [0.5 , 0.5 , 0.5 , .5], Arrowheads [0.04], Thickness [0.008],
    Arrow[{{{0, 0, 0}, {1, 0, 0}}, {{0, 0, 0}, {-1, 0, 0}}, {{0, 0, 0}, {0, 1, 0}}, {{0, 0, 0}, {0, -1, 0}}, {{0, 0, 0}, {0, 0, 1}}, {{0, 0, 0}, {0, 0, -1}}}]}, {Opacity [.4], Yellow , Sphere [{0, 0, 0}]}],
 Graphics3D [Style[Text["R", {0, 0, 1.1}], Black , Italic , 30]], Graphics3D [Style[Text["L", {0, 0, -1.1}], Black , Italic , 30]], Graphics3D [Style[Text["D", {0, 1.1, 0}], Black , Italic , 30]],
 Graphics3D [Style[Text["A", {0, -1.1, 0}], Black , Italic , 30]], Graphics3D [Style[Text["H", {1.1, 0, 0}], Black , Italic , 30]], Graphics3D [Style[Text["V", {-1.1, 0, 0}], Black , Italic , 30]], ImageSize → 600]
```

Out[ ]=



In[ ]:=
```
(* Purity *)
Purity[Rho_] := Re[Tr[MatrixPower [Rho , 2]]]
```

```
In[ ]:= PurityList1 = Table[Purity[RhoList1[[i]]], {i, 1, Dimensions[RhoList1][[1]]}]
        Max[PurityList1]
        Min[PurityList1]
        StandardDeviation[PurityList1]
Out[ ]= {0.500615, 0.500604, 0.500604, 0.500594, 0.500575, 0.500055, 0.500069}
Out[ ]= 0.500615
Out[ ]= 0.500055
Out[ ]= 0.000262286
In[ ]:= Sum[PurityList1[[i]], {i, 1, Dimensions[PurityList1][[1]]}] / Dimensions[PurityList1][[1]]
Out[ ]= 0.500445
In[ ]:= (* DOP - degree of polarization *)
In[ ]:= DOPList1 = Table[Sqrt[Sum[States1[[j, i]]^2, {i, 1, 3}]], {j, 1, Dimensions[States1][[1]]}]
        Max[DOPList1]
        Min[DOPList1]
        StandardDeviation[DOPList1]
Out[ ]= {0.035061, 0.0347576, 0.0347682, 0.0344715, 0.0339229, 0.0104601, 0.0117097}
Out[ ]= 0.035061
Out[ ]= 0.0104601
Out[ ]= 0.0114834
In[ ]:= Sum[DOPList1[[i]], {i, 1, Dimensions[DOPList1][[1]]}] / Dimensions[DOPList1][[1]]
Out[ ]= 0.0278787
```