In[1]:=

```
Λ = {{1, 1, -1, 1}, {1, 1, 1, -1}, {1, -1, -1, -1}, {1, -1, 1, 1}}
M = 1/Sqrt[2] {{1, 0, 0, I}, {0, I, 1, 0}, {0, I, -1, 0}, {1, 0, 0, -I}}
θ0 = (Inverse[Λ].{Φ0, Φ1, Φ2, Φ3})[[1]]
θ1 = (Inverse[Λ].{Φ0, Φ1, Φ2, Φ3})[[2]]
θ2 = (Inverse[Λ].{Φ0, Φ1, Φ2, Φ3})[[3]]
θ3 = (Inverse[Λ].{Φ0, Φ1, Φ2, Φ3})[[4]]
σx = {{0, 1}, {1, 0}}
σy = {{0, -I}, {I, 0}}
σz = {{1, 0}, {0, -1}}
ϕ1 = 1/Sqrt[2] * (KroneckerProduct[{{1, 0}}, {{1, 0}}] + KroneckerProduct[{{0, 1}}, {{0, 1}}])
ϕ2 = -I/Sqrt[2] * (KroneckerProduct[{{1, 0}}, {{1, 0}}] - KroneckerProduct[{{0, 1}}, {{0, 1}}])
ϕ3 = 1/Sqrt[2] * (KroneckerProduct[{{1, 0}}, {{0, 1}}] - KroneckerProduct[{{0, 1}}, {{1, 0}}])
ϕ4 = -I/Sqrt[2] * (KroneckerProduct[{{1, 0}}, {{0, 1}}] + KroneckerProduct[{{0, 1}}, {{1, 0}}])
DMatrix =
 {{Exp[I * Φ0], 0, 0, 0}, {0, Exp[I * Φ1], 0, 0}, {0, 0, Exp[I * Φ2], 0}, {0, 0, 0, Exp[I * Φ3]}}
FullSimplify[M.DMatrix.ConjugateTranspose[M] -
  Exp[I * θ0] * MatrixExp[I * (θ1 * KroneckerProduct[σx, σx] +
       θ2 * KroneckerProduct[σy, σy] + θ3 * KroneckerProduct[σz, σz])]]
```

Out[1]= $\{\{1, 1, -1, 1\}, \{1, 1, 1, -1\}, \{1, -1, -1, -1\}, \{1, -1, 1, 1\}\}$

Out[2]= $\left\{\left\{\frac{1}{\sqrt{2}}, 0, 0, \frac{i}{\sqrt{2}}\right\}, \left\{0, \frac{i}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right\}, \left\{0, \frac{i}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0\right\}, \left\{\frac{1}{\sqrt{2}}, 0, 0, -\frac{i}{\sqrt{2}}\right\}\right\}$

Out[3]= $\frac{\Phi 0}{4} + \frac{\Phi 1}{4} + \frac{\Phi 2}{4} + \frac{\Phi 3}{4}$

Out[4]= $\frac{\Phi 0}{4} + \frac{\Phi 1}{4} - \frac{\Phi 2}{4} - \frac{\Phi 3}{4}$

Out[5]= $-\frac{\Phi 0}{4} + \frac{\Phi 1}{4} - \frac{\Phi 2}{4} + \frac{\Phi 3}{4}$

Out[6]= $\frac{\Phi 0}{4} - \frac{\Phi 1}{4} - \frac{\Phi 2}{4} + \frac{\Phi 3}{4}$

Out[7]= $\{\{0, 1\}, \{1, 0\}\}$

Out[8]= $\{\{0, -i\}, \{i, 0\}\}$

Out[9]= $\{\{1, 0\}, \{0, -1\}\}$

Out[10]= $\left\{\left\{\frac{1}{\sqrt{2}}, 0, 0, \frac{1}{\sqrt{2}}\right\}\right\}$

Out[11]= $\left\{\left\{-\frac{i}{\sqrt{2}}, 0, 0, \frac{i}{\sqrt{2}}\right\}\right\}$

Out[12]= $\left\{\left\{0, \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0\right\}\right\}$

Out[13]= $\left\{\left\{0, -\frac{i}{\sqrt{2}}, -\frac{i}{\sqrt{2}}, 0\right\}\right\}$

Out[14]= $\left\{\left\{e^{i\,\Phi 0}, 0, 0, 0\right\}, \left\{0, e^{i\,\Phi 1}, 0, 0\right\}, \left\{0, 0, e^{i\,\Phi 2}, 0\right\}, \left\{0, 0, 0, e^{i\,\Phi 3}\right\}\right\}$

Out[15]= {{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}

```
(*OK, we miraculasly exponentiated all this happiness*)
```

In[16]:=
```
FullSimplify[
 M.DMatrix.ConjugateTranspose[M] - Exp[I * θ0] * MatrixExp[I * (θ1 * KroneckerProduct[σx, σx] +
       θ2 * KroneckerProduct[σy, σy] + θ3 * KroneckerProduct[σz, σz])]]
```

Out[16]= {{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}

In[ ]:=

In[ ]:=

In[ ]:=

In[ ]:=